Short Communication

Assessment of a new algorithm in the management of acute respiratory tract infections in children

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Objectives: To assess the practicability of a new algorithm in decreasing the rate of incorrect diagnoses and inappropriate antibiotic usage in pediatric Acute Respiratory Tract Infection (ARTI). **Materials and Methods:** Children between 1 month to15 years brought to outpatient clinics of a children's hospital with acute respiratory symptoms were managed according to the steps recommended in the algorithm. **Results:** Upper Respiratory Tract Infection, Lower Respiratory Tract Infection, and undifferentiated ARTI accounted for 82%, 14.5%, and 3.5% of 1 209 cases, respectively. Antibiotics were prescribed in 33%; for: Common cold, 4.1%; Sinusitis, 85.7%; Otitis media, 96.9%; Pharyngotonsillitis, 63.3%; Croup, 6.5%; Bronchitis, 15.6%; Pertussis-like syndrome, 82.1%; Bronchiolitis, 4.1%; and Pneumonia, 50%. **Conclusion:** Implementation of the ARTIs algorithm is practicable and can help to reduce diagnostic errors and rate of antibiotic prescription in children with ARTIs.

Key words: Acute respiratory tract infection, algorithm, children

INTRODUCTION

Acute Respiratory Tract Infections (ARTIs) are the most common reasons for children visiting a physician, leading to increased utilization of health services including hospital admissions.[1] Furthermore, Lower Respiratory Tract Infections (LRTI) are major cause of morbidity and mortality (25%-50%) in developing countries.[2-4] Incidence rates of ARI in children of developing and developed countries are comparable, but cause-specific mortality rates from ARTIs are 10 to 50 times higher in underdeveloped countries.[5,6]

However, most childhood ARTIs have a viral etiology.[7,8] They are the principal reason for antibiotic prescriptions in the pediatric population (e.g., 46% in a Dutch study[9]) resulting in increasing bacterial resistance, adverse drug effects, and increased financial burden.

Facilities for identifying various organisms are totally lacking in underdeveloped societies, and limited in transitional countries. WHO has initiated a program for clinical management and control of ARTIs which has resulted in the reduction of ARTI mortality rates by 25% to 67%.[4,10,11] Some countries have programmed to recommend guidelines approach to ARITs.[12-14] We developed an algorithm for the diagnosis of ARTIs in children solely based on clinical manifestations, with minimal use of laboratory facilities and the main objective of this study was to assess the practicability of this algorithm, how much the ARITs and antibiotics usage are common and in comparison with other studies could it reduce the rate of incorrect diagnoses and inappropriate antibiotic usage.

MATERIALS AND METHODS

This prospective cross-sectional study was conducted from October 2007 to September 2008, on children aged between one month and 15 years with acute respiratory symptoms, cough, fever, hoarseness, and nasal discharge with or without tachypnea, in the outpatients clinics of a university-affiliated children's hospital in Tehran.

ARTI was defined as respiratory symptoms lasting < 3 weeks.All consecutive patients above the age of one month and below the age of 15 years with ARTIs symptoms brought to the outpatients clinics were included and patients with more than 3 weeks' signs

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and symptoms, chronic lung or heart diseases, and primary or secondary immunodeficiency were excluded. Informed consent was obtained from the parents before inclusion in the study.

Demographic and clinical data were collected from the visit notes. Algorithm designed for this study was derived from clinical manifestations of ARTIs described in the Nelson Textbook of Pediatrics.[15] In this algorithm, the physician categorizes the patients into lower and upper ARTI according to respiratory rate and lung findings on auscultation [Figure 1].

Tachypnea was defined according to the standard reference charts set by the WHO for different age groups and fever as an axillary temperature of >38°C.

Trained physicians examined the patients and classified them according to the algorithm into nine primary diagnoses:

Upper Respiratory Tract Infections (URTIs): Common Cold, Sinusitis, Otitis media, and Pharyngotonsillitis.

Lower Respiratory Tract Infections (LRTIs): Croup, Bronchitis, Pertussis-like syndrome, Bronchiolitis, and Pneumonia.

All data were fed into the computer and analyzed by SSPS 11.5 software (Chicago, USA). The study variables were categorical and were summarized as frequency and percentages.

