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Risk Factors for Lower Respiratory Tract Infection and Recurrent Lower Respiratory Tract Infection in Children

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Abstract

Introduction: A survey was administered to the families of children hospitalized due to lower respiratory tract infections in winter. Risk factors that may cause non-recurrent LRTI and recurrent LRTI in hospitalized children were compared.

Materials and Methods: Survey questions were asked to the families of pediatric patients who were hospitalized with a diagnosis of LRTI in the training and research hospital during the winter period and did not have a known chronic disease. Patients were divided into two groups: children hospitalized due to recurrent LRTI and non-recurrent LRTI (first hospitalization). Factors that may cause LRTI were compared between the two groups.

Results: 47 of 77 patients (61%) were male. There were 43 (55.8%) patients between 1 and 6 months. There were 25 (32.5%) patients living in crowded houses. The number of patients exposed to cigarette smoke was 61 (79.2%). 28 (36.4%) of the patients lived in a damp house. Five of the six patients with a history of premature birth had been recurrently hospitalized (p= 0.013). Among those with a family history of atopy, 80.6% had non-recurrent LRTI and 19.4% had recurrent LRTI (p=0.004). There was a positive relationship between household population and the number of smokers.

Conclusion: Risk factors for LRTI include young age, male gender, atopic family history, low socioeconomic level, exposure to cigarette smoke and premature birth. History of premature birth, young age, and atopic family history are risk factors for recurrent LRTI.

Keywords: Childhood; respiratory tract infection; family structure; living conditions.

Introduction

Childhood Lower Respiratory Infections (LRTIs) may progress rapidly in young children. It can cause serious mortality and death. LRTI includes cases of bronchitis, bronchiolitis, bronchopneumonia, and pneumonia. The diagnosis of viral and bacterial pneumonia can sometimes be difficult to determine by chest X-ray and clinical findings (1, 2). Following an upper respiratory tract disease, the lower respiratory tract encounters pathogenic agents as a result of impaired host defense. Peribronchial epithelial tissue is then infiltrated by leukocytes, resulting in airway edema. This process reduces lung compliance, increases resistance, and decreases the movement of secretions proximal to larger airways. This causes airway obstruction. Occlusion of small airways causes distal air spaces to collapse, air trapping, and altering the ventilation-perfusion relationship. In severe infections, it causes bronchial-bronchiolar epithelial necrosis or pulmonary parenchymal necrosis (2). The lungs, airways, and immune system are most vulnerable during the early years of life (3, 4). The most common causative factors for LRTI differ according to age. Poor socioeconomic status, living in crowded home environments, poor hygiene conditions, exposure to air pollution, exposure to cigarette smoke, inadequate nutritional intake, malnutrition, inadequate access to health services, male gender, low birth weight, preterm birth, parental smoking, immunodeficiency, presence of congenital anomalies, chronic pulmonary disease or reactive airway disease, swallowing dysfunction, underlying congenital heart disease, immunodeficiency and immunosuppression, Down syndrome, history of atopy, and gastroesophageal reflux, and ciliary dysfunction are risk factors for developing LRTI. These patients may require hospitalization for LRTIs. Recurrent LRTI occurs if precautions are

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not taken (1, 2, 5, 6). In addition, autoimmune diseases and possible allergies should be kept in mind in children with chronic cough. Parental consanguinity, sibling death, presence of atopic diseases in the family, family member with cystic fibrosis or primary ciliary dyskinesia, and presence of someone in the close circle diagnosed with tuberculosis should be evaluated (7). We questioned the sociodemographic characteristics of children hospitalized for LRTI and the risk factors that may cause LRTI. We aimed to compare these risk factors in children with recurrent hospitalizations due to LRTI and those hospitalized for the first time.

