bias may occur with telephone surveys of patients and families after a surgical procedure. Finally, the diagnosis of obstructive sleep-disordered breathing on the basis of history findings, with similar assessments of improvement after surgery, does not have the quantitative accuracy of preoperative and postoperative polysomnographic evaluations. Despite these limitations, this study succeeded in showing that intracapsular tonsillar reduction (partial tonsillectomy) shows great promise as a safe effective treatment for children with obstructive sleep-disordered breathing and appears to cause less morbidity than standard tonsillectomy. Additional studies with more long-term follow-up monitoring are required to assess the recurrence rates for both obstructive and infectious tonsillar disease, after this procedure is performed among young children.

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Asthma

PATHOPHYSIOLOGY

EARLY THICKENING OF THE RETICULAR BASEMENT MEMBRANE IN CHILDREN WITH DIFFICULT ASTHMA


Purpose of the Study. To determine whether reticular basement membrane (RBM) thickening is present among children with difficult-to-control asthma and to compare the findings with those for adults with asthma.

Study Population. Subjects were 19 children (6–16 years of age) with difficult-to-control asthma. Control subjects were 10 children (7–16 years of age) without asthma, 10 adults with mild asthma, 6 adults with severe asthma, and 8 healthy adults.

Methods. The 19 asthmatic children underwent bronchoscopy and endobronchial biopsy as part of an asthma evaluation. Patients were treated with oral prednisolone therapy (40 mg/day) for 2 weeks before the biopsy. Exhaled nitric oxide levels were measured before and after the course of corticosteroids. Endobronchial samples were obtained from third-order or higher bronchi on either side of the lung. The control subjects were pediatric patients undergoing bronchoscopy because of other indications. The adults with mild asthma were corticosteroid-naive. Adults with severe asthma underwent biopsy while intubated because of a severe asthma attack. The 8 adult control subjects were nonsmokers. Three biopsy specimens for each patient were fixed immediately and stained for light-microscopic evaluation.

Results. Children with asthma had an average RBM thickness of 8.2 μm (range: 5.4–11.2 μm). Adults with mild asthma had a mean RBM thickness of 8.1 μm (range: 5.8–10.0 μm); adults with severe asthma had a mean RBM thickness of 7.2 μm (range: 2.8–10.0). Adult control subjects had an average RBM thickness of 4.4 μm (range: 3.2–6.3 μm; P < .01); pediatric control subjects had an average RBM thickness of 4.9 μm (range: 3.7–8.3 μm; P < .01). There was no correlation of RBM thickness with duration of asthma or age. The exhaled nitric oxide concentrations before and after prednisolone treatment were 16.9 ppb (range: 1.2–33.4 ppb) and 8.1 ppb (range: 1.3–24.5 ppb), respectively (normal values at the study center: <12.5 ppb). There was no correlation between RBM thickness and exhaled nitric oxide levels.

Conclusions. The authors concluded that RBM thickening is a feature of childhood asthma that is not present among normal control subjects. RBM thickening is a common feature of asthma among adults and children but is not correlated with age, severity, or duration.

Reviewers’ Comments. This study demonstrated that histologic changes in the airways of children with severe asthma, as evidenced by RBM thickening, are similar to those seen among adults. This is one of the few such studies among children and is novel for the inclusion of child and adult control subjects. The authors were unable to show a link between RBM thickness and severity of asthma or a marker of inflammation (exhaled nitric oxide).

This information raises questions regarding the timing and appropriateness of antiinflammatory treatment delivered with the hope of preventing airway remodeling among children with asthma. Clinical trials are needed to establish whether it is possible to prevent these changes and whether such prevention is important.

LIPOPOLYSACCHARIDE-ENHANCED, TOLL-LIKE RECEPTOR 4-DEPENDENT, T HELPER CELL TYPE 2 RESPONSES TO INHALED ANTIGEN


Purpose of the Study. To evaluate the dose-dependent effects of lipopolysaccharide (LPS) (endotoxin) inhalation and LPS-induced activation of toll-like receptor 4 (TLR4) on the generation of T helper (Th) cell type 2-dependent allergic inflammatory responses to an inhaled antigen, ovalbumin (OVA).

Study Population. Wild-type or TLR4-deficient, 6- to 10-week-old, female mice were studied.

