Ineffective airway clearance: prevalence and spectrum of its clinical indicators

Desobstrução ineficaz de vias aéreas: prevalência e espectro de seus indicadores clínicos

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Abstract

Objective: To identify the prevalence of nursing diagnosis of ineffective airway clearance, clinical indicators, and spectrum of manifestation in children with acute respiratory infection; to determine the association between its indicators and the probability of identification.

Methods: Cross-sectional study involving 192 hospitalized children. Interviews and pulmonary evaluations were performed, and the data were sent to diagnosticians for diagnostic inference. Statistical packages were used for data analysis.

Results: 71.9% of the children presented the diagnosis under study. The clinical indicators were ineffective cough, respiratory rales, excessive amount of mucus, dyspnea, orthopnea, change in breathing rate, and change in respiratory frequency; manifested by the moderate spectrum. The indicators of dyspnea, restlessness, orthopnea, excessive amount of mucus, respiratory rales, and ineffective cough showed a significant linear relationship.

Conclusion: The nursing diagnosis showed a high prevalence and association between indicators and the likelihood of identifying the nursing diagnosis was established.

Resumo

Objetivo: Identificar a prevalência do diagnóstico de enfermagem de desobstrução ineficaz de vias aéreas, indicadores clínicos e espectro de manifestação em crianças com infecção respiratória aguda; determinar associação entre os indicadores e a probabilidade de identificação.

Métodos: Estudo transversal que incluiu 192 crianças internadas. Foram realizadas entrevistas e avaliação pulmonar, e os dados foram encaminhados a diagnosticadores para inferência diagnóstica. Utilizaram-se pacotes estatísticos para análise dos dados.

Resultados: 71,9% das crianças apresentaram o diagnóstico em estudo. Os indicadores clínicos foram: tosse ineficaz, ruídos adventícios respiratórios, quantidade excessiva de muco, dispneia, ortopneia, mudança no ritmo respiratório e mudança na frequência respiratória; manifestados pelo espectro moderado. Os indicadores dispneia, inquietação, ortopneia, quantidade excessiva de muco, ruídos adventícios respiratórios e tosse ineficaz apresentaram relação linear significativa.

Conclusão: O diagnóstico de enfermagem apresentou alta prevalência e associação entre os indicadores e a probabilidade de identificação do diagnóstico de enfermagem foi estabelecida.

Introduction

Acute respiratory infections are important causes of childhood morbidity and mortality worldwide, exerting strong pressure on health services.[1] Clinical manifestations associated with these infections in children are and can become quite serious, triggering a broad spectrum of disturbances in the respiratory function.[2]

The identification of respiratory nursing diagnoses is particularly important in people with respiratory disorders because the airways are compromised.[3] It should be pointed out that ineffective airway clearance, as well as other respiratory diagnoses, are usually priority because they directly affect tissue oxygenation, requiring quick and resolutive interventions. Thus, a thorough evaluation of the respiratory function is essential, as well as good clinical judgment on the manifestations presented in order to develop correct diagnoses and improve the planning of nursing actions.

However, in specific clinical situations such as in the care of children with acute respiratory infection, it is possible that nurses have difficulty in inferring respiratory diagnoses with precision given the occurrence of typical clinical indicators and the overlap between these diagnoses. Also considered should be the lack of familiarity with the nursing diagnoses classification systems and the subjectivity of the diagnostic reasoning process, corroborating toward a greater uncertainty and insecurity of the clinical judgment.[4]

Human responses to health problems are heterogeneous and personal, differing from one individual to another. This situation contributes to the occurrence of different degrees of involvement of the diagnoses and their clinical indicators. In this context, the diagnostic inference can be strongly influenced by the prevalence and spectrum of manifestation of the members that make up the nursing diagnosis team. Therefore, studies of this nature can contribute to support the diagnostic reasoning and nursing care.

