



The Prevalence of Asthma and Pneumonia in Children Under 5 Years of Age With Acute Respiratory Symptoms Based on Reports From Attending Specialists and Standard Criteria

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Abstract

Background and Objectives: Asthma and pneumonia are the common inflammatory diseases in children with similar pulmonary symptoms such as coughing and shortness of breath. Due to the high similarity between the clinical symptoms of the diseases and the lack of appropriate paraclinical tools for the diagnosis of asthma, this study aims to consider the prevalence of asthma and pneumonia in children with acute respiratory symptoms. In this descriptive cross-sectional study, 155 children aged less than 5 years diagnosed with asthma or pneumonia in Ali Asghar hospital were studied.

Methods: A checklist was applied which contained the necessary information for the accurate diagnose of patients based on standard criteria and clinical features confirmed by a medical specialist team, including an infectious pediatrician and a pediatric asthma and allergy specialist. Eventually, the diagnosis results reported by the attending specialist's team and the emergency physician were analyzed through SPSS software.

Findings: Of all participants, 109 (70.3%) were males and 46 (29.7%) were females. There was a significant difference in the prevalence of asthma and pneumonia reported by the emergency physician and medical specialist team ($k=0.31$; $P<0.001$). Emergency physician reported 55 patients (35.5%) with asthma, 96 patients (61.9%) with pneumonia, and 4 patients (2.6%) with asthma and pneumonia. The medical teams reported 84 patients (54.2%) with asthma, 40 patients (25.8%) with pneumonia, and 31 patients (20%) with asthma and pneumonia.

Conclusions: Due to the similarities in clinical symptoms of asthma and pneumonia, the reported incidence of asthma is less than the true level because of misdiagnosis with pneumonia.

Keywords: Asthma, Pneumonia, Pediatrics

Background and Objectives

Asthma is a chronic airway disease that increases airway resistance and responds to stimuli. Inflammatory cells such as mast cell, eosinophil, T lymphocytes and chemical mediators cause chronic inflammation. This inflammation ultimately causes hyperplasia of the muscles in the airway structure and the proliferation of extracellular matrix proteins and, as a result irreversible ducts dysgenesis.¹⁻³ In developed countries, asthma is the most common cause of chronic childhood disease. In America, 7 million children under the age of 18 suffer from asthma. Asthma is also more common in boys than

in girls.^{1,4} In European countries, 30 to 50 million people have been reported with asthma, which accounts for 10% of the population.⁵ Asthma in children is often associated with coughing, wheezing and shortness of breath. Patient histories should include the number of attacks of dyspnea, exercise intolerance, predisposing factors and familial history of asthma and allergies. Clinical symptoms of asthma show up to 50% to 80% of their first year of life. Viral infections, exposure to allergens and stimulants, such as cigarette smoke, are the other associated risk factors. These children usually have a history of allergic diseases such as eczema or allergic rhinitis.^{2,6-8} Pneumonia is defined as the lower respiratory tract infection, which includes the airway and parenchyma. One of the most important causes of the death in children under the age of 5 years is pneumonia, which accounts for

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about 15% of deaths in developing countries.^{9,10} Different viral and bacterial agents are the cause of pneumonia, of which *Pneumococcus* is the most important bacterium and respiratory syncytial and influenza viruses are the most important viruses.¹¹ Both asthma and pneumonia show symptoms of cough and shortness of breath, with or without fever and wheezing.^{1,12} The accurate diagnosis of pneumonia is based on radiological, clinical, and laboratory findings.^{13,14} Due to the lack of single method and limitation of the use of spirometric method in children under the age of 5 years, researchers are using multiple items such as a corticosteroid test, skin allergy test, global initiative for asthma (GINA), modified asthma productive index (mAPI), and asthma-associated risk factors for the diagnosis of asthma. In these criteria, consideration of the history of repeated attacks, parental asthma, allergic rhinitis, eosinophilia more than 4%, sensitivity to food allergens, sex, history of respiratory infections and atopic dermatitis are important for the accurate diagnosis.^{1,15,16} Due to the similarities of the clinical features of asthma with other diseases, wrong diagnosis rate is high in many children with different age groups. Thus, studies at different ages have reported fewer or higher prevalence of asthma than actual values. Pneumonia is considered as one of the most commonly diagnosed diseases that are misdiagnosed with asthma at an early age.^{5,17} In this study, we are seeking to provide a more accurate diagnosis of children under 5 years old with clinical features of asthma and pneumonia based on accepted international guidelines. The researcher also explains the importance of accurate diagnosis of these diseases by examining the history of previous pneumonia diagnosis and the treatment received in patients with asthma.

