had significantly shorter ICU length of stay, duration of continuously nebulized albuterol therapy, and duration of supplemental oxygen therapy and were significantly less likely to require intravenous β2-AR agonist therapy, compared with those with the Arg/Arg or Arg/Gly genotype. Genetic polymorphisms at position 27 were not associated with response to β2-AR agonist therapy or with the other clinical outcomes measured.

CONCLUSIONS. In this group of children with severe asthma exacerbations, those with the Gly/Gly genotype at position 16 of the β2-AR had more-rapid responses to β2-AR agonist therapy and shorter ICU lengths of stay.

REVIEWERS COMMENTS. This article provides further evidence of the complexity of asthma genetics. The relationship between β2-AR genotypes and responses to β2-AR agonists is controversial, with different studies coming to opposing conclusions. Responses may depend largely on how the β2-AR agonist is dosed (short-term, single-dose treatment versus long-term, repeated dosing). This study was limited by the small study size. However, the study presents another step toward linking asthma genotypes with asthma phenotypes. This should allow the use of pharmacogenetics to treat specific patient populations in an evidence-based manner, an exciting future!

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Chromosome 17q21 Gene Variants Are Associated With Asthma and Exacerbations But Not Atopy in Early Childhood

PURPOSE OF THE STUDY. To determine the association between the 17q12–q21 locus and various clinical characteristics of asthma and atopic sensitization during childhood.

STUDY POPULATION. The Copenhagen Prospective Study on Asthma in Childhood (COPSAC) included a birth cohort of 411 children born to mothers with a history of asthma. Three hundred seventy-six of these children underwent genotyping for a particular, single-nucleotide polymorphism (SNP), rs7216389, in the 17q12–q21 locus.

METHODS. Three hundred seventy-six children underwent genotyping for 20 SNPs, including rs7216389. Infants were enrolled at age 1 month and were seen once every 6 months until age 6 years. Parents recorded daily symptoms. End points included investigator-diagnosed asthma or atopic disease and objective measurements of lung function and atopic sensitization, at various follow-up points.

RESULTS. Homozygosity for the T allele at SNP rs7216389 was associated with experiencing wheezing (hazard ratio [HR]: 1.64 [95% confidence interval [CI]: 1.05–2.59]), asthma (HR: 1.88 [95% CI: 1.15–3.07]), and acute severe exacerbations (HR: 2.66 [95% CI: 1.58–4.48]). Significantly increased bronchial hyperresponsiveness was seen at ages 1 month and 4 years but not 6 years. However, increased risk of asthma exacerbations persisted through age 6 years (incidence ratio: 2.48 [95% CI: 1.42–4.32]). There was no increased risk for eczema, rhinitis, or atopic sensitization.

CONCLUSIONS. The rs7216389 SNP at the 17q12–q21 locus was associated with increased risk of asthma, asthma exacerbations, and bronchial hyperresponsiveness. However, it was not associated with any increased risk of atopic sensitization, eczema, or rhinitis.

REVIEWER COMMENTS. This particular polymorphism was shown previously to be associated with increased risk for developing asthma. The data from this study describe the clinical phenotype associated with this SNP in a population of infants and young children at increased risk for asthma. It seems to confer a specific risk for asthma without increased atopy. This study was performed with a selected population at high risk for asthma, and future research will need to determine whether these findings are replicable in the general population.

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Serum Vitamin D Levels and Markers of Severity of Childhood Asthma in Costa Rica

PURPOSE OF THE STUDY. To determine whether vitamin D levels are associated with asthma severity and allergy during childhood.

STUDY POPULATION. Six hundred sixteen Costa Rican children with asthma, 6 to 14 years of age, were included. Asthma was defined as physician-diagnosed asthma and ≥2 respiratory symptoms or asthma attacks in the past year.