RESULTS

The algorithm was used for management of 1 209 patients,

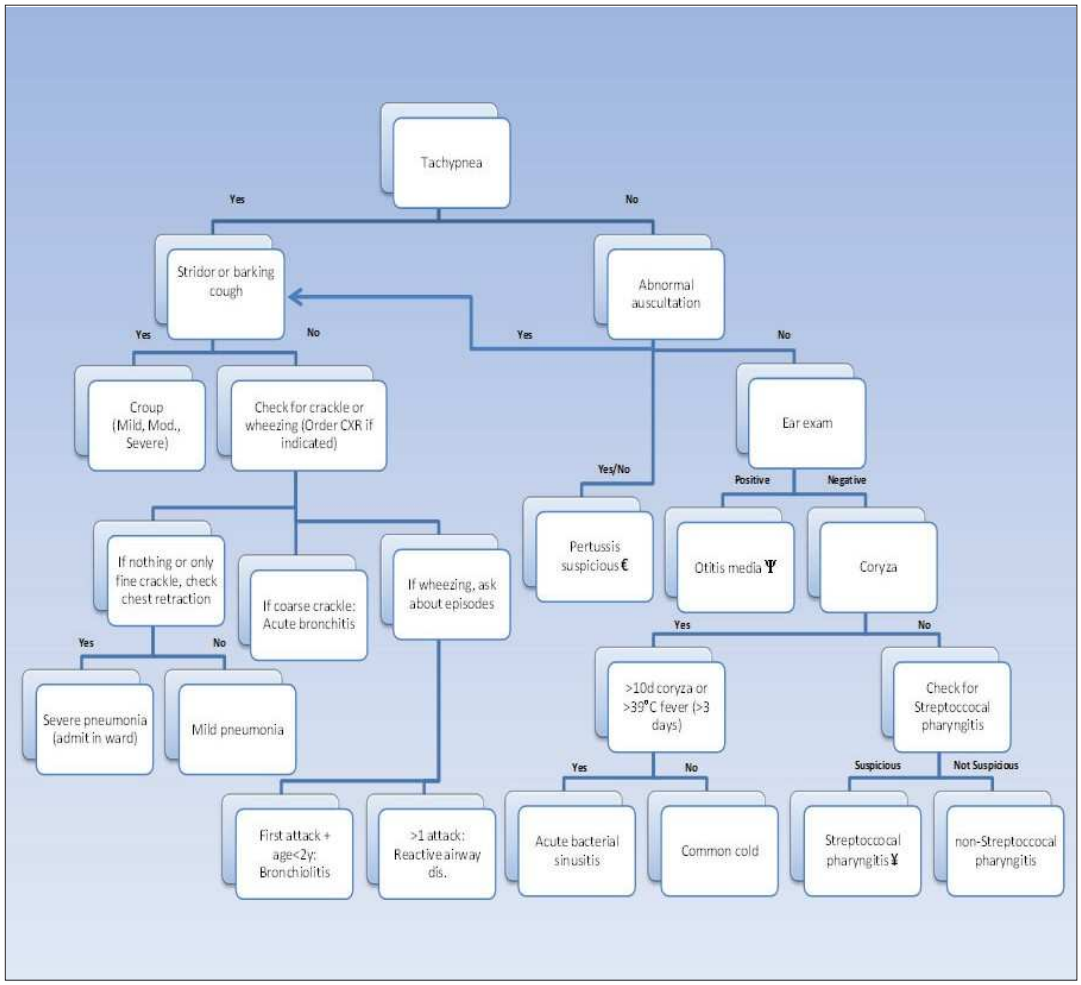

Figure 1: Acute Respiratory Tract Infection Algorithm; Ψ presence of ≥2 following criteria: a) otic pain or irritability, b) redness of tympanic membrane, c) absence of tympanic membrane landmarks like incus, promontory, cone of light, d) bulging of tympanic membrane or perforated membrane; €presence of ≥2 following criteria: a) recent family history of cough ≥2 weeks, b) paroxysmal cough attacks with no sigh between them, c) post cough emesis, d) presence of whooping or apnea after cough attacks; ¥presence of ≥2 following criteria: age between 5 to 15 years old, b) exudative pharyngitis, c) tenderness of anterior neck adenitis, d) high-grade fever (tem ≥39°C)

Male: female = 1.2: 1; and 44.8% were <2 years. URTI, LRTI, and Undifferentiated ARTI accounted for 996 (82%), 176 (14.5%), and 42 (3.5%) cases, respectively. Specific diagnoses are presented in [Figure 2].