Methods

In this descriptive cross-sectional research, 155 children aged 6 to 59 months who admitted with acute respiratory symptoms (such as cough and shortness of breath) and diagnosis of asthma and pneumonia from March 2016 to March 2017 at Ali Asghar hospital (Tehran province, Iran), were entered into the study. In this study, the census-based longitudinal method was applied for sampling. All necessary information needed for the accurate diagnosis of asthma and pneumonia was collected in a checklist using international guidelines and consulting with a medical team containing an infectious specialist and a specialist in asthma and allergy. Documents of clinical findings and family history were also available (Figure 1). After completing the required information, the checklist of each patient was evaluated by asthma and allergy specialist and an infectious disease specialist. Specialists

used the GINA guidelines, modified asthma predictive index and associated risk factors presented in reference books for the diagnosis of asthma and used the WHO criteria to diagnose bacterial pneumonia based on physical, radiological and laboratory findings (Figure 2). The initial diagnosis provided by the emergency physician in the hospital and specialists in this study were classified in one of the three following categories: (i) asthma, (ii) pneumonia, and (iii) asthma and synchronous pneumonia. Eventually, the diagnosis results reported by the medical team and the physician were analyzed by SPSS software.

Statistical Analysis

Descriptive analysis was used to describe the data, including mean \pm standard deviation (SD) for quantitative

Check list			
Name:	Sex:	Age:	
Phone:			
Chief complaint:			
Clinical Manifestation:			
Cough:	dyspnea:	temperature:	
O ₂ saturation:			
CXR findings:			
Normal	Haziness	No Graphy	
Lab Data:			
Leukocyte:	Poly:	CRP:	ESR:
Family His of Asthma and Allergy: y/n			
Previous Attack: y/n			
Previous pneumonia: y/n			
Atopic: y/n	Rhinitis: y/n		
Night dyspnea: y/n			
Skin eczema: y/n			
Spray consumption: y/n			
AB consumption: y/n Food or another			
Allergy: y/n			

Figure 1. The Applied Checklist.

