
Overview of pneumococcal disease in pediatric in Morocco

Casablanca, 09/12/2020

Topics

- **Nasopharyngeal carriage**
- **Invasive pneumococcal disease**
 - **Incidence of IPD**
 - **Serotype distribution**
 - **Antibiotic resistance**

Pneumococcal Disease in Pediatric in Morocco

Study of nasopharyngeal carriage of *Streptococcus pneumoniae* and its antibiotics resistance in healthy children aged less than 2 years in the Marrakech region (Morocco)

Study Overview

- The study determined the prevalence and risk factors of pneumococcal nasopharyngeal carriage to assess the antibiotic susceptibility of the isolates and the serotypes present **prior to the introduction of the conjugate pneumococcal vaccine**
- The study **from 2008 to 2009** and recruited healthy children aged from 2 to 24 months with a mean age of 10.6 months

Study Results

Epidemiology:

- 302 strains of *S. pneumoniae* were isolated from 660 healthy children (45.8%)
- Healthy carriage of *S. pneumoniae* was observed in 85.5% of urban children and in 58.9% of infants who were breastfed for less than 2 months

Source: [Bouskraoui M. et al., 2015](#)

Article Snapshot



Archives de Pédiatrie
Volume 18, Issue 12, December 2011, Pages 1265-1270



Mémoire original

Étude du portage rhinopharyngé de *Streptococcus pneumoniae* et de sa sensibilité aux antibiotiques chez les enfants en bonne santé âgés de moins de 2 ans dans la région de Marrakech (Maroc)

Study of nasopharyngeal carriage of *Streptococcus pneumoniae* and its antibiotics resistance in healthy children aged less than 2 years in the Marrakech region (Morocco)

M. Bouskraoui^a, N. Soraia^{a,*,} K. Zahlane^a, L. Arsalane^a, C. Dot^b, P. Mariani^b, E. Bingen^b

[Show more](#)

<https://doi.org/10.1016/j.arcped.2011.08.028>

[Get rights and content](#)

Résumé

Le portage sain de *Streptococcus pneumoniae* (*S. pneumoniae*) a fait l'objet de très peu d'études au Maroc. Avec l'émergence des souches résistantes aux antibiotiques à travers le monde, et l'apparition de nouveaux sérotypes, une surveillance épidémiologique s'impose avant l'introduction du vaccin dans notre pays.

Objectifs

Ce travail avait pour objectif de déterminer la prévalence et les facteurs de risque du portage rhinopharyngé de *S. pneumoniae* chez les enfants de moins de 2 ans au niveau de la région de Marrakech, et d'évaluer la sensibilité aux antibiotiques des souches isolées ainsi que la distribution des sérotypes circulants avant l'introduction du vaccin pneumococcique conjugué.

Patients et méthodes

De 2008 à 2009, 660 enfants en bonne santé âgés de moins de 2 ans ont été prélevés au cours de visites systématiques de suivi des vaccinations au niveau des différents dispensaires de la région de Marrakech.

Résultats

Le portage de pneumocoque a été observé chez 45,8 % des enfants. Les principaux facteurs de risque de portage étaient un allaitement maternel de moins de 2 mois, la présence d'une fratrie de plus de 1, le tabagisme passif et le faible niveau socioéconomique. Un total de 302 souches ont été isolées dont 34,7 % étaient de sensibilité diminuée aux antibiotiques. Parmi elles, 12,9 % avaient un haut niveau de résistance et 87,1 % avaient un bas niveau de résistance à la pénicilline. La résistance à l'amoxicilline concernait 3,3 % des souches et aucune n'était résistante au céfotaxime. Le sérotypage des isolats de *S. pneumoniae* a montré la fréquence des sérotypes 19F, 6, 14, 23, 18 et 9. L'étude des sérotypes vaccinaux a montré que la couverture sérotypique théorique était autour de 57 % pour le vaccin heptavalent conjugué et de 85 % pour le vaccin conjugué à 13 valences.

Conclusion

Ces données sur le portage rhinopharyngé ont permis d'évaluer sa fréquence et les principaux facteurs de risques associés et de rapporter l'état de la résistance à la pénicilline des souches de portage chez les enfants de moins de 2 ans au niveau de la région de Marrakech. L'évolution des sérogroupes et sérotypes circulants et de la résistance aux antibiotiques des souches isolées impose la mise en place d'une surveillance épidémiologique avant l'introduction du vaccin pneumococcique conjugué dans notre pays.

Pneumococcal Disease in Pediatric in Morocco

Study of nasopharyngeal carriage of *Streptococcus pneumoniae* and its antibiotics resistance in healthy children aged less than 2 years in the Marrakech region (Morocco)

Serotype Distribution:

- 6, 19F, 23, 14, 19A, 18 and 9 serotypes were frequent in the *S. pneumoniae* isolates
- Serotype coverage by the heptavalent pneumococcal vaccine was 57% while the 13-valent conjugate vaccine offered 85% coverage

Table 1: Distribution of *S. pneumoniae* strains

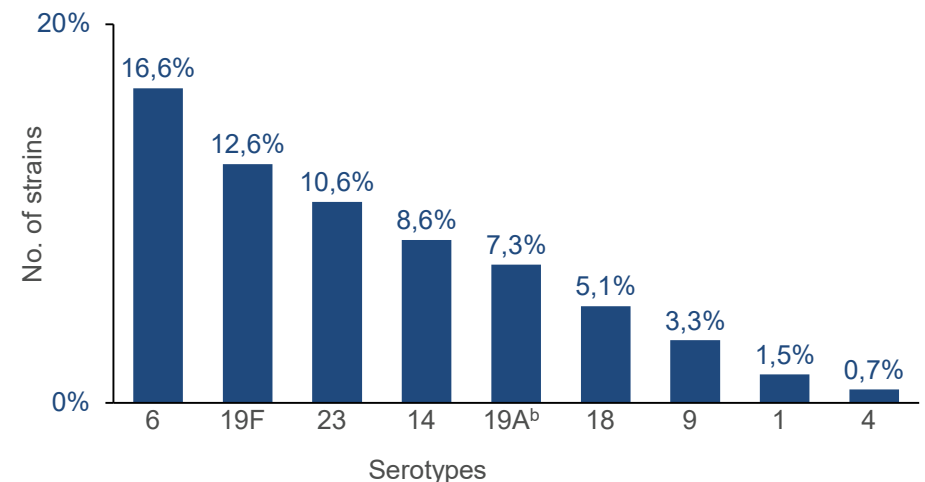
Serotypes / Serogroups ^a	N (%)
6	25 (16.6%)
19F	19 (12.6%)
23	16 (10.6%)
14	13 (8.6%)
19A ^b	11 (7.3%)
18	7 (5.1%)
9	5 (3.3%)
1	2 (1.5%)
4	1 (0.7%)

^aNon groupable: 48 (32%) excluding the groupings (1,3,4,6,9,14,18,19,23); ^b19 no A and no F: 3 (2.2%)

Antibiotics resistance :

- Antibiotics resistance of strains isolated was relatively low regarding data of literature.
- 34,7% of strains isolated had a decreased susceptibility to penicillin.

