

Underlying Causes of Recurrent Pneumonia in Turkish Children in a University Hospital

by Ergin Çiftçi, Meltem Güneş, Yavuz Köksal, Erdal İnce, and Ülker Doğru
Ankara University Medical School, Department of Pediatrics, Ankara, Turkey

Summary

The aim of this study was to determine the relative frequency of underlying illnesses for recurrent pneumonia in children. Children who had two or more episodes of pneumonia per year, or three or more episodes in a lifetime were investigated retrospectively at Ankara University Medical School, Department of Pediatric Infectious Diseases, between January 1997 and October 2002. Out of 788 children hospitalized for pneumonia, 71 (9 per cent) met the criteria for recurrent pneumonia. An underlying illness was demonstrated in 60 patients (85 per cent). In this group, the underlying illness was diagnosed prior to pneumonia in 11 patients (18.3 per cent), during the first episode in 12 patients (20 per cent), and during recurrence in 37 patients (61.7 per cent). Underlying diseases were bronchial asthma (32 per cent), gastroesophageal reflux (15 per cent), immune disorders (10 per cent), congenital heart defects (9 per cent), anomalies of the chest and lung (6 per cent), bronchopulmonary dysplasia (4 per cent), cystic fibrosis (3 per cent), tuberculosis (3 per cent), and aspiration syndrome (3 per cent). No predisposing illness could be demonstrated in 11 patients (15 per cent). In conclusion, approximately one-tenth of hospitalized children with pneumonia in our hospital had recurrent pneumonia. Most of these children had an underlying illness, which was demonstrated by intensive investigation. Bronchial asthma in children aged more than 2 years and gastroesophageal reflux in children aged less than 1 year were the most common underlying illnesses for recurrent pneumonia.

Introduction

Pneumonia is an important cause of morbidity and mortality in children. Some children experience recurrence of this infection. Recurrent pneumonia is defined as at least two pneumonia episodes in a 1 year period or more than three episodes at any time with radiographic clearing between episodes.^{1,2} Recurrent pneumonia may result from various disorders, and the pediatrician should investigate these possible underlying causes.^{3,4} There are only a few studies of recurrent pneumonia in children,⁵⁻⁹ and to our knowledge, there is no study from Turkey about childhood recurrent pneumonia. We therefore initiated a retrospective study aimed at describing the underlying causes of recurrent pneumonia in children hospitalized in a university hospital.

Materials and Methods

All children admitted to Ankara University Medical School, Department of Pediatric Infectious Diseases, between January 1997 and October 2002, with a

hospital discharge diagnosis of pneumonia were identified. Children who had two or more episodes of pneumonia per year or three or more episodes in a lifetime, were included in the study. The diagnosis of pneumonia was based on cough, chest indrawing, tachypnea (respiratory rate > 50/min), fever (rectal temperature > 39.0°C or axillary temperature > 38.0°C) and lobar or bronchopneumonic infiltration determined by roentgenography. The patients who had a diagnosis of pneumonia without radiographic confirmations were excluded from the study.

Using a standardized data extraction form, information was obtained on the patient's demographic characteristics, including sex and age of the child, dates of hospitalizations, clinical findings, and results of laboratory and radiographic investigations for underlying causes. Patients were classified according to underlying illnesses that had previously been associated with pneumonia. These underlying conditions included congenital heart defects, congenital lung and airway anomalies, gastroesophageal reflux, immune disorders, cystic fibrosis, bronchial asthma, oral motor incoordination and swallowing dysfunctions. Confirmation of these underlying disorders were based on standardized laboratory tests including sweat chloride testing, pulmonary function tests with methacholine challenge, computed tomography scan of the chest,

Correspondence: Ergin Çiftçi, Ankara Üniversitesi Tıp Fakültesi, Çocuk Sağlığı ve Hastalıkları Anabilim Dalı, 06100 Dikimevi, Ankara, Turkey. Tel. 90312-362-3030; Fax 90312-362-0581; E-mail <erginciftci@doctor.com>.

