



## Serotype distribution and antibiotic susceptibility of *Streptococcus pneumoniae* strains in the south of Tunisia: A five-year study (2012–2016) of pediatric and adult populations



Sonia Ktari\*, Ikram Jmal, Manel Mroua, Sonda Maalej, Nour ElHouda Ben Ayed, Basma Mnif, Faouzia Rhimi, Adnene Hammami

Laboratory of Microbiology, Research Laboratory for Microorganisms and Human Disease, Faculty of Medicine, Habib Bourguiba University Hospital, Sfax, Tunisia

### ARTICLE INFO

#### Article history:

Received 15 May 2017

Received in revised form 19 October 2017

Accepted 20 October 2017

Corresponding Editor: Eskild Petersen, Aarhus, Denmark

#### Keywords:

*Streptococcus pneumoniae*

Antibiotic

Serotype

PCV

Tunisia

### ABSTRACT

**Objectives:** To analyze the serotype distribution of *Streptococcus pneumoniae* clinical isolates collected in the south of Tunisia over a 5-year period in different age groups and to assess their antimicrobial susceptibility patterns.

**Methods:** A total of 305 non-duplicate *S. pneumoniae* isolates were collected between January 2012 and December 2016 at the university hospital in Sfax, Tunisia. All isolates were serotyped by multiplex PCR. The antibiotic susceptibility of all isolates was determined using the disk diffusion test or Etest assay. **Results:** Among the 305 pneumococcal isolates, 76 (24.9%) were invasive and 229 (75.1%) were non-invasive. The most common serotypes were 19F (20%), 14 (16.7%), 3 (9.2%), 23F (7.5%), 19A (5.9%), and 6B (5.9%). Potential immunization coverage rates for pneumococcal conjugate vaccines PCV7, PCV10, and PCV13 were 58%, 59.3%, and 78.7%, respectively. Three-quarters (75.3%) of pneumococcal isolates were non-susceptible to penicillin. The resistance rate to erythromycin was 71.4%. Only two isolates were resistant to levofloxacin.

**Conclusions:** 19F and 14 were the most prevalent serotypes in the south of Tunisia. The inclusion of a PCV in the immunization program could be useful for reducing the burden of pneumococcal diseases. The high resistance rate to penicillin and macrolides is alarming. Prudent use of antibiotics is crucial to prevent the selection of multidrug-resistant pneumococci.

© 2017 The Authors. Published by Elsevier Ltd on behalf of International Society for Infectious Diseases. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

### Introduction

*Streptococcus pneumoniae* is a common bacterial pathogen responsible for various infections in children and the elderly (World Health Organization, 2012). Pneumococcal diseases range from non-invasive infections such as sinusitis and otitis media to more severe invasive diseases including meningitis, septicemia, and pneumonia. In developing countries, mortality as a result of pneumococcal disease is highest in young infants under the age of 2 years (World Health Organization, 2012). In 2015, the World

Health Organization (WHO) reported that invasive pneumococcal disease was responsible for approximately one million deaths in children younger than 5 years of age worldwide (Liu et al., 2016). In the developed world, elderly patients carry the major burden of disease (World Health Organization, 2007). The overall case fatality rate for pneumococcal bacteremia may reach 15–20% among adults and 30–40% among the elderly (World Health Organization, 2012).

Ninety-eight serotypes of *S. pneumoniae* have been identified based on the capsular polysaccharide (the principal virulence factor), but only a few cause the majority of severe pneumococcal disease and are frequently resistant to antibiotics (Jauneikaite et al., 2015; Ziane et al., 2016; Song et al., 2012; Dagan and Klugman, 2008). The serotype prevalence can vary by geographic region, patient age, and time period of surveillance. Since 2000, three pneumococcal conjugate vaccines (PCV) have been developed (PCV7, PCV10, and PCV13) to target the burden of disease caused by specific pneumococcal serotypes (Geno et al., 2015).