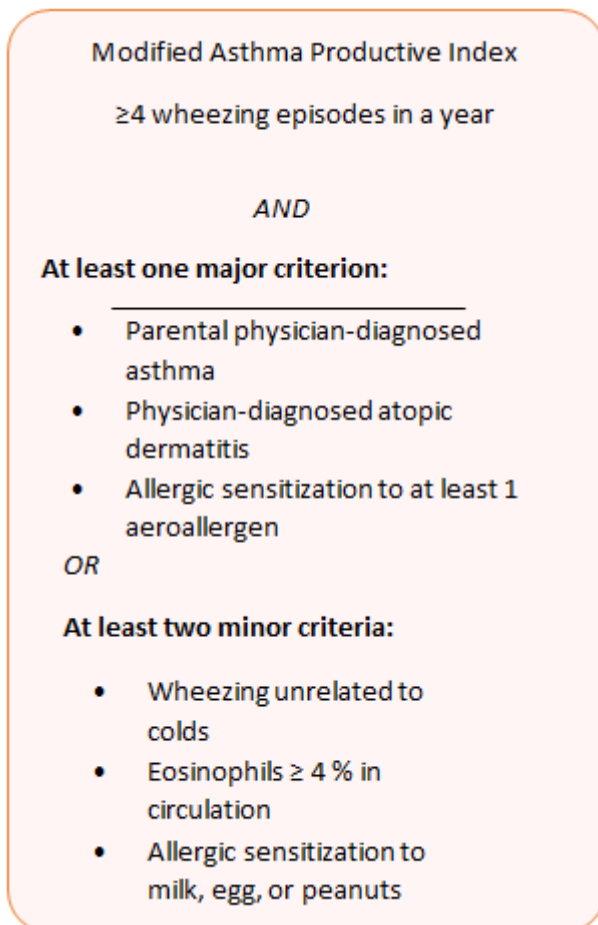


Figure 2. Modified Asthma Productive Index.

variables and frequency (percentage) for categorical variables. To investigate the relationship between diagnosis performed by physicians and the diagnosis of the medical team from the present study, the Cohen's kappa test was used. The correlation coefficient was calculated at the end. *P* values <0.05 were considered to be statistically significant.

Results

Of the 155 children studied, 109 (70.3%) were males and 46 (29.7%) were females. The hospital emergency physician diagnosed 55 (35.5%) children with asthma diagnosis, 96 (61.9%) with pneumonia and 4 (2.6%) with asthma and pneumonia (Table 1). The medical teams reported 84 (54.2%) children with asthma diagnosis, 40 (25.8%) children with pneumonia and 31 (20%) patients with asthma and pneumonia (Table 1). Based on the analysis performed by the Cohen Kappa statistical test, the correlation coefficient of the diagnosis of the two groups of physicians was 0.31 and showed a significant difference between the diagnosis of the two groups (*P*<0.001).

Discussion

Asthma and pneumonia are respiratory diseases with similar symptoms, but the chronic nature of asthma and the acute nature of pneumonia have increased the importance of accurate diagnosis of these diseases. Since the accurate diagnosis of these diseases is important for children's health, health economics, as well as detailed diagnostic guidelines for physicians who visit the patient for the first time, various studies have been conducted on the confounding factors for the accurate diagnosis of asthma. It seems that emergency physician may make a mistake between Asthma and pneumonia in diagnosis.^{2,17,18} In a study by Speight, on 34 patients aged 2 to 12 years with a definite diagnosis of asthma, a previous diagnosis of asthma was prescribed for only two patients, and others as a recurrent lung infection and bronchitis have been known.¹⁹ In our study, it was also shown that a number of asthmatic patients were admitted as pneumonia. In another descriptive study by Hazir et al, in Pakistan, of 1622 children under the age of 5 who complained of cough, shortness of breath and wheezing, 1004 children were diagnosed with mild pneumonia and the rest had severe pneumonia. Administration of three courses of corticosteroids and 3 to 5 days following-up showed that two-thirds of patients diagnosed with pneumonia probably did not require antibiotic therapy.²⁰ In our study, 63 out of the 115 patients (54.8%) who were diagnosed with asthma by the medical team, were treated with antibiotics before admission time. Therefore, it can be concluded that patients with asthma are not only do not receive adequate oral intake of corticosteroids, but also they receive inappropriate antibiotic therapies. Another study in Uganda, which was conducted on children aged 6 to 59 months with respiratory complaints, reported that 41.2% of patients had asthma syndrome, 53.7 had pneumonia, and the rest had other problems such as aspiration. It is also noticed that only 9.5% of children with asthma were diagnosed in the past. Furthermore, 95.3% of these children received inappropriate antibiotic treatment before admission time.²¹ The results of this study are similar to our findings and emphasize the importance of teaching medical students how to accurately diagnose asthma and its proper treatment. Patients with more than one history of pneumonia admission should be considered for the possibility of asthma. Various studies suggest the frequent occurrence of pneumonia that expresses the potential for asthma. Our study showed that out of 115 patients with asthma, 53 (46.1%) had a history of at least one previous admission with pneumonia. Therefore, since the differentiation of asthma and pneumonia in children under