Methods. Mice were sensitized with intranasal exposure to LPS-depleted OVA or OVA with either a low (0.1 μg) or high (100 μg) dose of LPS. After intranasal OVA challenge, pulmonary inflammatory responses were assessed through enumerating bronchoalveolar lavage cells, performing histopathologic analyses, measuring OVA-dependent cytokine production by lung-draining lymph node cells, and determining OVA-specific serum antibody levels. Dendritic cell responses to OVA with LPS were evaluated in cytokine production, activation marker expression, and cell migration studies.

Results. After antigen challenge, mice sensitized to OVA with low-dose LPS exhibited a Th2-associated response, with pulmonary eosinophilia, airway mucus secretion, Th2 cytokine (interleukin-5 and -13) production by lymph node cells, and production of high levels of OVA-specific immunoglobulin E and immunoglobulin G1. In contrast, mice sensitized to OVA with high-dose LPS developed a Th1-associated response, with a predominance of neutrophils, no airway mucus secretion, Th1 cytokine (interferon-γ) production by lymph node cells, and production of high levels of OVA-specific immunoglobulin G2a. No pulmonary inflammatory responses were observed with mice sensitized to LPS-depleted OVA. OVA sensitization of TLR4-deficient mice with either low- or high-dose LPS failed to generate inflammatory responses. However, treatment with tumor necrosis factor, which is secreted by LPS-stimulated dendritic cells, compensated.
for deficient dendritic cell activation, restoring the responses of TLR4-deficient mice to OVA with either low- or high-dose LPS.

**Conclusions.** The authors concluded that inhalation of low doses of LPS with OVA antigen was necessary to induce allergic or Th2-dependent responses in the lung, whereas inhalation of high doses of LPS with antigen induced nonallergic or Th1-dependent responses. The LPS-mediated effects on allergic sensitization were dependent on signaling through TLR4 on dendritic cells.

**Reviewers’ Comments.** The effects of endotoxin exposure on the development of atopy and asthma are seemingly paradoxical. Although studies show that exposure to endotoxin early in life inhibits the development of asthma and atopic disease, other studies demonstrate adverse effects of endotoxin on airway function. Although endotoxin is ubiquitous in children’s environments, the exposure level can vary and may be the factor influencing the development of atopy. For example, this dosage effect may help explain the protection from atopy associated with growing up on a farm, where endotoxin exposure is excessive. The results of this study are an intriguing advance toward understanding the basis for these conflicting data, suggesting a mechanism through which the dose of endotoxin present during aeroallergen exposure could influence the incidence of allergic sensitization.

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### ESSENTIAL ROLE OF NATURAL KILLER T CELLS PRODUCING INTERLEUKIN-4 AND INTERLEUKIN-13 IN THE DEVELOPMENT OF ALLERGEN-INDUCED AIRWAY HYPERREACTIVITY


**Purpose of the Study.** To determine the role of natural killer T (NKT) cells in the development of asthma.

**Methods.** NKT cell-deficient mice were used to determine the relative contribution of NKT cells to the development of T helper type 2 (Th2) responses and allergen-induced airway hyperreactivity (AHR).

**Results.** The investigators found that AHR, a cardinal feature of asthma, did not develop in the absence of NKT cells. The failure of NKT cell–deficient mice to develop AHR was not attributable to an inability of the mice to produce Th2 responses, because NKT cell-deficient mice that were immunized subcutaneously at nonmucosal sites produced normal Th2-biased responses. The failure to develop AHR could be reversed with the adoptive transfer of tetramer-purified NKT cells producing interleukin-4 and interleukin-13 to Jα181⁻/⁻ mice, which lack the invariant T-cell receptor of NKT cells, or with the administration to Cd1 days⁻/⁻ mice of recombinant interleukin-13, which directly affects airway smooth muscle cells.

**Conclusions.** Pulmonary NKT cells crucially regulate the development of asthma and Th2-biased respiratory immunity against nominal exogenous antigens. Therapies that target NKT cells may be clinically effective in limiting the development of AHR and asthma.

**Reviewer’s Comments.** The contribution of different cell types to the development of asthma is an area of intense interest. This elegant study points to the likely importance of NKT cells in the development of allergen-induced airway hyperreactivity, a cardinal feature of asthma.
LIPOPOLYSACCHARIDE-ENHANCED, TOLL-LIKE RECEPTOR 4-DEPENDENT, T HELPER CELL TYPE 2 RESPONSES TO INHALED ANTIGEN

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Pediatrics 2004;114;527
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*Pediatrics* 2004;114;527

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