Figure 1: Distribution of *S. pneumoniae* strains



Pneumococcal Disease in Pediatric in Morocco

Invasive pneumococcal disease among children younger than 5 years of age before and after introduction of pneumococcal conjugate vaccine in Casablanca, Morocco

Study Overview

- The study compared the incidence rate of IPD (invasive pneumococcal disease), rates of antibiotic resistance and serotype distribution in Moroccan children ≤ 5 years old, before and after the introduction of PCVs (pneumococcal conjugate vaccines) in Morocco
- The time period before the introduction of PCV was defined as January 2007–October 2010, and that after the introduction was January 2011–December 2014
- The children were divided into 2 age groups:
 - children ≤ 2 years old
 - children between 2 to 5 years

Article Snapshot

Invasive pneumococcal disease among children younger than 5 years of age before and after introduction of pneumococcal conjugate vaccine in Casablanca, Morocco



Idrissa Diawara^{a,b,*}, Khalid Zerouali^{a,b}, Khalid Katfy^{a,b}, Bahija Zaki^b, Houria Belabbes^{a,b}, Jilali Najib^c, Naima Elmdaghri^{a,b,d}

^aDepartment of Microbiology, Faculty of Medicine and Pharmacy, 19 rue Tarik Bnou Zyad, Casablanca, Morocco

^bBacteriology-Virology and Hospital Hygiene Laboratory, University Hospital Centre Ibn Rochd, 1, Rue des Hôpitaux, Casablanca, Morocco

^cDepartment of Pediatric Infectious Diseases and Clinical Immunology, University Hospital Centre Ibn Rochd, Casablanca, Morocco

^dPasteur Institute of Morocco, 1 Louis Pasteur place, Casablanca, Morocco

ARTICLE INFO

Article history:

Received 19 May 2015

Received in revised form 27 August 2015

Accepted 25 September 2015

Corresponding Editor: Eskild Petersen, Aarhus, Denmark

Keywords:

Streptococcus pneumoniae

Invasive pneumococcal disease

Pneumococcal conjugate vaccine

Antibiotic resistance

ABSTRACT

Objectives: The purpose of this study was to compare the incidence rate of invasive pneumococcal disease, the rates of antibiotic resistance and serotype distribution among children ≤ 5 years old before and after PCVs introduction in Casablanca, Morocco.

Methods: This study was conducted at the Ibn Rochd University Hospital Centre of Casablanca during two periods encompassing pre- and post-implementation of PCVs, respectively from January 2007 to October 2010 and from January 2011 to December 2014. All the non-duplicate invasive *S. pneumoniae* isolates recovered during the study periods were included.

Results: There were 136 cases of IPD, 91 before and 45 after PCVs introduction. The greatest decrease in incidence rate of IPD occurred in children ≤ 2 years of age declining from 34.6 to 13.5 per 100,000 populations ($p < 0.0001$) before and after vaccination, respectively. The incidence rate of PCV-7, PCV-10 non-PCV-7 and PCV-13 non-PCV-10 serotypes decrease significantly from 18.0 to 4.6, from 5.7 to 1.3 and from 5.7 to 0.8/100,000 population ($p < 0.001$) in the same age, respectively.

Conclusion: Shifts in the distribution of IPD serotypes and reductions in the incidence rate of disease suggest an effective reduction of the burden of IPD in children, but continued high quality surveillance is critical to assess the changes in serotype distributions.

© 2015 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/>).

Source: [Diawara I. et al., 2015](#)

Pneumococcal Disease in Pediatric in Morocco

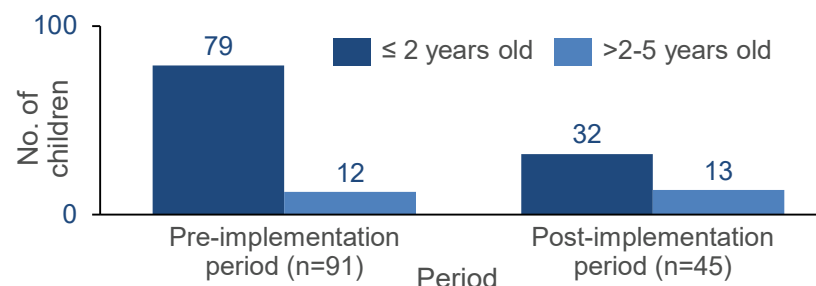
Invasive pneumococcal disease among children younger than 5 years of age before and after introduction of pneumococcal conjugate vaccine in Casablanca, Morocco

Study Results

Incidence Rate of IPD:

- 136 cases of IPD were detected, and *S. pneumoniae* isolates were recovered from these children
 - Among them, 91 isolates were from the pre-implementation period (79 from children ≤ 2 years old and 12 from children $>2-5$ years old)
 - 45 isolates were detected in the post-implementation period (32 from children ≤ 2 years old and 13 from children $>2-5$ years old)
- **The overall annual incidence rate of IPD decreased significantly from 34.6 to 13.5 per 100,000 populations among children ≤ 2 years of age, before and after vaccination, respectively**
- For children between 2 to 5 years of age, the rate of IPD incidence for the pre- and post-vaccination period showed a non-significant change

Figure 1: Distribution of *S. pneumoniae* in children of ≤ 2 years old and $>2-5$ years old during pre and post implementation period



Antibiotic Resistance:

- No significant differences were observed in the antimicrobial resistance rates between pre and post-vaccination periods for erythromycin, tetracycline, chloramphenicol ($p > 0.05$) for the two age groups (≤ 2 years and $>2-5$ years old)
- A significant reduction of penicillin and cotrimoxazole non-susceptible strains occurred in children under 2 years old. The proportion changed from 50.6% to 21.9% ($p = 0.005$) and from 39.2% to 6.3% ($p = 0.0004$) for PNSP and cotrimoxazole non-susceptible strains respectively. All the strains were susceptible to ceftriaxone.

Pneumococcal Disease in Pediatric in Morocco

Invasive pneumococcal disease among children younger than 5 years of age before and after introduction of pneumococcal conjugate vaccine in Casablanca, Morocco

Serotype Distribution:

Table 2: Incidence of vaccine and non-vaccine serotypes according to age groups before and after introduction of PCVs in Morocco

Serotypes	Pre-implementation – 2007-2010 No. of cases/100,000 populations	Post-implementation – 2011 – 2014 No. of cases/100,000 populations					P-value
		2011	2012	2013	2014	Total (2011-2014)	
≤ 2 years old							
PCV7 serotypes ^a	18.0	1.7	8.5	8.4	0.0	4.6	<0.0001
PCV10-nonPCV7 serotypes ^b	5.7	1.7	0.0	0.0	3.3	1.3	0.02
PCV13-nonPCV10 serotypes ^c	5.7	1.7	1.7	0.0	0.0	0.8	0.003
Non-PCV13 serotypes ^d	5.3	10.3	3.4	6.7	6.7	6.8	NS
Total	34.6	15.4	13.6	15.1	10.0	13.5	<0.0001
> 2 - 5 years old							
PCV7 serotypes	0.6	0.04	0.4	0.4	0.4	0.4	NS
PCV10-nonPCV7 serotypes	0.3	0.0	0.4	0.8	0.0	0.3	NS
PCV13-nonPCV10 serotypes	0.2	0.08	0.0	0.0	0.0	0.2	NS
Non-PCV13 serotypes	0.2	0.0	0.0	0.0	1.6	0.4	NS
Total	1.2	0.1	0.8	1.2	2.0	1.3	NS