In this context, we aimed to identify the prevalence of the ineffective airway clearance diagnosis, its clinical indicators, and the spectrum of manifestation of these indicators in children with acute respiratory infection; and determine the association between clinical indicators and the subjective probability of identifying the nursing diagnosis.

Methods

Quantitative, cross-sectional study conducted in an inpatient unit of a children's hospital in the city of Fortaleza, northeastern Brazil. The subjects of the study were children up to 5 years old and with a diagnosis of an acute respiratory infection hospitalized between April and August 2013, which was the period of data collection. Children with an unstable clinical picture, drug allergic processes, or with neurological or cardiovascular comorbidities were excluded from the study.

The sample consisted of 192 children. To collect data, an instrument was used adapted from a prior study conducted among children with acute respiratory infection.[5] The instrument consisted of three parts. The first included personal and social-demographic data, and history of the child's health problem. The second part was for the collection of respiratory symptoms, and the third part consisted of a detailed pulmonary physical exam considering the indicators of ineffective airway clearance diagnosis.[6] The first and second parts of the instrument were filled out through interviews with the adults responsible for the children. The techniques for pulmonary assessment followed the procedures described in the literature.

Data were collected by a nurse and four nursing students, undergraduate research fellows, previously trained for familiarization with the instrument and standardization of the lung physical examination. The training lasted eight hours during which the diagnostic procedures for pulmonary evaluation were reviewed and discussed in detail as well as the clinical indicators of the diagnosis under study.

After collecting the data, a research protocol was adopted. This protocol was developed by the authors based on the specific literature containing the conceptual and operational definitions, as well as the spectrum of manifestation of the indicators

under study, allowing their assessment and classification.[2] The indicators were classified according to their spectrum as follows: severe, moderate, and mild. It should be pointed out that due to the difficulty to quantify the degree of impairment based on the literature, no spectra were developed for the following indicators: excessive amount of mucus, bulging eyes, and restlessness. It should be noted that the assessment of cough made it possible to analyze and classify the indicators of ineffective cough and absent cough. Two spectra were developed for the ineffective cough: mild and moderate. The severe spectrum of coughing represents the manifestation of absent cough.

The pulmonary evaluation also enabled the identification of other respiratory signs. This information was considered important for the diagnostic inference, which was allocated in the clinical indicators category not listed in the NANDA International (NANDA-I) taxonomy.

For the diagnostic inference, four nursing professors were selected with clinical and/or teaching practice and who participate in research groups and develop studies with nursing diagnoses in the area of child health. These nurses were duly trained and submitted to evaluations in order to identify their performance in diagnostic inference process. The measurement of the quality of the inferences was determined by the Kappa coefficient. At the end of the test all reached the profile of acceptable performance (minimum Kappa of 0.85).

The information about the presence or absence of clinical indicators, spectrum of manifestation, and indicators not listed in the NANDA-I of the children evaluated were sent electronically to the nurse diagnosticians. They judged the presence or absence of ineffective airway clearance diagnosis based on the subjective probability of identifying the diagnosis organized into four levels: definitely absent, probably absent, probably present, and definitely present. The occurrence of the diagnosis was determined by absolute agreement among the diagnosticians. In case there was disagreement, the diagnosticians gathered together to reach a consensus on the inference.

The statistical analysis of the data was performed with the help of SPSS version 21.0 for Windows®

and software R version 2.12.1. For the descriptive analysis, the absolute frequencies, percentages, and measurements of central tendency and dispersion were considered. The Kolmogorov-Smirnov test was used to verify the normality of the numerical variables. To analyze the linear relationship and correlation between the clinical indicators and the subjective probability of identifying the ineffective airway clearance diagnosis, the chi-square test for linear trend and the Spearman correlation coefficient were used, respectively.

The development of the study complied with national and international ethical guidelines for research involving human beings.

