

receive ganciclovir for 6 weeks.^{2,3} In our 3 patients no adverse effects were noted during the administration of ganciclovir. Different ganciclovir regimens have been reported in symptomatic infants congenitally infected with CMV to minimize the adverse effect with maximum efficacy of ganciclovir.^{2,3,9,10} The dosage of ganciclovir in infants that will optimally improve outcome without leading to adverse effects is unknown. A higher dosage⁹ or a longer duration of therapy¹⁰ might be more effective in preventing hearing loss associated with congenital CMV. Although it has not been studied in neonates, valganciclovir has been shown to be as effective as intravenous ganciclovir for CMV-induced retinitis in adult patients with AIDS. The availability of this oral medication raises the possibility of conducting a randomized controlled study in infants with perinatal CMV and HIV-1 infection.

In our 3 patients with perinatal HIV-1 and CMV infections, none are developmentally normal. Speech delay has been observed in all patients, and hearing loss and motor delay have been seen in patient 1. Although the early institution of ganciclovir therapy with antiretrovirals could be beneficial in controlling CMV infection through maintenance of strong and specific immune function in HIV-infected children, long-term improvement of neurologic outcome associated with congenital CMV infection is uncertain. A prospective study will be necessary to determine the effect of ganciclovir for the long-term neurologic outcome of infants with HIV-1 and CMV.

Potential conflict of interest—none disclosed.

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Retrospective and prospective parental reports of sleep in children with asthma

To the Editor:

Interest in the daytime effects of nocturnal asthma has followed an established literature linking sleep loss to impaired daytime functioning in children.¹⁻³ However, documentation of sleep problems in most studies was primarily based on parental report, the accuracy of which has not been established. Data from the Childhood Asthma Management Program (CAMP) provide the opportunity to critically evaluate 2 methods of reporting nocturnal awakening caused by asthma, examining associations between reported sleep difficulty, asthma severity, and psychological functioning in children with mild-to-moderate asthma.

CAMP was a multicenter, randomized clinical trial initiated by the National Heart, Lung, and Blood Institute to assess the long-term effects of 3 asthma treatments on lung growth in children who were 5 to 12 years of age and demonstrated mild-to-moderate disease at the time of enrollment.^{4,5} Approval was obtained from the institutional review boards at all 8 CAMP sites before initiation of the study. During the screening period before randomization, baseline data were collected, including spirometry before and after bronchodilator, airway responsiveness to methacholine, allergy skin test results, asthma history, current asthma symptoms, and psychological functioning of the child and family. Participants completed daily asthma diary cards during the screening period while receiving only albuterol on an as-needed basis. Patients with severe asthma (ie, those with an FEV₁ of <65% of predicted value, >1 hospitalization, or ≥6 oral steroid bursts in the year before screening or intubation at any time in the past because of asthma) were excluded from participation.

Awakening because of asthma symptoms was assessed in all participants by means of 2 contrasting methods

during the prandomization phase of CAMP. The retrospective recall data were gathered at the first screening visit during an asthma history interview. The prospective recording of awakenings caused by asthma occurred during the 28-day screening interval before randomization. The mean time interval between the first screening visit and the beginning of the 28-day interval was 31.2 days (SD, 19.6 days).

Data were categorized to achieve complimentary groups for analysis of differences in characteristics of the children by reporting method. Retrospective data were recoded in 3 categories of awakening: (1) almost every night; (2) once to 1 time per week but not nightly (combining at least once a week but not nightly, at least once a month but not weekly, and at least once but not monthly); and (3) never. Prospective diary card data were recoded in 3 categories: (1) 4 or more awakenings; (2) 1 to 3 awakenings; and (3) no awakenings.