Notes: Incidences were calculated as incidence = Number of serotype x 100,000/ populations (≤ 2 years old or 2 - 5 years old) during the years of surveillance at Casablanca; The Grand Casablanca population was estimated at 56,319 in 2007 and 59,993 in 2014 for children ≤ 2 years, and 237,278 in 2007 and 252,750 in 2014 for children >2 – 5 years old; ^aPCV7 vaccine serotypes are: 4, 6B, 9V, 14, 18C, 19F and 23F; ^bPCV10-nonPCV7 are: 1, 5 and 7F; ^cPCV13-nonPCV10 are 3, 6A and 19A; ^dNon-PCV13 serotype; NS – non-significant

Notes: PCV – Pneumococcal Conjugate Vaccine; PNSP – Penicillin Non-susceptible *S. pneumoniae*; IPD – Invasive Pneumococcal Diseases

Source: [Diawara I. et al., 2015](#)

Pneumococcal Disease in Pediatric in Morocco

Four years laboratory-based surveillance of invasive Pneumococcal Diseases in Morocco: what Impacts of the Pneumococcal Conjugate Vaccine in Moroccan population

Study Overview

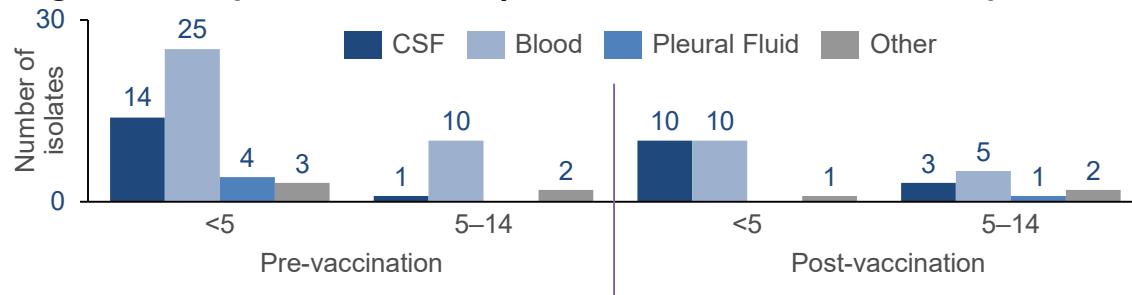
- The study evaluated the incidence of invasive pneumococcal diseases (IPD) in Casablanca before and after the introduction of pneumococcal vaccine (PCV13). It also determined the rates of antibiotic resistance and serotype distribution
 - It included patients aged 10 days to 80 years old
 - The study considered January 2008 to December 2009 as the time period before the introduction of PCV13 vaccine, and January 2011 to December 2012 as the post vaccine introduction period

Study Results

Etiology:

- A total of 186 invasive *S. pneumoniae* strains were isolated

Figure 1: Sample of invasive *S. pneumoniae* isolates in the two periods*



Note: The research paper represents data for all age groups, however, we have highlighted data for the pediatric population only; *The graph has been recreated using the ScanIT tool, and may not reflect the exact values. Source: [Diawara I. et al., 2014](#)

Article Snapshot

ISPPD-9
March 9-13, 2014
Hyderabad, India

ISPPD-0565
Diawara I^{1,2}, Zerouali K^{1,2}, Belbess H^{1,2}, Elmdaghni N^{1,2,3}

Background and objective
Streptococcus pneumoniae is the major agent of invasive disease such as meningitis, sepsis, bacteremia, arthritis, etc¹. World Health Organisation (WHO) has recommended the inclusion of Pneumococcal Conjugate Vaccine (PCV) in childhood immunization programmes worldwide, particularly in countries where mortality rates among children less than five years old of age are > 50/1000 live births or where > 50000 children die annually². In October 2010, pneumococcal conjugate 13-valent vaccine (PCV-13) was introduced in Moroccan National Program of Immunization (NPI), which was replaced (July 2012) by the PCV-10. In this study we determined the incidence of invasive pneumococcal diseases in Casablanca (Morocco) 2 years pre- and 2 years post PCV introduction, as well as the rates of antibiotic resistance and serotype distribution.

Methods
This prospective study and laboratory based surveillance of invasive pneumococcal isolates after the introduction of PCV-13 was conducted at the Ibn Rochd University Hospital of Casablanca, Morocco. Time periods encompassing pre- and post-implementation of PCV (January 2008 to December 2009 and January 2011 to December 2012, respectively) were examined. The incidence of Invasive Pneumococcal Disease (IPD) was recorded. The isolates were confirmed as pneumococcal by presence of alpha haemolysis on blood agar, optochin susceptibility and bile solubility. Serotyping was done using pneumotest kit and serotyping by Quellung capsular swelling for the strains isolated in children less than five years old and by the reformulated current sequential multiplex PCR typing³ for the other ages. Antimicrobial susceptibility was determined using Clinical and Laboratory Standards Institute recommendations (2012). Statistical analyses were done using Epi-Info version 7 and R 3.0.2 software. We considered p<0.05 to be significant.

Results et Discussion
A total of 186 invasive *S. pneumoniae* strains were isolated from blood, cerebrospinal fluid, pleural fluid and other sterile sites (Fig.1). Prior to PCV introduction, 112 cases of Invasive Pneumococcal Diseases (IPD) were observed and 74 cases after in overall population study.
During the first period, the most prevalent serotype were 1, 23F, 19F, 6B, 3, 7F, 18C, 24 et 8, whereas during the post-vaccination period, the most frequent were 3, 6B, 14, 8, 19A, 1, 7F et 6A in all age included (Fig.2).
A significant reduction of the IPD incidence rate was observed in children less than 5 years old, as well as the PCV-13 and PCV-10 serotypes in the same age range (Table 1).
Regarding to antibiotic resistance (Fig.3), among all age group only an important reduction was observed in penicillin G resistant *S. pneumoniae* strains (PRSP) from 43% to 22% (p = 0.09) in children less than 5 years old. All strains were susceptible to Ceftriaxone.
Moreover, in children less than 5 years old a significant reduction of theoretical coverage of PCV10 and PCV13 serotypes was observed: from 70% to 45% (p = 0.05) and from 82.6% to 63.6% (p=0.02), respectively. (Fig.4)

Conclusion
This is the first report on sero-epidemiology of IPD in Morocco after the pneumococcal conjugate vaccine introduction. These preliminary results show a relatively effect of vaccination on children less than 5 years of age. We observed a significant decrease in the invasive pneumococcal disease cases since the vaccine introduction as well as an antibiotic resistance particularly in children < 5 years old. Continued surveillance is essential to measure the emerging of new serotypes and antibiotic resistance strain, and the potential impact of new PCV (PCV-10), recently introduced into the NPI schedule in place of PCV-13. It's therefore important to continue monitoring and to expand nationwide.