\* Corresponding author at: Laboratory of Microbiology, Faculty of Medicine, Habib Bourguiba University Hospital, Avenue Majida Boulila, 3027 Sfax, Tunisia.

E-mail addresses: [ktari\\_sonia@medecinesfax.org](mailto:ktari_sonia@medecinesfax.org) (S. Ktari), [ikramjmalcott@live.fr](mailto:ikramjmalcott@live.fr) (I. Jmal), [mannoumroua@hotmail.com](mailto:mannoumroua@hotmail.com) (M. Mroua), [maalej.sonda@laposte.net](mailto:maalej.sonda@laposte.net) (S. Maalej), [bayednour@yahoo.fr](mailto:bayednour@yahoo.fr) (N.E. Ben Ayed), [basma\\_mnif@yahoo.fr](mailto:basma_mnif@yahoo.fr) (B. Mnif), [faouzia.rhimi@rns.tn](mailto:faouzia.rhimi@rns.tn) (F. Rhimi), [adnene.hammami@rns.tn](mailto:adnene.hammami@rns.tn) (A. Hammami).

PCV7 was launched in Tunisia in 2008, followed by PCV10 and PCV13 in 2012. However, these vaccines are only available in the private sector and are not included in the national immunization program for childhood vaccination. The choice of vaccine in each country must take into account the circulating serotypes. Current local data on pneumococcal serotypes in Tunisia are limited, and only a few reports from Tunisia have been published in the last decade (Charfi et al., 2012; Rachdi et al., 2011; Marzouk et al., 2014, 2015; Raddaoui et al., 2015).

Penicillin has been the drug of choice for the treatment of pneumococcal infections for a long time. However, since the 1990s there has been a dramatic increase in the prevalence of *S. pneumoniae* with reduced susceptibility to penicillin, as well as to other antibiotics. In Tunisia, the prevalence of antimicrobial-resistant strains of *S. pneumoniae* has increased, making infections more difficult to treat (Charfi et al., 2012; Rachdi et al., 2011; Marzouk et al., 2015).

The aim of this study was to analyze the serotype distribution of invasive and non-invasive *S. pneumoniae* strains isolated in the south of Tunisia over a 5-year period (2012–2016) in different age groups and to assess their antimicrobial susceptibility patterns.

## Materials and methods

### Clinical isolates

This study was conducted at the Habib Bourguiba University Hospital located in Sfax, Tunisia. This hospital serves as the first-line medical center for an urban population of one million inhabitants and as a referral center for a larger population coming from the south of Tunisia. Approval for the study was obtained from the Ethics Committee of Habib Bourguiba University Hospital. A total of 305 non-duplicate strains of *S. pneumoniae* collected between January 2012 and December 2016 were included in this study. The isolates were obtained from invasive and non-invasive sites in both pediatric and adult patients. Invasive *S. pneumoniae* isolates were recovered from clinical specimens obtained from normally sterile body sites (blood, cerebrospinal fluid (CSF), pleural fluid, and articular fluid). Non-invasive *S. pneumoniae* isolates were recovered from clinical specimens such as sputum, tracheal/bronchial aspirates, and ear exudates. The study population was stratified into three age groups: <5 years, 5–65 years, and >65 years.

The identification of the isolates was confirmed using standard procedures, including Gram staining, optochin sensitivity, and bile solubility tests.

### Antibiotic susceptibility

The susceptibility of all isolates to penicillin, amoxicillin, cefotaxime, tetracycline, chloramphenicol, erythromycin, lincomycin, pristinamycin, norfloxacin, levofloxacin, rifampicin, trimethoprim-sulfamethoxazole, vancomycin, and teicoplanin was determined by disk diffusion method. Minimum inhibitory concentrations (MICs) of penicillin, amoxicillin, cefotaxime, and levofloxacin were determined by Etest method. All tests were performed following the guidelines of the Antibiogram Committee of the French Society of Microbiology (CA-SFM-2013) (Comité de l'Antibiogramme de la Société Française de Microbiologie, 2013). Penicillin-intermediate and resistant strains were collectively referred to as penicillin non-susceptible strains.