TABLE 1
Underlying causes of recurrent pneumonia in children

Underlying illness	Number of patients (%)
Bronchial asthma	23 (32)
Gastroesophageal reflux	11 (15)
Immune disorder	7 (10)
Partial IgA deficiency	3
Transient hypogammaglobulinemia	3
DiGeorge syndrome	1
Congenital heart disease	6 (9)
Ventricular septal defect	3
Atrial septal defect	2
Complete atrioventricular septal defect	1
Anomalies of the chest and lung	4 (6)
Tracheoesophageal fistula	1
Tracheal stenosis	1
Congenital bronchiectasis	1
Diaphragmatic hernia	1
Bronchopulmonary dysplasia	3 (4)
Pulmonary tuberculosis	2 (3)
Cystic fibrosis	2 (3)
Aspiration syndrome	2 (3)
Unknown	11 (15)
Total	71 (100)

laryngoscopy, flexible bronchoscopy, serum α l-antitrypsin level, serum immunoglobulins, the number of T and B lymphocytes, lymphoblastic transformation, serum total IgE level, specific immunoglobulins for various allergens, and *Candida* and tuberculin skin test. Gastric fluid examination for acid fast bacilli and hemosiderin-laden macrophages were performed in only a subgroup of patients. Gastroesophageal reflux was demonstrated by barium swallow or gastric scintiscan, or esophageal pH manometry. Congenital cardiac anomalies were demonstrated by echocardiography.

Results

During the study period, 788 patients were admitted to the hospital with a diagnosis of pneumonia. Seventy-one of them (9 per cent) met the definition of recurrent pneumonia. There were 49 (69 per cent) males and 22 (31 per cent) females. The mean age of the patients when recurrent pneumonia was diagnosed was 23.6 ± 22.7 months (range 3 months–12 years). The mean pneumonia episode of patients was 5.2 ± 2.8 episodes (range 2–20 episodes).

An underlying disease was demonstrated in 60 (85 per cent) of the patients with recurrent pneumonia. Twenty-three patients (32 per cent) had bronchial asthma, 11 patients (15 per cent) had gastroesophageal reflux, seven patients (10 per cent) had immune disorder, six patients (9 per cent) had

congenital heart defect, four patients (6 per cent) had anomalies of the chest and lung, three patients (4 per cent) had bronchopulmonary dysplasia, two patients (3 per cent) had cystic fibrosis, two patients (3 per cent) had tuberculosis, and two patients (3 per cent) had aspiration syndrome. No predisposing illness could be demonstrated in the remaining 11 patients (15 per cent) (Table 1).

Age was an important parameter for the two leading causes of recurrent pneumonia. Nine patients (82 per cent) with gastroesophageal reflux were less than 1 year old, whereas 19 patients (83 per cent) with bronchial asthma were more than 2 years old.

Out of the 60 patients with a detected underlying illness for recurrent pneumonia, 11 patients (18.3 per cent) were diagnosed with an underlying illness prior to the first episode of pneumonia, 12 patients (20 per cent) were diagnosed during the first episode of pneumonia, and 37 patients (61.7 per cent) were diagnosed after pneumonia recurrences (Table 2). Most patients with bronchial asthma and gastroesophageal reflux were diagnosed only after pneumonia recurrences. All patients with congenital heart defect were diagnosed prior to the first episode of pneumonia, while all patients with immune disorder were diagnosed after pneumonia recurrences.

Discussion

Although possible approaches to the investigation of recurrent pneumonia have been described, there are few studies of recurrent pneumonia in the pediatric population.^{5–9} This is the first report of the underlying causes of recurrent pneumonia in Turkish children. In our study, 9 per cent of hospitalized patients with a diagnosis of pneumonia met the definition of recurrent pneumonia. Similarly, 8 per cent of hospitalized patients with pneumonia met the criteria for recurrent pneumonia in a study with a large pediatric population.⁹

We demonstrated an underlying illness for recurrent pneumonia in 85 per cent of our patients. In our study, the most frequent underlying illness was bronchial asthma, followed by gastroesophageal reflux, immune disorders, and congenital heart defects. Bronchopulmonary dysplasia, cystic fibrosis, congenital bronchiectasis, tuberculosis, aspiration syndrome, tracheoesophageal fistula, and diaphragmatic hernia were relatively rare causes of recurrent pneumonia. The most common causes of recurrent pneumonia were aspiration syndrome, bronchial asthma, and immune disorders, according to studies from Canada, United States and Saudi Arabia, respectively.^{6,8,9} Eigen, *et al.*⁶ found that 20 (25 per cent) of 81 patients with recurrent or persistent pneumonia had an underlying cause. Of the 61 children without an underlying cause, 49 per cent had a family history of allergies and asthma, 31 per