METHODS. Study participants were identified on the basis of questionnaires sent to 113 Costa Rican schools. Participants answered additional questions and underwent pulmonary function testing, methacholine challenge testing, allergy skin-prick testing, serum total immunoglobulin E (IgE) and allergen-specific IgE measurements, peripheral blood eosinophil counts, and serum 25-hydroxyvitamin D3 measurements. Linear and logistic regression models were created to assess associations between factors.
RESULTS. Twenty-eight percent of participants had vitamin D levels of <30 ng/mL, which is the lower limit of the normal range. Each 1-log unit increase in vitamin D level was associated with decreased odds of any hospitalization in the past year (odds ratio [OR]: 0.05 [95% confidence interval [CI]: 0.004–0.71]), use of inhaled corticosteroids and/or leukotriene inhibitors in the past year (OR: 0.18 [95% CI: 0.05–0.67]), and increased airway hyperresponsiveness (OR: 0.15 [95% CI: 0.024–0.097]). In multivariate analysis, increasing serum levels of vitamin D were associated with lower total serum IgE levels, peripheral eosinophil counts, and dust mite-specific IgE levels.

CONCLUSIONS. Vitamin D deficiency is relatively frequent in Costa Rican children, and lower levels are associated with increased markers of allergy and asthma severity.

REVIEWER COMMENTS. Maternal vitamin D intake during pregnancy has been inversely associated with asthma symptoms in early childhood. However, no study has examined the relationship between measured vitamin D levels and markers of asthma severity in childhood. This study found an association between reduced vitamin D levels and increased markers of allergy and asthma severity in a population of Costa Rican children with asthma. Additional study of this topic using an unslected birth cohort, a case-control approach, or a clinical trial of vitamin D supplementation would be a preferable next step. Also of note, although the authors used the current standard “normal” lower threshold to define vitamin D deficiency, there is substantial debate about what the appropriate lower limit should be.

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TH17 Cells Mediate Steroid-Resistant Airway Inflammation and Airway Hyperresponsiveness in Mice

PURPOSE OF THE STUDY. To investigate the function of T-helper 17 (TH17) cells in the context of antigen-induced airway inflammation.

METHODS. The authors examined the role of TH17 cells in asthma by using a mouse model in which severe combined immunodeficient (SCID) mice were challenged with ovalbumin. On day 0, ovalbumin-specific TH2 or TH17 cells were adoptively transferred into the SCID mice. The SCID mice were challenged with ovalbumin for 3 consecutive days after cell transfer. Mice were treated with dexamethasone or phosphate-buffered saline (control) before cell transfer on day 0 and before ovalbumin challenge on day 2. In a separate experiment, wild-type mice and interleukin 17 (IL-17) receptor-null mice underwent the same protocol.

RESULTS. Transfer of ovalbumin-specific TH2 or TH17 cells into the SCID mice, followed by ovalbumin challenge, resulted in specific cellular influx into the airways and airway hyperreactivity (AHR). TH2 cell reconstitution resulted in airway inflammation that consisted mostly of eosinophils and lymphocytes and was sensitive to dexamethasone. TH17 cell reconstitution resulted in a primarily neutrophilic airway response that was resistant to dexamethasone. Adoptive transfer of ovalbumin-specific TH2 or TH17 cells, followed by ovalbumin challenge, resulted in AHR in both cases, but the AHR was sensitive to dexamethasone in the mice reconstituted with TH2 cells and not in the mice reconstituted with TH17 cells. The inflammatory and cellular responses associated with TH17 cell transfer were mediated primarily by IL-17, because IL-17 receptor-knockout mice did not develop airway neutrophilia after adoptive transfer of ovalbumin-specific TH17 cells, followed by ovalbumin challenge.

CONCLUSIONS. Reconstitution of SCID mice with TH17 cells in a model of antigen-induced airway inflammation leads to airway neutrophilia and AHR. TH17 cell-mediated neutrophil influx into the airways and AHR are resistant to dexamethasone treatment.

REVIEWERS COMMENTS. Asthma is a significant cause of morbidity and death in the pediatric population, and steroid-resistant asthma is a particularly challenging asthma phenotype to manage. This study provides insight into a possible mechanism of steroid-resistant asthma, involving neutrophil recruitment into the lung tissues by TH17 cells in an IL-17–dependent pathway. Future research should be directed at determining whether the findings in this mouse model are applicable to humans and identifying patients with this asthma phenotype. If these findings prove applicable to humans, then TH17 cell–and IL-17–specific therapies may prove useful for patients with steroid-resistant asthma.

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DIAGNOSIS AND MANAGEMENT
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