Results

Most children assessed were male (59.4%) with a mean age of 23.13 months (± 17.63). Asthma was the most prevalent respiratory disease in the family members up to the second-degree (43.5%). The average family income of those responsible for the children was R$ 1,002.70. The most prevalent medical diagnoses were pneumonia (67.7%) and bronchiolitis (20.8%).

Table 1 describes the data on the prevalence of the ineffective airway clearance diagnosis, its clinical indicators, and the spectrum of manifestation of these indicators.

From the diagnostic inference, 71.9% of the children definitively presented the ineffective airway clearance diagnosis, whereas 7.3% definitively did not present the nursing diagnosis.

The most prevalent indicators were as follows: ineffective cough, respiratory rales, dyspnea, excessive amount of mucus, orthopnea, change in breathing rate, and change in respiratory frequency. It is noteworthy that two children did not have cough nor signs suggestive of secretion, and nine had effective cough. Cyanosis and bulging eyes were not identified in the children evaluated.

According to the spectrum of manifestation, most children manifested dyspnea, change in breathing rate, orthopnea, respiratory rales, decreased breathing sounds, and hampered vocalization in moderate

spectrum, whereas 19.8% manifested a change in respiratory frequency in a severe spectrum. For ineffective cough, 51.0% of the children manifested this indicator in a light spectrum, whereas 1.0% manifested cough in a severe spectrum (cough absent).

Table 1. Prevalence of the ineffective airway clearance diagnosis, its clinical indicators, and the spectrum of manifestation

Variables	n(%)
Ineffective airway clearance	
Probably absent	9(4.7)
Definitely absent	14(7.3)
Probably present	31(16.1)
Definitely present	138(71.9)
NANDA-I clinical indicators	
Dyspnea	130(67.8)
Light spectrum	8(4.2)
Moderate spectrum	108(56.3)
Severe spectrum	14(7.3)
Change in respiratory frequency	90(46.9)
Light spectrum	24(12.5)
Moderate spectrum	28(14.6)
Moderate spectrum	38(19.8)
Change in breathing rate	91(47.4)
Light spectrum	22(11.5)
Moderate spectrum	50(26.0)
Severe spectrum	19(9.9)
Orthopnea	97(50.5)
Light spectrum	25(13.0)
Moderate spectrum	70(36.5)
Severe spectrum	2(1.0)
Respiratory rales	159(82.8)
Light spectrum	11(5.7)
Moderate spectrum	148(77.1)
Decreased breathing sounds	16(8.3)
Light spectrum	6(3.1)
Moderate spectrum	10(5.2)
Absent cough	2(1.0)
Ineffective cough	179(93.2)
Light spectrum	98(51.0)
Moderate spectrum	81(42.2)
Hampered vocalization	51(26.6)
Light spectrum	13(6.8)
Moderate spectrum	38(19.8)
Restlessness*	24(12.5)
Excessive amount of mucus*	130(67.7)
Indicators not listed in the NANDA-I*	
Altered chest-vocal fremitus	25(13.0)
Increased breathing sounds	19(9.9)
Altered pulmonary percussion	10(5.2)
Auscultation of altered voice	4(2.1)

n - number of individuals; % - Percentage; * Spectrum of manifestation not evaluated

Table 2 shows the results of the linear relationship tests between the clinical indicators listed in NANDA-I, indicators not listed in the taxonomy, and the subjective probability of identifying the ineffective airway clearance diagnosis.

Table 2. Linear trend between the clinical indicators, indicators not listed in NANDA-I, and the subjective probability of identifying the ineffective airway clearance diagnosis

