Cost Reduction with Inhaled Corticosteroid Prescribing Guide in Children Admitted for Severe Acute Asthma

Michi Yang[1] and Shreya Joshi[1], Pharm.D. Candidate, Laura L. Bio, Pharm.D., BCPS[1], Colleen Smith, Pharm.D., BCPPS[2]

[1] Philadelphia College of Pharmacy, [2] Children's Regional Hospital at Cooper University Hospital

Philadelphia College of Pharmacy
University of the Sciences

Cooper University Hospital

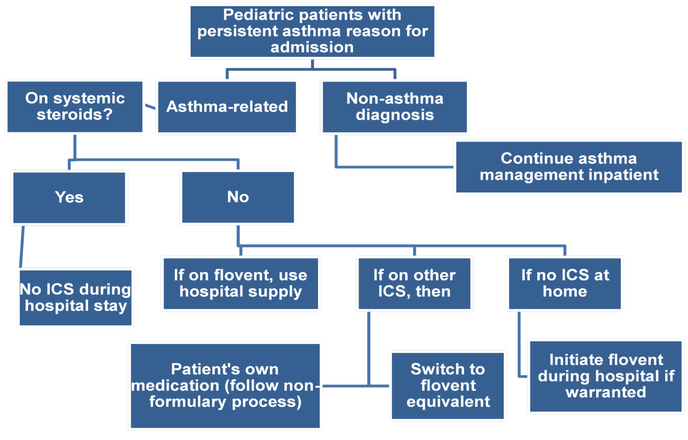
Abstract

Introduction:
Pediatric patients with severe acute asthma (SAA) were commonly ordered their home asthma controller medications at our institution upon admission to support adherence, resulting in concomitant prescribing of both systemic (SCS) and inhaled corticosteroids (ICS). However, the benefit of this practice is unknown and pharmacokinetic principles do not support it.[2] Therefore, a prescribing guide was implemented to limit ICS prescribing for hospitalized pediatric patients receiving SCS for SAA to reduce cost.
Objective: To compare ICS cost in the pre- to post-guide implementation cohort in pediatric patients admitted for SAA while receiving SCS.
Methods: Retrospective chart review of children admitted for SAA in the month of September 2013 (pre-guide cohort A) and September 2014 (post-guide cohort B. Patients that received SCS during the study time period were screened for inclusion based on following criteria: age 6 months - 14 years old, home ICS use prior to admission, and admission diagnosis of SAA. The study protocol was approved by the institutional review board. Data collection included age, gender, weight, asthma severity and home dose ICS was categorized per EPR3 asthma guidelines from National Institute of Health.[3]
The primary endpoint was ICS cost per patient. Secondary endpoint was readmission rate within 30 days for asthma exacerbation. Descriptive statistics were used to report baseline demographics and total cost of ICS to the institution based on number dispensed. Institution cost was extrapolated to annual cost based on the monthly cost per cohort. Statistical analysis included Fisher exact and Mann-Whitney U for nominal and continuous data, respectively.
Results:
A total of 91 patients received SCS during the study period and were screened for inclusion. Fifty patients were excluded due to lack of home ICS use, resulting in 16 patients included in cohort A and 25 patients in cohort B.
Conclusion:
Implementation of a prescribing guide significantly reduced the incidence of ICS prescribing and cost to the institution.

Background

- Purpose of study: To compare ICS cost in the pre- to post-guide implementation cohort in pediatric patients admitted for SAA while receiving SCS.
- Based on the pharmacokinetics and pharmacodynamics of systemic corticosteroid (SCS) and inhaled corticosteroid (ICS), there is no benefit aside from potentially patient adherence to maintain ICS during severe acute asthma (SAA) on SCS.[1]
- ICS are not considered pharmacokinetically bioequivalent to SCS.[2]
- The addition of ICS (budesonide) to standard therapy (salbutamol, ipratropium bromide, and a single dose of a SCS, prednisolone 2 mg/kg) had no significant impact on emergency admission rates compared to placebo in pediatric patients with SAA.[3]
- At our institution, an ICS prescribing guideline was implemented to patients admitted for severe asthma exacerbation who were currently taking home ICS. The protocol was implemented to show reduction in ICS cost per patient who did not receive ICS in addition to SCS during the admission for SAA (see Figure 1).

Figure 1. Inhaled Corticosteroid Inpatient Prescribing Guideline



Methodology

- **Patient inclusion criteria:** Age 6 months - 14 years old, home ICS use prior to admission, and admission diagnosis of SAA.
- **Study time period:** September 2013 (pre-guide cohort A) and September 2014 (post-guide cohort B)
- **Data collected:** Age, gender, weight, asthma severity, home ICS, home ICS dose categorized per Expert Panel Report 3 (EPR3) asthma guideline[4], home albuterol formulation, controller medication, SCS loading dose, SCS dose frequency, ICS orders, total cost of ICS, and readmission within 30 days for SAA.
- Cost of Flovent® 44mcg and 110mcg is $143.91 and $196.96 respectively.
- The study protocol was approved by the institutional review board from Cooper Health System (IRB#: 15-140EX).
- **Primary endpoint:** To determine ICS cost per patient (Mann-Whitney U)
- **Secondary endpoints:** To determine the readmission rate for asthma exacerbation (Fisher exact).

Results

- There were 91 patients that were screened for inclusion for the study.
- Forty-one patients were included: 16 in cohort A and 25 in B.
- No difference in baseline demographics except home ICS category (see Table 1).
- No patients were readmitted within 30 days.