Antibiotics were prescribed in 33% of all visits; rates of antibiotic prescription in URTI were: Common cold, 4.1%; Sinusitis, 85.7%; Otitis media, 96.9%; and Pharyngotonsillitis, 63.3%. For LRTIs: Croup, 6.5%; Bronchitis, 15.6%; Pertussis- like syndrome, 82.1%; Bronchiolitis, 4.1%; and Pneumonia, 50% [Table 1]. Clinicians prescribed antibiotics in 33% of all visits. Most commonly used antibiotics were amoxicillin/ clavulanate (34.5%), amoxicillin (20.8%), azithromycin (17.5%), erythromycin (8.7%), and penicillin (8.5%).

DISCUSSION

By using the recommended algorithm, physicians prescribed antibiotics for approximately one-third of children with ARTI. These figures are in sharp contrast to another study in our center, which reported antibiotic prescription rate of >80% in children with ARTI.[16] ARTIs are the number one reason for antibiotic prescribing in the United States accounting for about 50% of all antibiotic prescription.[17] As reported from Scandinavia, prescribing patterns for ARTIs vary widely between physicians.[18] Antibiotic therapy in ARTIs is often guided by clinical manifestations as etiological pathogens may remain undiscovered in most cases even if all invasive diagnostic steps were taken.[19,20] Also, cultural factors such as prescribing practices, parents' expectations, and structure of the healthcare system may result in differences in clinical practice and antibiotic consumption between countries.[21,22]

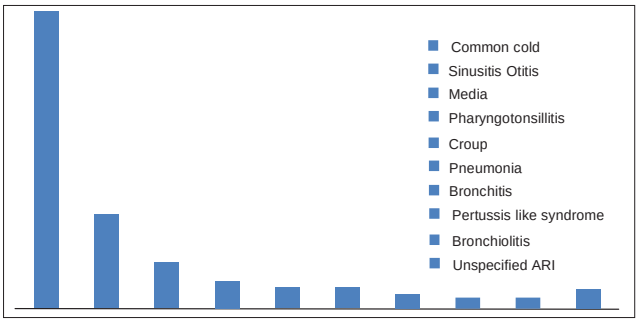

Figure 2: Acute Respiratory tract infection frequency

Table 1: Frequency of antibiotic usage in acute respiratory tract infections

	Percent %
Common cold	4.1
Sinusitis	85.7
Otitis Media	96.9
Pharyngotonsillitis	63.3
Croup	6.5
Bronchitis	15.6
Pertussis-like syndrome	82.1
Bronchiolitis	4.1
Pneumonia	50

Some physicians prescribe antimicrobials for bronchitis if the child complains of productive cough, although controlled trials have failed to demonstrate the benefit of antibiotic treatment for acute bronchitis.[23] The belief that purulent nasal discharge is an indication for antibiotics seems to be common, despite evidence that purulence of nasal discharge does not indicate bacterial infection.[24,25]

Our research team had attempted to reduce antibiotic prescribing for respiratory tract infections by an educational intervention similar to some other studies.[26,27] Studies have shown the importance of parental demands for antibiotic treatment, and trials that included educational interventions for both parents and physicians had promising results, with Smabrekke *et al*. demonstrating a reduction in antibiotic prescriptions for acute otitis media, from 90% to 74%, and also a reduction in broad-spectrum antibiotic use.[28-30]

Our findings reveal that using the suggested algorithm is practicable, and may be effective in defining various forms of ARI more clearly, thereby improving antibiotic prescription patterns for these infections in children. The main limitation of our study is the lack of a control group that was managed without using the algorithm; however, as stated above, a previous study done in the same hospital, which investigated antibiotic usage in outpatients with acute respiratory infections, does show a very high rate of antibiotic prescription, prior to the use of the algorithm.[16] Further multi-central researches and control group are necessary.

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