Table 1. The Cross-tabulation of the Prevalence of Reported Asthma and Pneumonia by the Hospital General Physician

		General physician DX			Total
		Asthma	Pneumonia	Asthma & Pneumonia	
Asthma	Count	47	37	0	84
	Expected count	29.8	52.0	2.2	84.0
	% Within our DX	56.0%	44.0%	0.0%	100.0%
	% Within doctor DX	85.5%	38.5%	0.0%	54.2%
	% Of total	30.3%	23.9%	0.0%	54.2%
Our DX Pneumonia	Count	4	36	0	40
	Expected count	14.2	24.8	1.0	40.0
	% Within our DX	10.0%	90.0%	0.0%	100.0%
	% Within doctor DX	7.3%	37.5%	0.0%	25.8%
	% Of total	2.6%	23.2%	0.0%	25.8%
Asthma & pneumonia	Count	4	23	4	31
	Expected Count	11.0	19.2	.8	31.0
	% Within our DX	12.9%	74.2%	12.9%	100.0%
	% Within doctor DX	7.3%	24.0%	100.0%	20.0%
	% Of total	2.6%	14.8%	2.6%	20.0%
Total	Count	55	96	4	155
	Expected Count	55.0	96.0	4.0	155.0
	% Within our DX	35.5%	61.9%	2.6%	100.0%
	% Within doctor DX	100.0%	100.0%	100.0%	100.0%
	% Of total	35.5%	61.9%	2.6%	100.0%

5 years old is not easy, the possibility of misdiagnosis in these diseases is relatively high. The misdiagnosis of the illness, in addition to the patient's inappropriate treatment, increases the risk of future complications of asthma and impose additional costs on the health of nations.

Conclusions

Our study revealed that the diagnosis of asthma is less than the actual report. Misdiagnosis of asthma and pneumonia has led to the inappropriate treatment of asthma with unnecessary antibiotics. Attention to the asthma associated risk factors and also past medical history can help to accurate diagnosis of the disease and prevent long-term complications.

Abbreviations

GINA: Global initiative for asthma; mAPI: modified asthma productive index; WHO: World health organization.

Competing Interests

None declared.

Authors' Contributions

AB contributed to patients selection, data analysis, and

manuscript writing. BS contributed to manuscript writing and review, questionnaire analysis. SG participated in manuscript writing and data analysis. MA participated in study design, manuscript review and submission process.

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References

1. Marcdante KJ, Kliegman R. Nelson Essentials of pediatrics. 8th ed. Philadelphia, PA: Elsevier; 2019:149.
2. Haghbin S, Ebrahimi S, Rezaei M, Pourmahmoudi A. A study of some environmental factors in Asthma among children aged 6 months to 6 years in Yasuj. *Armaghane Danesh*. 2003;8(2):33-39. [Persian].
3. Godfrey S. What is asthma? *Arch Dis Child*. 1985;60(11):997-1000. doi:10.1136/adc.60.11.997
4. Rajaeifard A, Moosavi Zadeh A, Pourmahmoudi A, Naeimi E, Hadinia A, Karimi A. Evaluation of prevalence and related