Pneumococcal Disease in Pediatric in Morocco

Four years laboratory-based surveillance of invasive Pneumococcal Diseases in Morocco: what Impacts of the Pneumococcal Conjugate Vaccine in Moroccan population

Incidence Rate of IPD:

- In the pre-vaccination period, 112 IPD cases were observed and 74 IPD cases were observed after the introduction of the PCV vaccine
- A significant reduction in the rate of IPD incidence was observed in children aged below 5 years, and in PCV-13 and PCV-10 serotypes in the same age group**

Serotype Distribution:

- Serotypes 19A, 1, 23F, 19F, 6B, 3, 7F, 18C, 24 and 8, were most prevalent in the pre-vaccination period while serotypes 3, 6B, 14,8,19A, 1, 7F and 6A were more frequent in the post-vaccination period in all age groups
- In children aged less than 5 years, the theoretical coverage of PCV10 and PCV13 serotypes reduced from 70% to 45%(p = 0.05) and from 82.6 % to 63.6 % (p=0.02) in the pre- and post-vaccination periods, respectively

Table 1: Distribution of clinical IPD before and after vaccine introduction

Age group (years)	Pre-vaccination		Post-vaccination		P value
	No. of cases	Incidence*	No. of cases	Incidence*	
All Serotypes					
All ages	112	0.78	74	0.47	0.0006
<5	46	1.49	22	0.68	0.019
5–14	14	0.45	10	0.31	NS
PCV13 Serotypes					
All ages	67		39		0.0014
<5	38		14		0.0004
5–14	7	0.23	6	0.19	NS
PCV10 Serotypes					
All ages	49	0.34	23	0.15	0.0005
<5	29	0.94	10	0.31	0.001
5–14	6	0.19	3	0.09	NS

Note: *Incidence is number of cases/ 1000 admission; NS – not significant

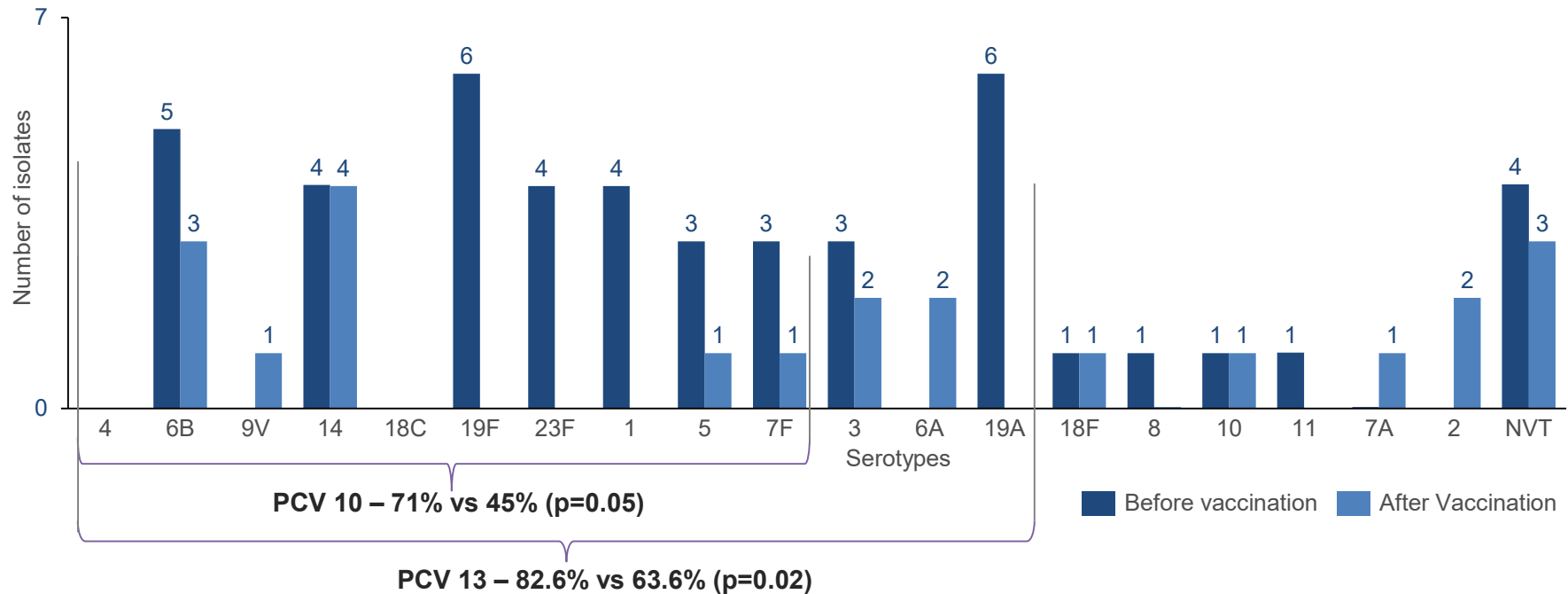
Note: PCV – Pneumococcal Conjugate Vaccine; IPD – Invasive Pneumococcal Diseases; The research paper represents data for all age groups, however, we have highlighted data for the pediatric population only. Source: [Diawara I. et al., 2014](#)

Pneumococcal Disease in Pediatric in Morocco

Four years laboratory-based surveillance of invasive Pneumococcal Diseases in Morocco: what Impacts of the Pneumococcal Conjugate Vaccine in Moroccan population

Serotype Distribution:

Figure 4: Serotype distribution of invasive pneumococcal strains in children <5 years before and after the PCV vaccine introduction*



Note: NVT – Non Vaccine Type; IPD – Invasive Pneumococcal Diseases; The research paper represents data for all age groups, however, we have highlighted data for the pediatric population only; *The graph has been recreated using the ScanIT tool, and may not reflect the exact values. Source: [Diawara I. et al., 2014](#)

Pneumococcal Disease in Pediatric in Morocco

Serotypes and Antibiotic Susceptibility of *Streptococcus pneumoniae* Isolates from Invasive Pneumococcal Disease in Morocco (Meningitis Cases)

Study Overview

- The study assessed the antimicrobial susceptibility of *Streptococcus pneumoniae* isolates from invasive incidences of meningitis cases and their serotype distribution **between 2012 and 2013**

Study Results

Antibiotic Susceptibility:

- 81% of the *S. pneumoniae* strains were resistant against antibiotics while the other 19% were sensitive

Article Snapshot

Serotypes and Antibiotic Susceptibility of *Streptococcus pneumoniae* Isolates from Invasive Pneumococcal Disease in Morocco (Meningitis Cases)

Soumaya Chaiboub^{1,2*}, Hassan Berny³, Bouchra Razzouk³, Zakaria Mennane¹, Aicha Qasmaou¹, Karima Hallout¹, Youssef Ikken¹, Reda Charof¹