Materyals and Methods

This is a prospective study and a cross-sectional study. Children who were hospitalized with the diagnosis of LRTI between 10.02.2018 and 10.05.2018 in the pediatric health and diseases service of the only education and research hospital in the province were included in the study. Consent was obtained from the parents for this study. The patient's gender and body weight percentage and age (months) at the time of admission were recorded. A questionnaire was applied to families who agreed to answer the questionnaire questions by face-to-face interview technique. The interviewee was the patient's mother. During the interview, the mother read the questions aloud and answered them. The following questions were asked in the questionnaire: What is the patient's birth week? What is the method of birth (normal spontaneous vaginal birth or cesarean section)? When is the time to start complementary foods? Do family members have asthma, eczema and/or dermatitis? Is there an allergic disease in the family? What is a heating device used at home? Do you think the humidity in your home is high? How many people living in the house? Are there any animals (pets) in the house? What is the family structure like? How many people live in the house? Is there anyone smoking in the house, if so, who smokes, and how many cigarettes are smoked? What is the mother's education level? What is the father's education level? What is the family's average monthly income? Does the patient have a history of hospitalization with the diagnosis of LRTI? How many times did she stay in the hospital for this reason? Study inclusion criteria: Being a child aged 1 month to 18 years, no known neuromuscular disease, no congenital anomalies, swallowing dysfunction, gastroesophageal reflux, etc. no of a diagnosed chronic disease that may predispose to LRTI. Exclusion criteria from the study: Being younger than 1 month, older than 18 years, having any neuromuscular disease, having congenital anomalies, swallowing dysfunction, gastroesophageal reflux, etc. having a previously diagnosed chronic disease that may predispose to LRTI.

Ethical approval: This study was conducted in accordance with the Declaration of Helsinki. Approval was obtained from the Erzincan Binali Yıldırım University Clinical Research Ethics Committee (session no. 19/decision no. 19/19). Written informed consent in accordance with the Declaration of Helsinki was obtained from all patients participating in our study.

Statistical analysis: Categorical variables were summarized as numbers and percentages, while continuous variables were summarized as mean±standard deviation or median (minimum – maximum) value. Chi-square test statistics were used to compare categorical measurements between groups. Spearman's rank correlation coefficient was used to determine the relationship between numerical variables. IBM SPSS 21 (Armonk, NY: IBM Corp.) package program was used for statistical analysis of the data. A value of $p<0.05$ was considered statistically significant for all tests.

Results

A total of 77 patients, 30 (39%) females, and 47 (61%) males were included in our study. The mean age was 13.7 ±18.7 months, median age was 6 months (minimum 1 month -maximum 84 months). The age of 43 (55.8%) patients was between 1-6 months. The mean weight was 8.9 ±5.2 kg body. The median weight was 7.1 (minimum 2.35- maximum 37.00). Body weight percentiles were similar in both groups. Five of the six patients with a history of premature birth had been recurrently hospitalized ($p= 0.013$). Type of birth were similar in both group. Time to start complementary foods were similar in both group. Among those with a family history of atopy, 80.6% had non-recurrent LRTI and 19.4% had recurrent LRTI ($p=0.004$). Family structure 57 (74%) patients lived in a nuclear family and 20 (26%) patients lived in an extended family. Home warming tool, humidity of the house, number of people living in the house, presence of pets at home, the person smoking at home, the number of cigarettes smoked per day at home, mother's educational status, father's educational status were similar in both group. Table 1, Table 2, and Table 3 show comparisons between hospitalization and other factors.

Table 1: The relationship between the number of previous hospitalizations, age, gender, weight percentile, mode of delivery and familial atopy

