Variation in Preventive Care in Children Receiving Chronic Glucocorticoid Therapy

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Objective To assess preventive care measure prescribing in children exposed to glucocorticoids and identify prescribing variation according to subspecialty and patient characteristics.

Study design Retrospective cohort study of children initiating chronic glucocorticoids in the gastroenterology, nephrology, and rheumatology divisions at a pediatric tertiary care center. Outcomes included 25-hydroxyvitamin D (25OHD) and lipid testing, pneumococcal polysaccharide (PPV) and influenza vaccination, and stress dose hydrocortisone prescriptions.

Results A total of 701 children were followed for a median of 589 days. 25OHD testing was performed in 73%, lipid screening in 29%, and PPV and influenza vaccination in 16% and 78%, respectively. Hydrocortisone was prescribed in 2%. Across specialties, 25OHD, lipid screening, and PPV prescribing varied significantly (all $P < .001$). Using logistic regression adjusting for specialty, 25OHD testing was associated with older age, female sex, non-Hispanic ethnicity, and lower baseline height and body mass index z-scores (all $P < .03$). Lipid screening was associated with older age, higher baseline body mass index z-score, and lower baseline height z-score (all $P < .01$). Vaccinations were associated with lower age ($P < .02$), and PPV completion was associated with non-White race ($P = .04$).

Conclusions Among children chronically exposed to glucocorticoids, 25OHD testing and influenza vaccination were common, but lipid screening, pneumococcal vaccination, and stress dose hydrocortisone prescribing were infrequent. Except for influenza vaccination, preventive care measure use varied significantly across specialties. Quality improvement efforts are needed to optimize preventive care in this high-risk population. *(J Pediatr 2016;179:226-32).*

Although glucocorticoid therapy is common and effective in a number of pediatric conditions, its potent immunosuppressive and metabolic effects result in well-known and sometimes severe side effects or adverse events. These include, but are not limited to, infections, vertebral compression fractures, adrenal suppression, weight gain, and dyslipidemia. In addition, disease-specific factors increase the risk of infections, accelerated atherosclerosis, and fractures in inflammatory conditions such as systemic lupus erythematosus (SLE).

In recent years, expert panel reports evaluated preventive care in chronic illnesses across the age spectrum. For example, the Endocrine Society recommends 25-hydroxyvitamin D (25OHD) testing for individuals at risk for deficiency, such as those receiving glucocorticoid therapy.[1] In the American Academy of Pediatrics report from the Expert Panel on Integrated Guidelines for Cardiovascular Health and Risk Reduction in Children and Adolescents, lipid testing was strongly recommended for children with medical conditions associated with accelerated atherosclerosis, such as inflammatory conditions.[2] The Advisory Committee on Immunization Practices and the Infectious Diseases Society of America recommend pneumococcal and yearly influenza vaccination.[3] Finally, to prevent adrenal crisis in children receiving chronic glucocorticoid therapy, the Lawson Wilkins Pediatric Endocrine Society suggests parents be instructed in the use of intramuscular hydrocortisone in case of vomiting or severe stress to prevent acute adrenal insufficiency.[4] The data supporting these guidelines undoubtedly influenced recently published quality indicators in SLE[5,6] and inflammatory bowel disease,[7] which include process metrics in bone health and cardiovascular risk assessment, as well as influenza and pneumococcal vaccination.

Implementing guidelines in practice is often variable. Among pediatricians, lack of awareness and uncertainty as to how to address dyslipidemia may contribute to low reported lipid screening rates.[8] In a survey of pediatric rheumatologists,

25OHD	25-hydroxyvitamin D
BMI	Body mass index
PPV	Pneumococcal polysaccharide vaccine
GI	Gastrointestinal
SLE	Systemic lupus erythematosus

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physician-reported bone health monitoring was low despite the recognized risk of vertebral compression fractures.[9] The suboptimal rates may be in part due to ambiguity with result interpretation and clear management strategies. Low pneumococcal and influenza vaccination rates were noted in children with cystic fibrosis, HIV, diabetes mellitus, and liver transplants.[10] The prevention strategies unique to children receiving chronic glucocorticoid therapy and the predictors of utilization have not been systematically characterized. In addition, no studies have simultaneously assessed prescribing across preventive care domains. Understanding current care patterns in this high-risk population will be critical to future quality improvement initiatives. In this retrospective cohort study, we aimed to characterize preventive care utilization related to bone health, cardiovascular risk, infection, and adrenal insufficiency in children receiving chronic glucocorticoid therapy.