TABLE 2
The relation between the diagnosis of underlying illnesses and pneumonia episodes

Underlying illness	Diagnosed prior to first pneumonia episode	Diagnosed during first pneumonia episode	Diagnosed after pneumonia recurrence	Total
Bronchial asthma	0	7	16	23
Gastroesophageal reflux	0	2	9	11
Immune disorder	0	0	7	7
Congenital heart disease	6	0	0	6
Anomalies of the chest and lung	0	2	2	4
Bronchopulmonary dysplasia	3	0	0	3
Cystic fibrosis	0	1	1	2
Pulmonary tuberculosis	0	0	2	2
Aspiration syndrome	2	0	0	2
Total	11	12	37	60

cent had a history of wheezing, and 18 per cent were wheezing at the time of the initial evaluation. All these findings suggest that bronchial asthma is an important underlying illness for recurrent pneumonia in children.

Because of foetal echocardiography and cardiac murmur, all patients with congenital heart defect were diagnosed prior to the first episode of pneumonia. One patient with complete atrioventricular septal defect also had Down's syndrome.

Although most of our patients who had immune disorders also had recurrent upper respiratory tract infections, we were able to demonstrate the immune defects only after pneumonia recurrences.

Tracheal stenosis, tracheoesophageal fistula, and diaphragmatic hernia were detected during the first episode of pneumonia. Tracheal stenosis and H type tracheoesophageal fistula were demonstrated by computed tomography and barium swallow, respectively. After extensive investigation, we could not demonstrate any underlying illness in a boy with bronchiectasis, and we assumed that he had congenital bronchiectasis. Three children with bronchopulmonary dysplasia were premature, and received extensive oxygen therapy and mechanical ventilatory support during the newborn period. Both children with aspiration syndrome had cerebral palsy. Because consanguinity of parents is very common in our country, two patients with cystic fibrosis were not surprising in our study group. Tuberculosis is still an important problem in our country, and the diagnosis of this illness may be difficult. The two patients in our study group were diagnosed using a combination of various findings from family history, tuberculin skin test, computed tomography of the chest, and benefits from anti-tuberculosis therapy.

An underlying illness for recurrent pneumonia could be demonstrated only after pneumonia recurrence in approximately two-thirds of our

patients. Contrary to our findings, Owayed, *et al.*⁹ diagnosed an underlying illness prior to the first episode of pneumonia in 80.9 per cent of patients. This difference may be partially related to the difference of the most common underlying illnesses in the two studies. In addition, Canada is a developed country, whereas Turkey is a developing country, which may be another factor for the difference between the results of these two reports. Because of the high costs of investigation for underlying illness, most of our patients were investigated after pneumonia recurrence.

Similar to previous reports, although they had a heterogeneous age pattern, most of our patients with recurrent pneumonia were aged less than 2 years.⁹ This may be related to early presentation of various congenital anomalies and immune disorders, and the tendency to respiratory tract infections. Age less than 1 year was the most important parameter for patients with gastroesophageal reflux.

Unfortunately, our study had several limitations. Only hospitalized patients were included in the study. However, some patients with recurrent pneumonia could have been treated at outpatient clinics. In addition, some of our patients with a diagnosis of pneumonia at one time might be treated at another hospital later on for recurrences. So, we may not know the true percentage of patients with recurrent pneumonia in our hospital. Because of the retrospective nature of our study we could not investigate the effect of passive smoking on recurrent pneumonia. Indeed, passive smoking is a well-described risk factor for many pulmonary diseases and is much more common than some of the rare illnesses encountered in our study group.¹⁰ In addition, we considered only one underlying illness as the cause of recurrent pneumonia. So, we cannot know if 'underlying illness' was a direct effect or the only reason for pneumonia recurrence.

Our study shows that approximately one-tenth of Turkish children admitted to our hospital had recurrent pneumonia. Most of these children had an underlying illness that could be demonstrated by intensive investigation. Bronchial asthma in children aged more than 2 years and gastroesophageal reflux in children aged less than 1 year are the most common underlying illnesses for recurrent pneumonia.

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