		Total n (%)	Non-recurrent LRTI n (%)	Recurrent LRTI n (%)	*p*
Gender	Female	30 (39.0)	20 (66.7)	10 (33.3)	0.659
	Male	47 (61.0)	29 (61.7)	18 (38.3)	
Age	1-6 months	43 (55.8)	33 (76.7)	5 (23.3)	0.021
	7-12 months	12 (15.6)	8 (66.7)	3 (33.3)	
	13-24 months	9 (11.7)	3 (33.3)	6 (66.7)	
	24-36 months	8 (10.4)	4 (50.0)	4 (50.0)	
	>36 months	5 (6.5)	1 (20.0)	4 (80.0)	
Weight Percentile	<3	7 (9.1)	4 (57.1)	3 (42.9)	0.355
	3-9	1 (1.3)	1 (100.0)	0 (0.0)	
	10-24	12 (15.6)	7 (58.3)	5 (41.7)	
	25-49	19 (24.7)	14 (73.7)	5 (26.3)	
	50-74	13 (16.9)	5 (38.5)	8 (61.5)	
	75-89	13 (16.9)	8 (61.5)	5 (38.5)	
	90-96	9 (11.7)	8 (88.9)	1 (11.1)	
	>96	3 (3.9)	2 (66.7)	1 (33.3)	
Premature birth	Birth age >37 weeks	71 (92.2)	48 (67.6)	23 (32.4)	0.013
	Birth age ≤37 weeks	6 (7.8)	1 (16.7)	5 (83.3)	
Type of birth	Normal	40 (51.9)	26 (65)	14 (35)	0.796
	C/S	37 (48.1)	23 (62.2)	10 (37.8)	
Time to start complementary foods	Not yet started	31 (40.2)	23 (74.2)	8 (25.8)	0.225
	<6 months	21 (27.3)	13 (61.9)	8 (38.1)	
	≥6 months	25 (32.5)	13 (52.0)	12 (48.0)	
Family history of atopy	Yes	36 (46.8)	29 (80.6)	7 (19.4)	0.004
	No	41 (53.2)	20 (48.8)	21 (51.2)	

C/S: Cesarean section. For all patients (total) number and column percentages were reported. In groups, row percentages were reported according to variables.

Table 2: Number of previous hospitalizations, living environment and exposure to cigarette smoke

		n (%) Total	Non-recurrent LRTI n (%)	Recurrent LRTI n (%)	*p*
Home warming tool	Heating (Natural gas)	35 (45.5)	20 (57.1)	15 (42.9)	0.451
	Stove (coal stove)	41 (53.2)	28 (68.3)	13 (31.7)	
	Electric stove	1 (1.3)	1.0 (100.0)	0 (0.0)	
Humidity of the house	Yes	28 (36.4)	16 (57.1)	12 (42.9)	0.371
	No	49 (63.6)	33 (67.3)	16 (32.)	
Number of people living in the house	3-5 people	52 (67.5)	32 (61.5)	20 (38.5)	0.581
	≥6 people	25 (32.5)	17 (68.0)	8 (32.0)	
Pet at Home	Yes	6 (7.8)	3 (50.0)	3 (50.0)	0.470
	No	71 (92.2)	46 (64.8)	25 (35.0)	
Person smoking at home	No	16 (20.8)	9 (56.3)	7 (43.8)	0.541
	Father	45 (58.4)	29 (65.2)	16 (34.8)	
	Mother	1 (1.3)	1 (100.0)	0 (0.0)	
	Other people	4 (5.2)	3 (75.0)	1 (25.0)	
	Other person with parents	11(14.3)	8 (72.7)	3 (27.3)	
Number of cigarettes smoked per day at home	No	16 (20.8)	9 (56.3)	7 (43.8)	0.549
	< 20	26 (33.8)	16 (61.5)	10 (38.5)	
	≥ 20	35 (45.5)	24 (68.6)	11 (31.4)	

There was a positive correlation between the age of hospitalization and the age of starting solid food. There was a positive correlation between household population and the number of smokers (Table 4).