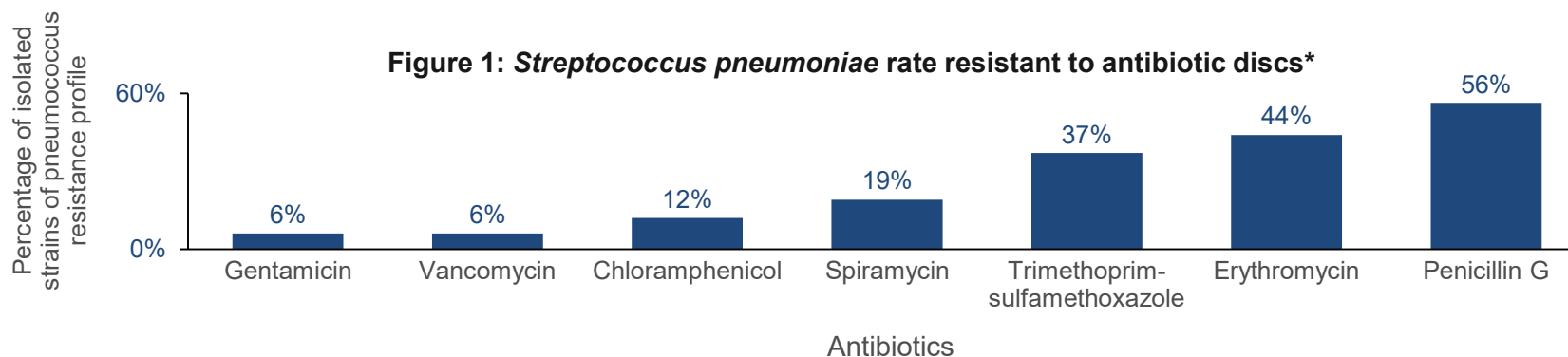
¹National Institute of Hygiene-Rabat, Morocco

²Faculty of Sciences-Kenitra, Ibn Tofail University, Kenitra, Morocco

³Faculty of Sciences- Rabat, University Mohammed V-Rabat, Morocco

ABSTRACT

The aim of this study was to examine the antimicrobial susceptibility of *Streptococcus pneumoniae* isolates from invasive meningitis cases, to determine the serotypes and susceptibility of serogroups/serotypes. Pneumococcal meningitis isolates were isolated from Cerebrospinal Fluid (CSF), between 2012 and 2013. Serotypes were determined using the capsular reaction test (Quellung test). Antimicrobial Susceptibility was tested using the disk diffusion method as determined by the CA-SFM guideline. The evaluation of susceptibility to β -lactams showed that 56% of the strains were penicillin non-susceptible strains, 31% were resistant to macrolides. The isolates were resistant to other antibiotics, 37% to trimethoprim-sulfamethoxazole, 12% to chloramphenicol, 6% was observed with glycopeptides and aminocyclitol. Almost all strains serotyped have a power of resistance with different families of antibiotics tested. Serotypes 2, 5, 6, 16, 12, 19A, 23 had a resistance to β -lactams and macrolides. All of isolates serotypes 6 and 32 were resistant to glycopeptides and aminoglycosides. This study aims to report the resistance evolution of *S. pneumoniae* strains and serogroups/serotypes with penicillin and different family's antibiotics from Moroccan pneumococcal isolates.



Source: [Chaiboub S. et al., 2017](#)

Pneumococcal Disease in Pediatric in Morocco

Serotypes and Antibiotic Susceptibility of *Streptococcus pneumoniae* Isolates from Invasive Pneumococcal Disease in Morocco (Meningitis Cases)

Serotype Distribution:

- A total of 9 serotypes – 1, 2, 5, 6, 12, 16, 19A, 23, 32, were isolated from invasive cases
- Resistance to penicillin was observed in serotypes 2, 5, 6, 16, 19A, 23 with a percentage of 56%

Table 1: Profile of resistance compared to different pneumococcal serotypes

Antibiotics tested family	Serotypes Pneumococcal strains expressing resistance	Resistance relative frequencies
Penicillins / Cephalosporins		
Penicillin G, oxacillin and amoxicillin	2, 5, 6, 16, 19A, 23	44%
Cefotaxime	2	
Macrolides		
Erythromycine	2, 5, 6, 23, 19A	31%
Spiramycin		
Sulfamides-trimethoprim		
Trimethoprim-sulfamethoxazole	1, 6, 23, 32,	37%
Phenicoles		
Chloramphenicol	23	12%
Glycopeptides		
Vancomycin	32	6%
Aminosides		
Gentamicine	32	6%

Conclusion: The study reported more than half of the pneumococcal isolates to be resistant to penicillin with different percentages observed with other antibiotics

Source: [Chaiboub S. et al., 2017](#)

Pneumococcal Disease in Pediatric in Morocco

Molecular characterization of penicillin non-susceptible *S. pneumoniae* isolated before and after pneumococcal conjugate vaccine implementation in Casablanca, Morocco

Study Overview

- The study aimed to determine the prevalence and molecular evolution of penicillin non-susceptible *S. pneumoniae* (PNSP) isolated from IPD (pneumococcal invasive diseases), before and after the introduction of pneumococcal conjugate vaccine in Casablanca, Morocco
 - In the study, 2007–2010 has been considered as the time period before the introduction of PCV (pneumococcal conjugate vaccine), and 2011–2014 as the post vaccine introduction period
- The study analyzed **361** *S. pneumoniae* isolates, collected from patients admitted for pneumonia between **2007 and 2014**

Article Snapshot

Molecular characterization of penicillin non-susceptible *Streptococcus pneumoniae* isolated before and after pneumococcal conjugate vaccine implementation in Casablanca, Morocco



Idrissa Diawara^{1,2}, Abouddihaj Barguigua³, Khalid Katfy^{1,2}, Kaotar Nayme^{1,4}, Houria Belabbes^{1,2}, Mohammed Timinouni⁴, Khalid Zerouali^{1,2} and Naima Elmdaghni^{1,2}

Abstract

Background: *Streptococcus pneumoniae* is a major cause of morbidity and mortality worldwide, especially among children and the elderly. The ability to effectively treat pneumococcal infection has been compromised due to the acquisition of antibiotic resistance, particularly to β -lactam drugs. This study aimed to describe the prevalence and molecular evolution of penicillin non-susceptible *S. pneumoniae* (PNSP) isolated from invasive diseases before and after pneumococcal conjugate vaccine implementation in Casablanca, Morocco.

Methods: Isolates were obtained from the Microbiology Laboratory of Ibn Rochd University Hospital Centre of Casablanca. Serogrouping was done by Pneumotest Kit and serotyping by the Quellung capsular swelling. Antibiotic susceptibility pattern was determined by disk diffusion and E-test methods. The PNSP were analyzed by pulsed-field gel electrophoresis (PFGE) and by genotyping of *pbp1a*, *pbp2b*, and *pbp2x* genes.