*S. pneumoniae* ATCC 49619 was used as a quality control strain during susceptibility testing. Isolates that were resistant to three or more classes of antimicrobial agent were defined as multidrug-resistant (MDR) *S. pneumoniae*.

## Serotyping

Capsular typing was performed with a combination of multiplex PCRs targeting serotypes/serogroups 1, 3, 4, 5, 6A/B, 7F, 7C, 8, 9V, 10A, 11A, 12F, 14, 15A, 15B/C, 16F, 17F, 18, 19A, 19F, 20, 22F, 23F, 31, 33, 34, 35B, 35F, and 38 using primers as described previously (Pai et al., 2006). Next, depending on the amplification pattern obtained, a simplex PCR reaction was performed for each serotype. Strains that could not be serotyped by multiplex PCR reaction were serotyped using a conventional PCR targeting other serotypes (23B, 24A, 23A, 6(C/D), 21, 13, 9N/L) with primers as described previously (Ziane et al., 2015). One representative of each serotype was confirmed by sequence analysis. Serotypes that could not be identified by PCR were classified as non-typeable. Chromosomal DNA was extracted from the overnight cultures of the isolates using an InstaGene kit (Bio-Rad, USA) according to the manufacturer's instructions.

## Statistical analysis

Statistical comparisons were made using the Chi-square test or Fisher's exact test. SPSS version 17.0 (SPSS Inc., Chicago, IL, USA) was used for the statistical analyses. *p*-Values of <0.05 were considered to be statistically significant.

## Results

### Clinical and epidemiological characteristics

Between January 2012 and December 2016, a total of 305 non-duplicate pneumococcal isolates were collected: 76 (24.9%) were invasive strains and 229 (75.1%) were non-invasive strains. Among these isolates, 114 (37.3%) were from children aged <5 years, of whom 81 (71%) were <2 years of age; 119 (39%) were from patients aged 5–65 years, of whom 94 (79%) were 18–65 years of age; and 52 (17%) were from patients aged >65 years. The age of the patient was unknown for 20 of the isolates. The mean age of the patients was 29.3 years (range 4 days to 85 years) and the male to female sex ratio was 1.9:1. The distribution of the *S. pneumoniae* strains according to the specimen type is shown in Table 1.

### Serotype distribution and coverage of PCVs

Among the 305 pneumococcal isolates, 278 (91.1%) were properly serotyped. In total, 28 different serotypes were identified. Eight major serotypes were found to account for 74.7% of all

**Table 1**  
Number of *Streptococcus pneumoniae* isolates by sample origin and patient age.

Sample	Patient age (years) <sup>a</sup>					Total
	<2	2–4	5–17	18–65	>65	
<b>Invasive samples</b>						76
Blood cultures	8	4	–	16	10	38
CSF	14	1	3	7	2	28
Puncture fluid <sup>b</sup>	3	–	1	–	2	6
Abscess	0	–	–	1	–	1
Total	25	5	4	24	14	72
<b>Non-invasive samples</b>						229
Lower respiratory tract samples	15	15	12	53	28	123
Auricular swabs	31	11	5	3	2	52
Sinus and nasal aspirates	3	1	3	3	–	10
Other samples	7	1	1	11	8	28
Total	56	28	21	70	38	213
<b>Overall total</b>	81	33	25	94	52	285

CSF, cerebrospinal fluid.

<sup>a</sup> Age was unknown for 20 isolates.

<sup>b</sup> Articular, pleural, and ascites fluid samples.

Download English Version:

<https://daneshyari.com/en/article/8739146>

Download Persian Version:

<https://daneshyari.com/article/8739146>

[Daneshyari.com](https://daneshyari.com)