Table 3: Education level of the patient's parents and the financial situation of the family

		Total n (%)	Non-recurrent LRTI n (%)	Recurrent LRTI n (%)	*p*
Mother's educational status	Illiterate	9 (11.7)	4 (44.4)	5 (55.6)	0.393
	Literate	2 (2.6)	2 (100.0)	0 (0.0)	
	Primary school	17 (22.1)	9 (52.9)	8 (47.1)	
	Middle school	26 (33.8)	17 (65.4)	9 (34.6)	
	High school	15 (19.5)	12 (80.0)	3 (20.0)	
	Universty	8 (10.4)	5 (62.5)	3 (37.5)	
Father's Educational status	Illiterate	1 (1.3)	1 (100.0)	0 (0.0)	0.622
	Literate	1 (1.3)	0 (0.0)	1 (1.1)	
	Primary school	26 (33.8)	15 (57.7)	11 (42.3)	
	Middle school	22 (28.6)	16 (72.7)	6 (27.3)	
	High school	19 (24.7)	12 (63.2)	7 (36.8)	
	Universty	8 (10.4)	5 (62.5)	3 (37.5)	
Family monthly income	Minimum salary	40 (51.9)	26 (65.0)	14 (35.0)	0.943
	Twice the minimum salary	25 (32.5)	15 (60.0)	10 (40.0)	
	Three times the minimum salary	5 (6.5)	3 (60.0)	2 (40.0)	
	More than three times the minimum salary	7 (9.1)	5 (71.4)	2 (28.6)	

Table 4: Spearman correlation analysis of hospitalization (recurrent and non-recurrent LRTI) and risk factors that may cause LRTI

		Age	Perc.	Foods	H. popul	M.Educ	F. Educ	Salary
Age	Rho	1.000	-0.161	0.786*	-0.048	-0.077	0.048	0.087
	P	.	0.162	0.001	0.678	0.503	0.675	0.450
Perc.	Rho	-0.161	1.000	-0.298*	-0.142	0.142	0.164	-0.006
	P	0.162	.	0.009	0.219	0.219	0.154	0.960
Food	Rho	0.786*	-0.298*	1.000	-0.063	-0.112	0.033	0.147
	P	0.001	0.009	.	0.589	0.334	0.778	0.202
H. popul.	Rho	-0.048	-0.142	-0.063	1.000	-0.150	-0.161	-0.001
	P	0.678	0.219	0.589	.	0.194	0.162	0.995
M.Educ.	Rho	-0.077	0.142	-0.112	-0.150	1.000	0.472*	0.395*
	P	0.503	0.219	0.334	0.194	.	< 0.001	<0.001
F. Educ	Rho	0.048	0.164	0.033	-0.161	0.472*	1.000	0.383*
	P	0.675	0.154	0.778	0.162	0.001	.	0.001
Salary	Rho	0.087	-0.006	0.147	-0.001	0.395*	0.383*	1.000
	P	0.450	0.960	0.202	0.995	0.001	0.001	.

Food: Time to start complementary foods, **F. Educ.:** Father's educational status, **H. popul.:** Number of people living in the house/ household population, **M. Educ.:** Mother's educational status, **Perc:** Weight Percentile, **Salary:** Monthly salary, **Rho:** Spearman's rank correlation coefficient.