Results: A total of 361 *S. pneumoniae* isolates were collected from 2007 to 2014. Of these isolates, 58.7% were obtained before vaccination (2007–2010) and 41.3% after vaccination (2011–2014). Of the 361 isolates, 80 were PNSP (22.2%). Generally, the proportion of PNSP between pre- and post-vaccination periods were 31 and 13% ($p = 0.009$), respectively. The proportion of PNSP isolated from pediatric and adult (age > 14 years) patients decreased from 34.5 to 22.9% ($p = 0.1$) and from 17.7 to 10.2% ($p = 0.1$) before and after vaccine implementation, respectively. The leading serotypes of PNSP were 14 (33 vs. 57%) and 19A (18 vs. 14%) before and after vaccination among children. For adults, serotypes 19A (53%) and 23F (24%) were the dominant serotypes in the pre-vaccination period, while serotype 14 (22%) was the most prevalent after vaccination. There were 21 *pbp* genotypes in the pre-vaccination period vs. 12 for post-vaccination period. PFGE clustering showed six clusters of PNSP grouped into three clusters specific to pre-vaccination period (clusters I, II and III), two clusters specific to post-period (clusters V and VI) and a cluster (IV) that contained clones belonging to the two periods of vaccination.

Conclusion: Our observations demonstrate a high degree of genetic diversity among PNSP. Genetic clustering among PNSP strains showed that they spread mainly by a restricted number of PNSP clones with vaccine serotypes. PFGE clustering combined with *pbp* genotyping revealed that vaccination can change the population structure of PNSP.

Source: [Diawara I. et al., 2017](#)

Pneumococcal Disease in Pediatric in Morocco

Molecular characterization of penicillin non-susceptible *S. pneumoniae* isolated before and after pneumococcal conjugate vaccine implementation in Casablanca, Morocco

Study Results

Prevalence:

- Of the total 361 *S. pneumoniae* isolates, 54.7% isolates were obtained from children aged 0 to 14 years belonging to the pre-vaccination period, and 41% from the post-vaccination period
- 22.2% of the *S. pneumoniae* isolates were recognized as PNSP (penicillin non-susceptible *S. pneumoniae*)
 - The proportion of **PNSP** in pre- and post-vaccination periods were **31%** and **13%** ($p = 0.009$), respectively
 - Proportion of PNSP isolated from pediatric patients decreased from 34.5% to 22.9% ($p = 0.1$) before and after vaccine implementation

Antibiotic Susceptibility:

- In the pre- and post- vaccination periods, PNSP showed varied resistance to multiple antibiotics (Figure1)

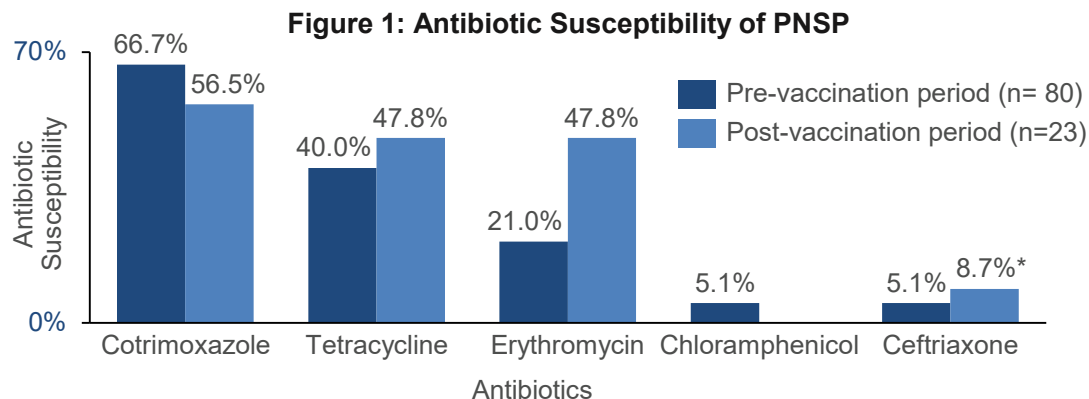


Table 1: Antibiotic Susceptibility of PNSP

Antibiotics	Pre-vaccination period (PNSP = 80)	Post-vaccination period (PNSP = 23)
Cotrimoxazole	66.7%	56.5%
Tetracycline	40%	47.8%
Erythromycin	21%	47.8%
Chloramphenicol	5.1%	–
Ceftriaxone	5.1%	8.7%*

Note: *intermediate susceptibility

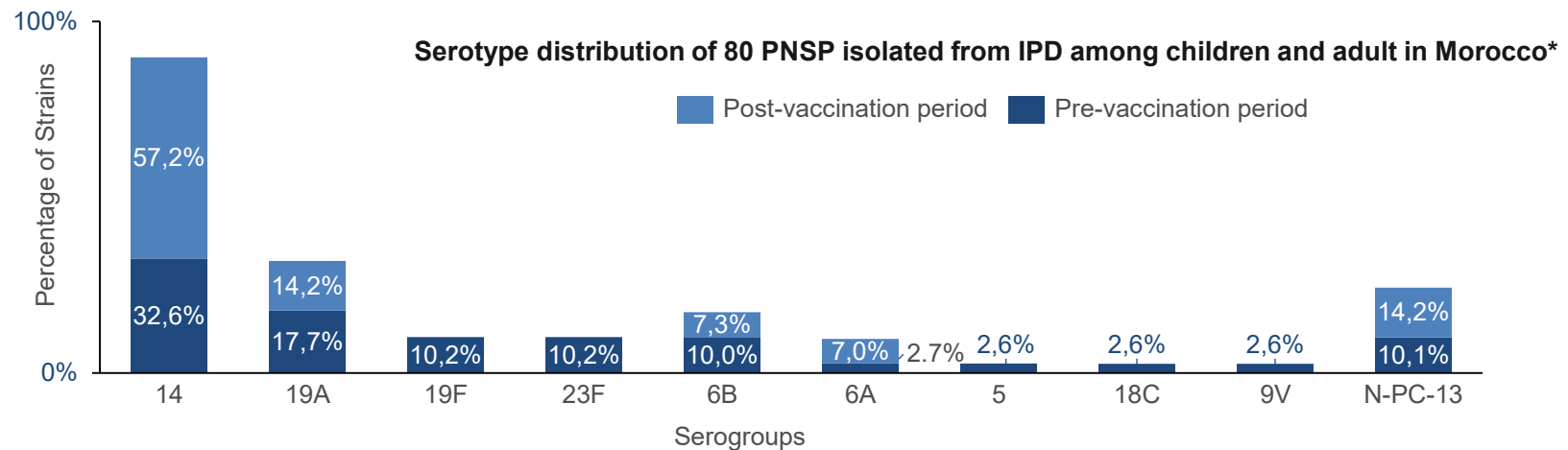
Source: [Diawara I. et al., 2017](#)

Pneumococcal Disease in Pediatric in Morocco

Molecular characterization of penicillin non-susceptible *S. pneumoniae* isolated before and after pneumococcal conjugate vaccine implementation in Casablanca, Morocco

Serotype Distribution:

- The leading PNSP serotypes were 14 (33% vs. 57%) and 19A (18 vs. 14%), before and after vaccination among children
- Serotype distribution revealed that vaccine serotypes and non-vaccine serotypes represented 90% and 10% of the PNSP isolated in children before vaccination
- Once the vaccine was introduced, vaccine and non-vaccine serotypes were represented as 85.7% and 14.3%, respectively



Conclusion: Study findings demonstrate a high degree of genetic diversity among PNSP, and that probably, the clones specific to pre-vaccine periods were eliminated by large scale vaccination in Casablanca