A protocol of psychological and cognitive measures was included with the objective of measuring the effect of asthma and its treatment on the psychological well-being of the child and family. These included the Child Behavior Checklist, Wechsler Intelligence Scales (Wechsler Intelligence Scale for Children–3rd edition/Wechsler Preschool and Primary Scales of Intelligence–Revised), Woodcock-Johnson Psychoeducational Battery–Revised, Wide Range Assessment of Memory and Learning, and the Gordon Diagnostic System. Details about the use of these psychological measures in CAMP have been provided previously.⁶

Within the CAMP population, 88% of the respondents reported any nighttime awakenings caused by asthma in their children when this variable was assessed retrospectively (see the Data analysis section in the Journal's Online Repository at www.mosby.com/jaci). In contrast, only 34% of the children were reported to have any awakenings caused by asthma when this information was gathered through diary card reporting. Study coordinator assessments of asthma severity were associated with the frequency of nighttime awakenings, regardless of whether nocturnal symptoms were reported retrospectively or prospectively. Those with mild asthma awoke less than those with moderate asthma (see Table E1 in the Journal's Online Repository at www.mosby.com/jaci). However, significant discrepancies were seen between retrospective and prospective reports of frequency of awakening, with higher frequencies of awakening reports emerging from retrospective recall than from prospective observations during the 28-day screening interval ($\chi^2 = 31$; $T = 3.79$; $P < .0001$; see Table E2 in the Journal's Online Repository at www.mosby.com/jaci). In the prospective characterization of nocturnal awakenings, the modal number of asthma-related awakenings was 0 (range, 0–7), and 50% of individuals with retrospective reports of nightly nocturnal awakenings caused by asthma recorded no nightly awakenings in the 28-day screening interval. Among those retrospectively reporting no nocturnal awakenings caused by asthma, 85% had no awakenings during the screening interval,

but 12% had 1 to 3 awakenings, and 3% had 4 or more awakenings.

Children with frequent nighttime awakening that was reported retrospectively had more indicators of poorly controlled asthma (increased emergency department and physician's office visits for treatment of acute asthma) and more school absence caused by asthma than those with infrequent nighttime awakening (see Table E3 in the Journal's Online Repository at www.mosby.com/jaci). The indicators of poorly controlled asthma were greatest in the group of children with almost nightly awakening over the previous 6 months.

A different set of relationships between nighttime awakening and indicators of asthma control emerged when awakening was reported prospectively with information from diary card records. There was no association between frequency of awakening and health care use, school absence, or age of onset of asthma symptoms (see Table E3 in the Journal's Online Repository). However, methacholine FEV₁ PC₂₀ values and change in FEV₁ percent predicted before and after bronchodilator both differed by frequency of awakening, becoming increasingly abnormal with greater nighttime awakening, reflecting increased airway lability in this group.

Thus retrospective parent reports of frequent awakening were associated with indicators of inadequate asthma management and control. When the same families reported sleep problems prospectively, awakenings were associated with evidence of increased airway lability but not increased school absence or health care use. The relationship between nighttime awakening and daytime behavior problems again contrasted sharply between the 2 methods of surveying nocturnal awakening. One-way ANOVA revealed that children whose parents reported increased nighttime awakening retrospectively had higher Thought Problem, Delinquent Behavior, and Aggressive Behavior scores from the Child Behavior Checklist than those with less frequent awakening (see Table E4 in the Journal's Online Repository at www.mosby.com/jaci). The highest problem-behavior scores were seen in the group with almost nightly awakening. In contrast, when the families reported prospectively, there were no differences apparent in any of the behavioral problem reports related to the frequency of nighttime awakening.

Children with retrospectively reported frequent nighttime awakening demonstrated decreased IQ and attention scores compared with those who awoke less frequently. The lowest scores were recorded in the group with awakening reported almost every night (see Table E5 in the Journal's Online Repository at www.mosby.com/jaci). In contrast, frequency of awakening, as reported prospectively, was not associated with any of the cognitive scores.

Documentation of sleep loss and relationships to disease severity and psychological functioning differed when reports of nocturnal awakenings caused by asthma were obtained by means of 2 separate methods in a single group of children with mild-to-moderate asthma.

Nocturnal awakenings caused by asthma would be expected to correlate with indicators of disease severity, such as decreased lung function and increased airway lability; this relationship occurred for the prospective but not retrospective reporting method of data collection. In contrast, nocturnal awakenings caused by asthma correlated with emotional problems when reporting was retrospective, but this was not the case when reporting was prospective. Given these findings, it is likely that parents are overreporting asthma-related nighttime awakenings in retrospective reports.