Discussion

In this study, children without chronic diseases who were hospitalized due to LRTI were investigated. Factors that may cause LRTI were compared between patients hospitalized for the first time due to LRTI and patients hospitalized for recurrent LRTI LRTI is the cause of approximately half of all hospitalizations in children aged 0-5 years. The reason may be a low immune response, narrow airways, or poor nutritional status (8, 9). Young age (especially under one year old), male gender may cause higher rates of hospitalization (6, 10). The age of more than half of our patients was between 1-6 months. The age of 93.5% of our patients were younger than 36 months. In childhood, LRTI cases are more common in boys than girls. This may be due to the smaller airway diameter in boys than in girls (6, 10). The number of male/female patients in our study was similar to the literature. Premature birth may be a risk factor for faster progression of respiratory tract infections and multiple hospitalizations (11). Among our patients, 83% of the children with a birth history of ≤37 weeks had a history of recurrent LRTI hospitalization. This situation supported the literature. It has been reported that the risk of severe LRTI in infancy in babies born by planned cesarean section is moderately higher compared to babies born vaginally (12). The number of recurrent hospitalizations was similar in both delivery types. Early introduction of supplementary foods and early discontinuation of breast milk may increase the risk of LRTI at a young age (13). In our study, the age of starting supplementary food was similar in both groups. Family and child history of atopyare risk factors for recurrent LRTI (14). About half of our patients had a family history of atopy. The number of recurrent hospitalizations due to LRTI was lower in those with a family history of atopy than in those without a family history of atopy. This may be due to the fact that those with atopy in their families are more protective of themselves and their children against environmental factors that may be risk factors. Particulate matter exposure (such as a passing mobile vehicle, or living in an industrial area) may be a predisposed factor for LRTI (15). Indoor air pollution caused by burning stoves at home may increase the likelihood of children developing LRTIs (16). About half of our patients used a coal stove at home. The number of recurrent hospitalizations was similar for those who used coal stoves and those who used a heater. The rate of hospitalization for LRTI may be increased in young children living in damp and moldy houses (17). About one-third of parents stated that their home was damp. There wasn't a significant relationship between the humidity of the house and repeated hospitalizations. Crowded home life may lead to recurrent hospitalizations due to LRTI. Having a crowded household is risky in terms of carrying and transmitting pathogenic agents (18). The risk of developing LRTI increases, especially in crowded houses with more than five living people (19). In our study, about a third of the patients lived in the same house with 6 or more people, and one-third of them had recurrent hospitalizations. The number of households population was similar in recurrent LRTI and ron-recurrent LRTI Pets may increase the likelihood of contracting lower respiratory tract infections in the community (20). Recurrent and non-recurrent LRTIs were similar in the presence of animals in the home. Children living in smoking houses are more likely to have respiratory diseases than those living in non-smoking homes (21). It has been reported that nicotine exposure increases the severity of LRTIs (21). In our study, a relationship was not found between those who were exposed to cigarette smoke and those who did not, in terms of recurrent hospitalization. In our country, the frequency of tobacco and tobacco product use among people over the age of 15 is 30.5% (22). The frequency of smoking in the fathers of our patients was 58.4%. Most of our patients, 80.5%, were exposed to cigarette smoke. Number of cigarettes smoked per day at home was similar in recurrent LRTI and non-Recurrent LRTI Studies have shown that the risk of developing LRTI is increased in children whose parents have a low educational level (6, 9). In most of the studies, it was stated that the parents of children with severe LRTI received education up to the primary or secondary school level (9). In our study, most of the mothers were secondary school graduates and most of the fathers were primary school graduates, and the education score was mostly medium. The educational level of the family was similar in patients with recurrent and non-recurrent hospitalizations. It has been reported that there is a relationship between low socioeconomic levels, especially in lower respiratory tract diseases (6,8). Half of our patients were not in good economic condition. The economic situation of children diagnosed with recurrent and non-recurrent LRTI was similar

Study limitations: It is a single center, the number of patients is small and there is no healthy control group. Strengths of our work: It is to

address a large number of issues that may cause LRTI in children without an underlying disease.

Conclusion

Male gender, young age, low socioeconomic level, low education level, exposure to cigarette smoke, family history of atopy, and premature birth are risk factors for LRTI. History of premature birth, young age, and atopic family history are risk factors for recurrent LRTI. Children's exposure to cigarette smoke should be avoided. Mothers, fathers, and, if necessary, other family members should be informed about the harms of smoking and the effects on children on this issue by official institutions and media during the prenatal period and at different times.

Ethics committee approval: The university medical sciences ethics committee gave permission for the study with the decision numbered 19/19 taken at the session numbered 19. Date: 13/02/2018

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Authors contribution: Study conception-design: İSK, NAP; data collection: İSK, NAP, İT; analysis-interpretation of results: İSK, YKA; draft manuscript preparation: İSK, NAP, İT, YKA. All authors reviewed the results and approved the final version of the manuscript.

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