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A prospective, observational, epidemiological evaluation of the aetiology and antimicrobial susceptibility of acute otitis media in Saudi children younger than 5 years of age

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Abstract *Background:* Information regarding acute otitis media (AOM) aetiology is important for developing effective vaccines. Here, bacterial aetiology and antimicrobial susceptibility of AOM were determined in young Saudi children.

Methods: Children aged 3–60 months with a new episode of AOM, who had not received antibiotics or had received antibiotics for 48–72 h but remained symptomatic, were enrolled in this prospective, observational, epidemiological study in Riyadh. Middle ear fluid (MEF) samples were collected by tympanocentesis or from spontaneous otorrhea, and tested for the presence of *Streptococcus pneumoniae*, *Haemophilus influenzae*, *Streptococcus pyogenes* and *Moraxella catarrhalis*. Antimicrobial susceptibility of the identified pathogens was assessed using *E*-tests.

Abbreviations: AOM; acute otitis media; ENT; ear, nose, and throat; EPI; expanded programme on immunisation; MEF; middle ear fluid; NTHi; non-typeable *H. influenzae*

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Results: Between June 2009 and May 2011, 66 children were enrolled. *S. pneumoniae* was detected in 6 episodes and non-typeable *H. influenzae* (NTHi) in 8 episodes. Moreover, *Staphylococcus aureus*, which is an uncommon cause of AOM, was detected in 17 episodes. Pneumococcal serotypes were 7F ($n = 2$), 23F ($n = 2$), 19F ($n = 1$) and 15F ($n = 1$). Susceptibility to cefotaxime was observed in all pneumococcal and *H. influenzae* isolates, to cefuroxime in 4/6 pneumococcal and 8/8 *H. influenzae* isolates, and to penicillin in 5/6 pneumococcal isolates.

Conclusions: *S. pneumoniae* and NTHi were major bacterial contributors for AOM in Saudi children.

1. Introduction

Acute otitis media (AOM) is one of the most common paediatric bacterial infections, affecting approximately 80% of children by the age of 3 years [1—3]. The main bacteria responsible for AOM in children are *Streptococcus pneumoniae*, *Haemophilus influenzae* and, to a much lesser extent, *Moraxella catarrhalis* and *Streptococcus pyogenes* [4,5]. Although previous studies suggested that approximately 1% of children are diagnosed with AOM in Saudi Arabia, those younger than 4 years of age are more affected than older children, and the incidence of paediatric AOM varies among the different regions and geographic settings. There is limited available information on the prevalence and aetiology of AOM in Saudi Arabia [6,7].

AOM is one of the primary reasons for antibiotic use in children, and inappropriate or extensive use of antibiotics may lead to increasing resistance among pathogens [1]. Multi-drug resistance in *S. pneumoniae* is a major public health concern in many countries across the world [8—10], including Saudi Arabia, where a high and increasing prevalence of antibiotic-resistant pneumococcal isolates is observed [11]. In Saudi Arabia, primary vaccination of infants and young children with pneumococcal conjugate vaccines has been included in the national Expanded Programme on Immunization (EPI) since February 2009. Currently, three pneumococcal conjugate vaccines are available, and the vaccination coverage rates reached 98% of Saudi toddlers younger than 1 year of age in 2010 [12].

The present study was designed to determine the aetiology of AOM in Saudi children, as well as the antimicrobial susceptibility of the identified pathogens and the vaccination status of the children. Up-to-date information regarding AOM aetiology is important for developing and implementing effective vaccines in Saudi Arabia, especially since previous studies suggested that changes in the distribution of pathogens and pneumococcal serotypes might occur after the introduction of pneumococcal conjugate vaccines [13—17].

2. Methods

2.1. Study design, setting and participants

This prospective, observational, epidemiological study was conducted in a routine clinical setting in Saudi Arabia between June 2009 and May 2011. One primary centre and several satellite centres, belonging to the same primary centre administration and Institution Review Board in Riyadh, were included in this study. Study participants were children between 3 months and 5 years of age, diagnosed as having AOM, and from whom a middle ear fluid (MEF) sample had been obtained by an ear, nose and throat (ENT) specialist. MEF samples were taken by tympanocentesis or by careful sampling of spontaneous otorrhea if perforation had occurred less than 24 h prior to the visit.

Children were eligible if they had at least one sign of otalgia (or its equivalent: irritability), conjunctivitis or fever, and either Paradise's criteria (bulging, diffused or localised inflamed tympanic membranes) [18] or spontaneous otorrhea that had occurred less than 24 h prior to the visit. Moreover, the onset of signs and symptoms of AOM had to occur within 72 h prior to the diagnosis of AOM by a physician. Children were excluded from the study if they were hospitalised during the diagnosis of AOM or during treatment; had otitis externa or otitis media with effusion; had a tympanostomy tube; received systemic antibiotic treatment for a disease other than AOM in the 72 h prior to enrolment; received antimicrobial prophylaxis for recurrent AOM; received antibiotics by the paediatrician or ENT specialist at the enrolment visit prior to the sampling of MEF or spontaneous otorrhea; or had received antibiotics for AOM and were clinically improving.