Notes: PNSP – penicillin non-susceptible *S. pneumoniae*; IPD – invasive pneumococcal diseases; *The graph has been recreated using the ScanIT tool, and may not reflect the exact values. Source: [Diawara I. et al., 2017](#)

Pneumococcal Diseases | SOMIPEV

Results of the observatory community confirmed acute bacterial meningitis the child's bringing six Moroccan university hospital centers (2012-2017)

Study Overview

- The multicenter retrospective study monitored the evolutionary aspects of meningitis epidemiology. Multiple hospitals were observed for community acute bacterial meningitis cases during 2012 – 2017

Study Results

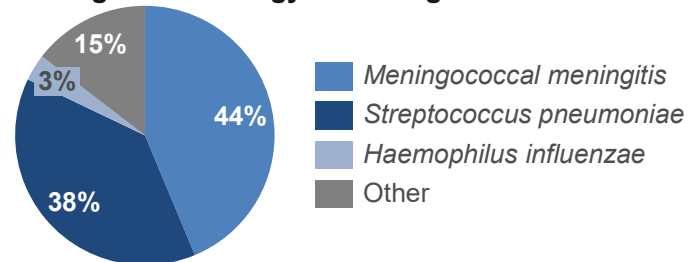
Incidence:

- 302 children, aged 28 days to 14 years, suffered with community acute bacterial meningitis
 - The infant population was worst hit by bacterial meningitis (46.35%)

Etiology:

- Most meningitis cases were caused by *meningococcal meningitis* (43.7%) and *streptococcus pneumoniae* (38.42%)

Figure 1: Etiology of Meningitis cases



Treatment:

- A third generation cephalosporin-based monotherapy was administered to 97.68% of the cases, which yielded favorable results in 71.01%

Source: [Bouskraoui et al., 2018](#)

Abstract Snapshot

6th Congrès National SOMIPEV
Marrakech, du 6, 7 et 8 Avril 2018

Résultats de l'observatoire des méningites bactériennes aiguës confirmées communautaires de l'enfant réunissant six centres hospitaliers universitaires marocains (2012-2017).

M. Bouskraoui, A. Oulmaati
CHU Tanger, CHU Hassan II Fès, CHU Mohammed VI Oujda, CHU Hassan II Casablanca, CHU Ibn Sina, CHU Mohammed VI Marrakech

Introduction : Les méningites bactériennes aiguës communautaires (MBAC) demeurent un réel problème de santé publique au Maroc avec une mortalité avoisinant les 10%. L'introduction dans le Programme National d'immunisation des vaccins contre l'Haemophilus influenzae b en 2007 et celui contre le pneumocoque en 2010 a contribué, inévitablement, au changement de l'épidémiologie des étiologies des méningites.

Objectifs : L'observatoire multicentrique des méningites, sous l'égide de la SOMIPEV, a pour mission principale la surveillance des aspects évolutifs de l'épidémiologie des méningites dans le but d'adapter la stratégie thérapeutique et préventive au niveau national.

Patients et méthodes : Il s'agit d'une étude rétrospective descriptive de 302 cas de MBAC confirmées, incluant tous les enfants âgés de 28 jours à 14 ans ayant présenté une méningite bactérienne à germe positif. Elle fait suite aux recommandations du congrès national de la SOMIPEV en 2012 qui, a créé un observatoire des MBAC confirmées chez l'enfant réunissant les données des centres hospitaliers universitaires de Rabat, Casablanca, Oujda, Marrakech, Tanger et Fès durant six années de 2012 à 2017. Les données sont analysées et notifiées selon une fiche numérisée, en coordination entre les pédiatres et les microbiologistes des centres concernés, puis adressés à l'observatoire.

Résultats : Entre 2012 et 2017, 302 cas de MBAC confirmées ont été colligés. L'âge moyen des patients était de 4,2 ans avec des extrêmes allant de 28 jours à 14 ans. On note une prédominance masculine avec un sexe ratio de 1,53. La répartition des patients était respectivement de 8,6% au CHU de Tanger, 32,45% au CHU de Casablanca, 16,55% au CHU de Rabat, 16,88 % au CHU de Fès, 25,16% au CHU de Marrakech et 0,33 % au CHU de Oujda. Les nourrissons sont les plus atteints de méningites bactériennes (46,35%). Le méningocoque représentait près de la moitié des cas de MBAC de l'enfant 132 cas (43,70%) et le pneumocoque près du tiers 78 cas (38,42%). Les méningites à Haemophilus influenzae étaient peu nombreuses 10 cas (3,31%). La prise d'antibiothérapie avant l'admission était de 30,29 % (91 cas). Les signes révélateurs des MBAC étaient respectivement la fièvre 93,45%, le syndrome méningé 42,12%. Les méningites à méningocoque sérotype B était majoritaire 89,57% (270 cas). Une monothérapie à base de céphalosporine de 3ème génération est administrée dans 97,68% (295 cas). L'évolution était favorable dans 71,01%. La connaissance de l'épidémiologie des bactéries et de leur sensibilité aux antibiotiques contribue au choix du traitement optimal des méningites.

Conclusion : La poursuite de la surveillance épidémiologique apparaît indispensable. Ainsi, il convient d'identifier le sérotype devant toute méningite afin d'adapter les schémas thérapeutiques et les protocoles de vaccination.

Pneumococcal Diseases | SOMIPEV

Pneumococcal pneumonia in children under 14 years of age at Ibn Rochd Casablanca Hospital: results of 8 years of surveillance (2007-2014)

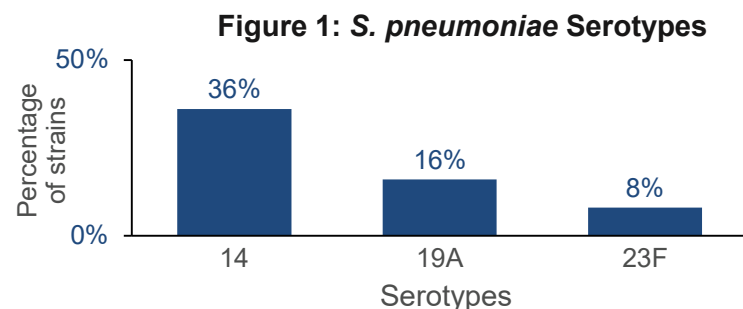
Study Overview

- Most deaths due to pneumococcal pneumonia occur in developing countries, of which 42% occur in Africa
- This retrospective study reported the prevalence of pneumococcal pneumonia, the distribution of serotypes and antibiotic susceptibility of strains isolated in children under 14 years of age, from 2007 to 2014
- All strains of pneumococcus were isolated from bronchial samples and / or blood cultures in the context of suspicion of pneumonia

Study Results

Serotyping:

- In total, 44 strains of *Streptococcus pneumoniae* were isolated in the children, 70% (31/44) of the isolates were from children under 5 years of age
 - 14 (36%), 19A (16%) and 23F (8%) were the dominated serotypes



Source: [Posters, SOMIPEV 2015](#)

Abstract Snapshot

P51 - Pneumonie à pneumocoque chez les enfants de moins de 14 ans au CHU Ibn Rochd de Casablanca : résultats de 8 ans de surveillance (2007-2014)

I. Diawara^{1,2}, K. Katfy^{1,2}, K. Zerouali^{1,2}, B. Zaki², H. Belabbes^{1,2}, N. Elmdaghri^{1,2,3}

¹ Laboratoire de Microbiologie Faculté de Médecine et de Pharmacie de Casablanca

² Laboratoire de Bactériologie, Viralogie et Hygiène, CHU Ibn Rochd, Casablanca

³ Institut Pasteur du Maroc, Casablanca.