Table 1. Comparison of Cohort A and B Patient Demographics

	Cohort A (n = 16)	Cohort B (n = 25)	p-value
Male, n (%)	13 (81.3)	13 (52)	0.097
Mean age, years (± SD)	5.91 ± 3.69	4.81 ± 2.76	0.466
Mean weight, kg (± SD)	24.61 ± 10.8	21.43 ± 19.7	0.509
Asthma Severity (%)			
Intermittent	3 (18.75)	4 (16)	1.0
Mild persistent	6 (37.5)	11 (44)	0.753
Moderate	2 (12.5)	4 (16)	0.170
Severe persistent	5 (31.25)	6 (24)	0.723
Home ICS (%)			
Budesonide nebulization	1(6.25)	0 (0)	0.3902
Fluticasone MDI	2 (12.5)	25 (100)	< 0.001
Beclomethasone MDI	13 (81.25)	0 (0)	< 0.001
Home ICS dose category (%)			
Low	9 (56.25)	17 (68)	0.517
Medium	2 (12.5)	7 (28)	0.441
High	5 (31.25)	1 (4)	0.026
Home albuterol formulation (%) *			
Nebulized	8 (50.0)	12 (48.0)	0.360
MDI	3 (18.8)	11 (44.0)	0.176
Controller medications (%)			
Montelukast	8 (50.0)	5 (20.0)	0.084
LABA	1 (6.25)	1 (4.00)	1.00

* Not documented for 5 patients in cohort A and 2 patients in cohort B.
ICS: Inhaled corticosteroid; LABA: Long-acting beta-agonist; MDI: Metered dose inhaler; SD: Standard deviation.

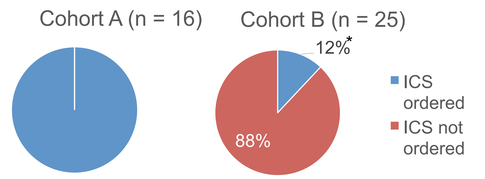
Table 2. Comparison of Corticosteroid Inpatient Orders

	Cohort A (n = 16)	Cohort B (n = 25)	p-value
ICS ordered (%)			
Fluticasone	15 (93.8)	3 (12.0)	< 0.001
Budesonide	1 (6.25)	0 (0.00)	0.390
Initial SCS ordered (%)			
Methylprednisolone	7 (43.8)	9 (36.0)	0.746
Prednisone	4 (25.0)	0 (0.00)	0.018
Prednisolone	5 (31.3)	16 (64.0)	0.058

ICS: Inhaled corticosteroid; MDI: Metered dose inhaler; SCS = Systemic corticosteroid.

Results (cont.)

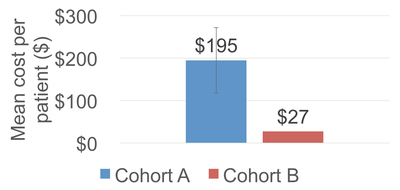
Figure 2. Comparison of Cohort A and B Ordered Inpatient ICS



* p < 0.001

ICS: Inhaled corticosteroid.

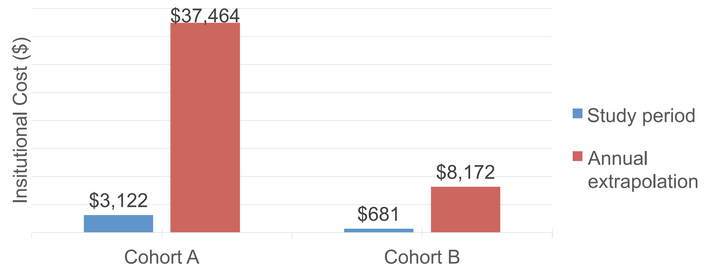
Figure 3. Comparison of Institutional ICS Cost Per Patient



	Cohort A (n = 16)	Cohort B (n=25)
Mean cost per patient ($ ± SD) *	195 ± 77	27 ± 86

* p < 0.001
SD: Standard deviation

Figure 4. Comparison of Institutional ICS Cost in Study Period and Extrapolated to Annual Cost Between Cohort A and B



Discussion

- Decrease in institutional ICS cost in children admitted for SAA while on SCS is both statistically and clinically significant ($29,292/year).
- Based on zero readmissions for both cohorts, no difference was observed with ICS ordering inpatient for children admitted for SAA and managed with SCS. This lack of difference is due to the small sample size and requires a larger study to investigate this outcome.
- Study limitations include the study time period of one month. September was selected based on it's association with a higher incidence of SAA in children due to seasonal changes.

Conclusions

Our study identified a significant reduction in the institutional cost of ICS with a prescribing guideline to prevent overuse of ICS during SCS therapy for SAA. Based on the findings from this pilot study of the month of September, further investigation is warranted.

References

1. Sadatsafavi M, Lynd LD, De Vera M,A., Zafari Z, FitzGerald JM. One-year outcomes of inhaled controller therapies added to systemic corticosteroids after asthma-related hospital discharge. Respir Med. 2015 [cited 2015 Jun 1];109(3):320-328.
2. Razi C, Akelma A, Harmanci K, Kocak M, Kuras Y. The addition of inhaled budesonide to standard therapy shortens the length of stay in hospital for asthmatic preschool children: A randomized, double-blind, placebo-controlled trial.Int. Allergy Immunol. 2015 May 30;166(4):297-303.
3. Alangari AA, Malhis N, Mubasher M, Al-Ghamedi N, Al-Tannir M, Riaz M, Umetsu DT, Al Tamimi S. Budesonide nebulization added to systemic prednisolone in the treatment of acute asthma in children: a double-blinded,randomized, controlled trial. Chest. 2014 Apr [cited 2015 Jun 3].
4. National Heart, Lung, and Blood Institute (USA). Expert panel report 3: guidelines for the diagnosis and management of asthma. 2007 Aug [updated 2008 Aug 5; cited 2015 Jul 7].