Methods

We used a retrospective cohort design to characterize patterns of screening and preventive care measure prescribing for children exposed to chronic glucocorticoid therapy. Data were extracted from electronic health records in the outpatient care network at The Children's Hospital of Philadelphia. The Institutional Review Board approved this study.

We retrospectively identified children initiating glucocorticoids between January 1, 2011, and December 31, 2012, with a minimum of 90 days of follow up. Data up to and including September 30, 2013, were used. All outpatient prescriptions for glucocorticoids during the study period were extracted. We created an electronic algorithm to inspect the start and end date of each prescription, the number of refills, the quantity dispensed, and free text instructions to determine the intended treatment duration.[11] Using both discrete and free text dose information, we determined the daily dose represented by each prescription. All doses were converted to equivalent milligrams of prednisone (1 mg of prednisone or prednisolone is equivalent to 4 mg hydrocortisone, 0.77 mg methylprednisolone, and 0.16 mg dexamethasone). All children whose glucocorticoid exposure represented at least 15 days of glucocorticoid treatment at a minimum dose of either 0.1 mg/kg/d or 5 mg/d of prednisone, whichever was lower, were included. We excluded patients whose exposure was below the minimum treatment threshold and prescriptions for inhaled or topical steroids, including oral budesonide for inflammatory bowel disease. We also excluded children who received 15 days or more of glucocorticoid treatment between July 1, 2010, and December 31, 2010, to ensure accurate glucocorticoid start date ascertainment within our study period. To validate our automated electronic algorithm, we performed a manual chart review of 98 charts of patients identified as having glucocorticoid exposure of any duration during the study period. Of the 98 patients, 60 met chronic exposure criteria using the automated method. We manually examined patient records to determine the glucocorticoid dose and duration to verify chronic. The manual chart review revealed 93% sensitivity and 87% specificity of the automated identification method for chronic glucocorticoid exposure.

Outcomes

Using data from the electronic health record, we described process and clinical outcomes in the domains of bone health, cardiovascular health and nutrition, immunization status, and adrenal insufficiency management. We first set out to characterize glucocorticoid exposure and its effect on anthropometric measures. Among children 2 years and older, we used reference data from the Centers for Disease Control and Prevention to calculate height and body mass index (BMI, kg/m^2) z-scores.[12] We compared baseline and follow-up measurements to characterize changes in height and BMI z-scores in our cohort with glucocorticoid exposure.

Our main outcomes for the study were process measures. Laboratory data were used to identify children with at least 1 order for a 25OHD between January 1, 2011, and September 30, 2013. The presence of at least 1 laboratory order for a lipid profile during the observation period was considered appropriate screening for dyslipidemia. Immunization records were extracted to determine whether children received pneumococcal and influenza vaccination. Because of the risk of invasive pneumococcal disease, all children at least 24 months old in our cohort should have received at least 1 dose of 23-valent pneumococcal polysaccharide vaccine (PPV). Documentation of any PPV administration prior to September 20, 2013, was recorded. We assessed PPV administration in the entire cohort, as well as a limited analysis in children 2 years and older at baseline, and according to primary care in or outside our hospital network. These analyses were performed to ensure that there was no difference between in and out of network patients in the recommended age range for vaccination. Excluding observation time for children less than 6 months of age, we assessed the proportion of children receiving at least 1 dose of seasonal influenza vaccine for each influenza season. Only patients who received primary care in our institution were included for the seasonal influenza vaccination analysis. This is commonly given in the outpatient setting, and we were unable to detect administration if given out of our network. We documented orders for home injectable hydrocortisone to treat adrenal insufficiency in emergency cases of severe stress after new chronic glucocorticoid exposure.

To determine the volume of preventive care utilization, we assessed the total number of preventive care measures prescribed in each individual. Influenza vaccination was excluded from this analysis because it was not reliably assessed in patients receiving care outside the hospital system. PPV is more difficult to obtain in the pediatric community setting and can be provided in subspecialty clinics. Therefore, PPV was more likely to be captured in our electronic record and was included in the analysis.

Covariates

We extracted demographic and clinical data to identify predictors of preventive care measure prescribing. Variables included race, ethnicity, sex, age at treatment initiation, in network