Variables	Ineffective airway clearance				
	DA	PA	PP	DP	p-value*
NANDA-I clinical indicators					
Dyspnea					<0.001
Present	0	3	19	108	
Absent	9	11	12	30	
Restlessness					0.020
Present	0	0	2	22	
Absent	9	14	29	116	
Change in respiratory frequency					0.561
Present	3	5	18	64	
Absent	6	9	13	74	
Change in breathing rate					0.509
Present	3	5	18	65	
Absent	6	9	13	73	
Orthopnea					<0.001
Present	0	2	12	83	
Absent	9	12	19	55	
Excessive amount of mucus					<0.001
Present	0	0	13	117	
Absent	9	14	18	21	
Respiratory rales					<0.001
Present	0	0	23	136	
Absent	9	14	8	2	
Decreased breathing sounds					0.492
Present	0	1	3	12	
Absent	9	13	28	126	
Absent cough					0.340
Present	0	1	0	1	
Absent	9	13	31	137	
Ineffective cough					<0.001
Present	0	12	30	137	
Absent	9	2	1	1	
Hampered vocalization					0.174
Present	2	2	6	41	
Absent	7	12	25	97	
Indicators not listed in the NANDA-I					
Increased breathing sounds					0.306
Presente	0	3	6	10	
Ausente	9	11	25	128	
Altered chest-vocal fremitus					0.004
Present	0	0	0	25	
Absent	9	14	31	113	
Altered pulmonary percussion					0.320
Present	0	2	3	5	
Absent	9	12	28	133	
Auscultation of altered voice					0.627
Present	0	0	1	3	
Absent	9	14	30	135	

DA - Definitely absent; PA - Probably absent; PP - Probably present; DP - Definitely present; * Chi-square test for linear trend

The indicators dyspnea, restlessness, orthopnea, excessive amount of mucus, respiratory rales, and ineffective cough showed a significant (p <0.005) linear relationship with the identification of ineffective airway clearance. Thus, the presence of these

clinical indicators in children with acute respiratory infection is associated with higher likelihood of identifying the diagnosis. For indicators not listed in NANDA-I, only altered chest-vocal fremitus showed a significant linear relationship with identifying the ineffective airway clearance diagnosis.

Table 3 shows the correlation between the spectrum of manifestation of the clinical indicators and the subjective probability of identifying ineffective airway clearance.

The spectrum of manifestation of the indicators dyspnea, orthopnea, respiratory rales, and ineffective cough presented a statistically significant correlation (p <0.005) with the subjective probability of identifying ineffective airway clearance. Thus, the manifestation of more severe spectra of these clinical indicators in children with acute respiratory infection is associated with higher likelihood of identifying the diagnosis.

Table 3. Correlation between the spectrum of manifestation of the indicators and the subjective probability of identifying ineffective airway clearance diagnosis

Spectrum of clinical indicators	Spearman's coefficient	p-value
Dyspnea	0.380	<0.001
Change in respiratory frequency	0.009	0.897
Change in breathing rate	0.005	0.943
Orthopnea	0.343	<0.001
Respiratory rales	0.787	<0.001
Decreased breathing sounds	0.032	0.660
Ineffective cough	0.320	<0.001
Hampered vocalization	0.116	0.110

Discussion

The limits of the results of this study are related to the use of interviews for data collection, considering the subjectivity of the clinical variables. The main contribution of the study is the importance of the correct identification of the diagnosis during the planning and execution of nursing care.

The findings of this study for the variables of gender and age agree with similar studies developed with children affected by respiratory illness in which most of the children evaluated were male and the mean ages were 20.35 and 24.42 months, respectively.[7,8] The preponderance of males as for morbidity from respiratory infections can be explained by the smaller size and greater tonicity of the airways among boys.

The most frequent respiratory infections were pneumonia and bronchiolitis, which is in agreement with similar studies in which pneumonia was the primary medical diagnosis identified in the children evaluated.[5,7] According to the diagnostic inference, 71.9% of the children definitively presented the ineffective airway clearance diagnosis. The high prevalence of this nursing diagnosis was also observed in other studies.[3,5,8,9] An open prospective cohort study conducted with children with acute respiratory infection found that 91.9% of participants developed an ineffective airway clearance diagnosis on the first day of treatment. Moreover, this diagnosis had a high incidence rate, indicating how quickly the children developed new cases of this diagnosis. Despite the similarities presented, it should be pointed out that, in this study, different than the above studies, the subjective probability for inference of the diagnosis was used.