Overreporting of awakenings because of concern about the child's illness or psychological problems in our study was also seen in a study of sleep patterns in children with attention deficit hyperactivity disorder.³ These parents frequently reported sleep problems that were not confirmed by objective actigraph recordings, a discrepancy the authors suggested might be due to a tendency for worried parents to overreport sleep problems. In addition, the children with attention deficit hyperactivity disorder characterized retrospectively to have frequent awakening demonstrated more psychological distress and used more emergency health care than those with less frequent awakening.³ Findings from other research showing that depressed mothers of pediatric patients are more likely to report physical symptoms⁷ underscore the potential retrospective response bias in parental report of illness symptoms in their children. Although prospective reporting might also be susceptible to sources of unexplained variance, including inconsistencies in the family member who completes the diary cards and the time when they do so, this method of reporting appears to provide more accurate sleep information.

Although other investigators have suggested that retrospectively reported nighttime awakening in children with asthma indicates the presence of a sleep disorder caused by the asthma and resulting in daytime psychological dysfunction,¹ the psychological deficits in this group of retrospectively identified poor sleepers do not suggest that they are due to sleep loss. For example, no evidence exists to indicate that a 10-point IQ deficit might result from sleep loss. Rather, this appears to be a group of children with diminished psychological resources experiencing emotional dysregulation, of which sleep loss is one symptom.⁸ As many as 25% of all children demonstrate sleep disturbances, which are sometimes associated with fears, enuresis, and other psychological problems.⁹ Therefore for many children, sleep disturbance is a symptom and not a cause of emotional dysregulation. This possibility should not lead to the conclusion that parental reports of sleep quality in their children are always inaccurate or should not be sought. Rather, the clinician should recognize the possibility that such reports are inaccurate or not a result of the child's asthma and consider other relevant information. For example, when a child with asthma presents with significant behavioral problems, the clinician might ask for additional information to determine whether sleep difficulty is related to the child's psychological state rather than their asthma and, if

this appears to be the case, refer the family for appropriate psychological intervention.

More severe symptoms of asthma were associated with increased nighttime awakening, regardless of whether they were identified retrospectively or prospectively. However, evidence for asthma severity was distinctly different in the methods of identification. When sleep problems were characterized retrospectively, children with frequent awakening had more emergency department visits, hospitalizations, physician's office visits, and asthma-related school absence in the year before baseline than children waking less frequently, even though they did not have greater methacholine responsiveness, greater bronchodilator reactivity, or decreased prebronchodilator FEV₁ percent predicted. Frequent health care use reflects poorly controlled but not necessarily objectively more severe asthma, often indicates insufficient treatment adherence, and occurs more frequently among psychologically distressed patients and families.¹⁰

In summary, evidence from this study indicates that parents' retrospective reports of frequent nighttime awakening might be identifying psychologically distressed children but not necessarily those with nocturnal asthma exacerbations. Numerous studies have used retrospective questionnaires to characterize the sleep of asthmatic children.^{1,2} Although the investigators in those studies concluded that reported sleep loss resulted in psychological problems, daytime fatigue, school absence, and impaired alertness and performance, results from this study suggest such causal attributions might be incorrect. When sleep problems were recorded prospectively on daily diaries, no evidence emerged of emotional or cognitive impairment caused by asthma-related awakening.

Additional investigation into the accuracy of self- and parent-reported sleep problems is warranted and should include a research design in which sleep is objectively measured through actigraphy or polysomnography, after which parents are asked to report subjectively on sleep latency, frequency of awakening, and sleep efficiency. With this protocol, investigations of sleep loss and consequent daytime psychological function in children and adults are likely to produce clearer information. Further evidence of a relationship between nocturnal asthma and daytime functioning might come from controlled trials in which improvement in nighttime symptoms and sleep are associated with improved performance in patients whose asthma has been successfully treated. Until such studies are conducted, conclusions about the relationship among pediatric asthma, sleep, and daytime functioning must be proffered with caution.

Please see the Journal's Online Repository at www.mosby.com/jaci for the complete CAMP Credit Roster.

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