- factors of pediatric asthma in children under six years old with logistic regression and probit. *Armaghane Danesh*. 2011;16(3):272-281. [Persian].
5. Kavanagh J, Jackson DJ, Kent BD. Over- and under-diagnosis in asthma. *Breathe (Sheff)*. 2019;15(1):e20-e27. doi:10.1183/20734735.0362-2018
 6. Bacharier LB, Guilbert TW. Diagnosis and management of early asthma in preschool-aged children. *J Allergy Clin Immunol*. 2012;130(2):287-296. doi:10.1016/j.jaci.2012.04.025
 7. Bosken CH, Hunt WC, Lambert WE, Samet JM. A parental history of asthma is a risk factor for wheezing and nonwheezing respiratory illnesses in infants younger than 18 months of age. *Am J Respir Crit Care Med*. 2000;161(6):1810-1815. doi:10.1164/ajrccm.161.6.9903030
 8. Fontes MJF, Fonseca MTM, Camargos PAM, Affonso AGA, Calazans GMC. Asma em menores de cinco anos: dificuldades no diagnóstico e na prescrição da corticoterapia inalatória (Asthma in children under five years of age: problems in diagnosis and in inhaled corticosteroid treatment). *J Bras Pneumol*. 2005;31(3):244-253. doi:10.1590/S1806-37132005000300011
 9. Tuti T, Agweyu A, Mwaniki P, Peek N, English M. An exploration of mortality risk factors in non-severe pneumonia in children using clinical data from Kenya. *BMC Med*. 2017;15(1):201. doi:10.1186/s12916-017-0963-9
 10. Liu L, Oza S, Hogan D, et al. Global, regional, and national causes of child mortality in 2000-13, with projections to inform post-2015 priorities: an updated systematic analysis. *Lancet*. 2015;385(9966):430-440. doi:10.1016/s0140-6736(14)61698-6
 11. Chang AB, Ooi MH, Perera D, Grimwood K. Improving the diagnosis, management, and outcomes of children with pneumonia: where are the gaps? *Front Pediatr*. 2013;1:29. doi:10.3389/fped.2013.00029
 12. Miller EK, Avila PC, Khan YW, et al. Wheezing exacerbations in early childhood: evaluation, treatment, and recent advances relevant to the genesis of asthma. *J Allergy Clin Immunol Pract*. 2014;2(5):537-543. doi:10.1016/j.jaip.2014.06.024
 13. Benguigui Y AF, Schmunis G, Yunes J. Respiratory infections in children. Pan American Sanitary Bureau, Regional office of the World Health Organization; 1999.
 14. Lynch T, Bialy L, Kellner JD, et al. A systematic review on the diagnosis of pediatric bacterial pneumonia: when gold is bronze. *PLoS One*. 2010;5(8):e11989. doi:10.1371/journal.pone.0011989
 15. Chang TS, Lemanske RF, Jr., Guilbert TW, et al. Evaluation of the modified asthma predictive index in high-risk preschool children. *J Allergy Clin Immunol Pract*. 2013;1(2):152-156. doi:10.1016/j.jaip.2012.10.008
 16. Global Initiative for Asthma Global Strategy for Asthma Management and Prevention 2018. https://ginasthma.org/wp-content/uploads/2018/04/wms-GINA-2018-report-tracked_v1.3.pdf.
 17. Nantanda R, Ostergaard MS, Ndeezi G, Tumwine JK. Clinical outcomes of children with acute asthma and pneumonia in Mulago hospital, Uganda: a prospective study. *BMC Pediatr*. 2014;14:285. doi:10.1186/s12887-014-0285-4
 18. karimi A, Armin S, Fahimzad SA. Acute Children Pneumonia. *Journal of Medical Council of Islamic Republic of Iran*. 2008;26(4):541-559. [Persian].
 19. Speight AN. Is childhood asthma being underdiagnosed and undertreated? *Br Med J*. 1978;2(6133):331-332. doi:10.1136/bmj.2.6133.331
 20. Hazir T, Qazi S, Nisar YB, et al. Assessment and management of children aged 1-59 months presenting with wheeze, fast breathing, and/or lower chest indrawing; results of a multicentre descriptive study in Pakistan. *Arch Dis Child*. 2004;89(11):1049-1054. doi:10.1136/adc.2003.035741
 21. Nantanda R, Tumwine JK, Ndeezi G, Ostergaard MS. Asthma and pneumonia among children less than five years with acute respiratory symptoms in Mulago Hospital, Uganda: evidence of under-diagnosis of asthma. *PLoS One*. 2013;8(11):e81562. doi:10.1371/journal.pone.0081562

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