The prevalence of the indicators ineffective cough, respiratory rales, excessive amount of mucus, dyspnea, orthopnea, change in breathing rate, and change in respiratory frequency are in agreement with studies in the literature.[3,8-10] This result can be attributed to the clinical picture of the most prevalent respiratory diseases in the children evaluated.

The indicators dyspnea, restlessness, orthopnea, excessive amount of mucus, respiratory rales, and ineffective cough showed a significant linear relationship with the identification of ineffective airway clearance.

In line with these findings, similar studies have shown an association between dyspnea and orthopnea, and the ineffective airway clearance diagnosis. Thus, the chances of children with respiratory infection developing ineffective airway clearance in the presence of these clinical indicators increase when compared to those who did not have such indicators.[3,8] The presence of obstructed airways generates pulmonary hypoventilation, excessive levels of carbon dioxide and hydrogens ions in the blood, triggering dyspnea, as well as an increase in the respiratory depth and frequency. Because of this, it is essential to search for a body position that facilitates lung expansion. In the horizontal

supine position, the respiratory muscles make a greater effort to expand the chest, making it impossible for individuals with respiratory difficulty to stay in this position, giving preference to the high dorsal decubitus position.

Results of other studies also detected an association between respiratory rales and ineffective airway clearance to the point that the presence of this clinical indicator is associated with a greater chance of children with respiratory infection developing ineffective airway clearance when compared to those who did not manifest such an indicator.[3,5,8,10] The edema and exudate production in the respiratory mucosa contribute to airway obstruction, triggering respiratory distress and wheezing. The passage of air occluded in the airways and collision of air with tracheobronchial secretions generate respiratory rales such as wheezes and crackles.

In pathological conditions such as respiratory diseases, increased mucus production occurs in order to protect the respiratory epithelium. In addition, these medical conditions occur with unfavorable changes in physical and biochemical composition of respiratory secretions, making it difficult to eliminate them by mucociliary activity and coughing, causing the accumulation and retention of secretions in the airways. These pathophysiological aspects determine the reduction in the speed of air flow and intrathoracic pressure necessary to remove mucus, triggering a decrease in the effectiveness of coughing in the mobilization and elimination of respiratory secretions.[11] Also noteworthy is the inability of most children in the mechanism of expectoration, which contributes to the manifestation of the indicators of excessive amount of mucus and ineffective cough. Corroborating with our findings are results of other studies that have found that ineffective coughing was strongly associated with ineffective airway clearance.[5,10] Given this indicator, the probability of the occurrence of the diagnosis was 96.4%.[5]

The condition of obstructed airways causes great suffering to the patient, especially in children. Difficult respiratory movements turn breathing into a conscious effort, which is manifested in some patients with agitation, irritability, and decreased cooperation.

This may explain the association between restlessness and the diagnosis of ineffective airway clearance.

Altered chest-vocal fremitus presented a significant linear relationship with the identification of ineffective airway clearance. In the consolidation of the lung parenchyma due to the presence of a lot of bronchial secretion, the fremitus is more harsh or coarse to palpation. Under the conditions of bronchial obstruction, pleural or pneumothorax effusion, the vocal sound is not transmitted to the chest wall, resulting in decreased or abolished fremitus.

Conclusion

The nursing diagnosis showed a high prevalence and association between indicators. The likelihood of identifying the nursing diagnosis was established.

Collaborations

Andrade LZC and Silva VM participated in the project conception, research development, data collection, analysis and interpretation of the data, writing, critical review of the intellectual content, and final approval of the version to be published. Lopes MVO collaborated with the project conception, research development, analysis and interpretation of data, statistical analysis, critical review of the intellectual content, and final approval of the version to be published. Chaves DBR and Távora RCO contributed with the project conception, research development, writing, critical review of the intellectual content, and final approval of the version to be published.

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