Email du premier auteur : diawaraidris@gmail.com

Introduction : Les infections des voies respiratoires basses font parties des principales causes de décès chez les enfants de moins de 5 ans. *Streptococcus pneumoniae* figure parmi les principaux agents responsables de cette infection. Presque tous les décès surviennent dans les pays en voie de développement dont 42% en Afrique. Malgré la morbidité et la mortalité importantes de la pneumonie chez l'enfant, son épidémiologie et sa pathogenèse, particulièrement dans les pays en voie de développement, continuent d'être négligées et par conséquent sous-estimées. Le but de cette étude était de relater la prévalence des pneumonies à pneumocoque, la distribution des sérotypes et la sensibilité aux antibiotiques des souches isolées chez les enfants de moins de 14 ans.

Matériel et méthodes : Cette étude rétrospective a été effectuée au CHU Ibn Rochd de Casablanca de 2007 à 2014. Toutes les souches de pneumocoque isolées des prélèvements bronchiques et/ou des hémocultures dans un contexte de suspicions de pneumonie ont été incluses dans l'étude. Les souches ont été identifiées selon la procédure standard e bactériologie : morphologie des colonies, sensibilité à optochine, type d'hémolyse et la lyse des sels biliaires. La sensibilité aux antibiotiques a été réalisée selon les recommandations du CLSI 2014. Le sérotypage a été réalisé par agglutination et par gonflement de la capsule avec des anti-sérums (Staten Institute).

Résultats : Au total, nous avons isolé 44 souches de pneumocoques responsables de pneumonie chez l'enfant. 70% (31/44) provenaient des enfants de moins de 5 ans. Parmi les 44 souches, 64% (28/44) étaient des souches isolées de prélèvements bronchiques, 36% (16/44) en hémoculture. Les sérotypes dominants étaient le 14 (36%), 19A (16%) et 23F (8%). Le taux de résistance à la Pénicilline G, Cotrimoxazole, Tétracycline, Erythromycine et Chloramphénicol était respectivement 47%, 25%, 23%, 18% et 2,2%. Toutes les souches étaient sensibles au Ceftriaxone.

Conclusion : A travers cette étude, il ressort que les pneumonies à pneumocoque touchent plus les enfants de moins de 5 ans. Les souches isolées présentent un taux de résistance très élevés aux molécules de choix pour le traitement des pneumonies. Par ailleurs, les sérotypes les plus fréquemment isolés sont partiellement couverts par les vaccins conjugués actuellement homologués au Maroc. Il est donc essentiel de continuer la surveillance pour suivre d'éventuel changement de prévalence ou de la distribution des sérotypes.

Pneumococcal Diseases at Marrakech CHU

Epidemiology of community invasive infections in children at Marrakech CHU (2010-2018)

Study Overview

- **Invasive infections** include meningitis, bacteremia, and puncture fluid infections. These infections are one of the main causes of severe morbidity and mortality in children.
- To establish the bacteriological profile of these invasive infections, a surveillance based on data from the microbiology laboratory was carried out, including all strains of pneumococcus, meningococcus and Haemophilus influenzae isolated from children hospitalized at the Pediatric Mother Child Division from LCS, Hemocultures and pleural fluid.
- Samples were taken from **children under 15 years old and hospitalized** at the various pediatric departments of the Mohammed VI University Hospital of Marrakech between **January 2010 and December 2018**.

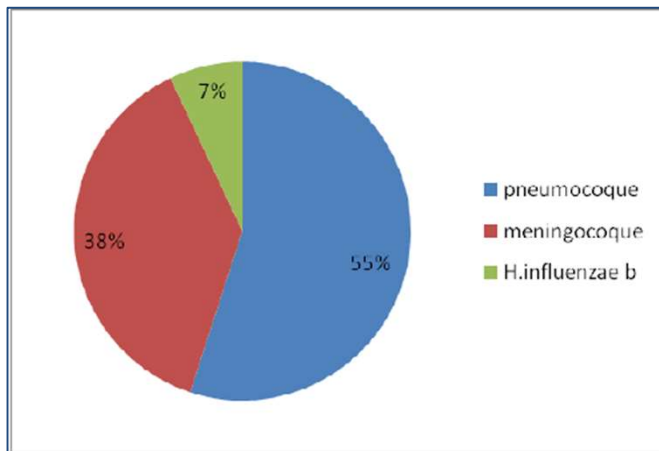
Study Results

- During this period, **248 bacteriologically confirmed invasive infections** were recorded at any confounding site. The average age of the children was 3 years.
- These II mainly affected the child under 4 years in 71% of cases, the child between 4 and 10 years in 25% and the child over 10 years in 4% of cases.

Pneumococcal Diseases at Marrakech CHU

Epidemiology of community invasive infections in children at Marrakech CHU (2010-2018)

Figure 1: Distribution of invasive infections in children according to species at the University Hospital of Marrakech between 2010 and December 2018 (n = 248)



- **Pneumococcal IIs ranked first with 55% of the II organisms in children**, followed by meningococcus 38% and H.influenzae 7%

Figure 2 : Evolution between 2010 and 2018 according to the species isolated from invasive infections in children at Marrakech University Hospital (n = 248)



- Between 2010 and 2018, there was an **increase in the prevalence of invasive pneumococcal infections from 2015**.

Pneumococcal Diseases at Marrakech CHU

Epidemiology of community invasive infections in children at Marrakech CHU (2010-2018)

- A gradual and significant decrease in invasive infections with serotype vaccines was found over this period.
- Thus, there was a decrease in pneumococcal meningitis serotype (PCV10) and a replacement related to the progressive increase in pneumococcal meningitis of non-vaccinal serotype in all age groups.
- **The predominant serotypes in meningitis were serotypes 23F (vaccinal), 15 (non-vaccinal), 19NA NB (non-vaccinal), 3 (PCV13 vaccine), 19A (PCV 13 vaccine).** Several other non-vaccine serotypes were increasing compared to 2010, such as serotypes 15, 19NA NB, 11A and 12F.
- **The vaccine serotypes fell sharply between 2010 and 2018 and from 2015, no vaccine serotype was found in meningitis in children. The serotypes included in PCV 13, 3, 19A and 6A remained between 2010 and 2018.**
- In children, a very significant regression of serotypes covered by PCV10 meningitis was found between 2010 and 2014 ranging from 75% in 2010 to 14% in 2014 with a disappearance of serotypes covered by PCV 10 from 2015.
- Penicillin-reduced susceptibility strains accounted for 23% of all isolates. These strains were mainly found in non-vaccine serotypes. No C3G resistant strain was isolated.

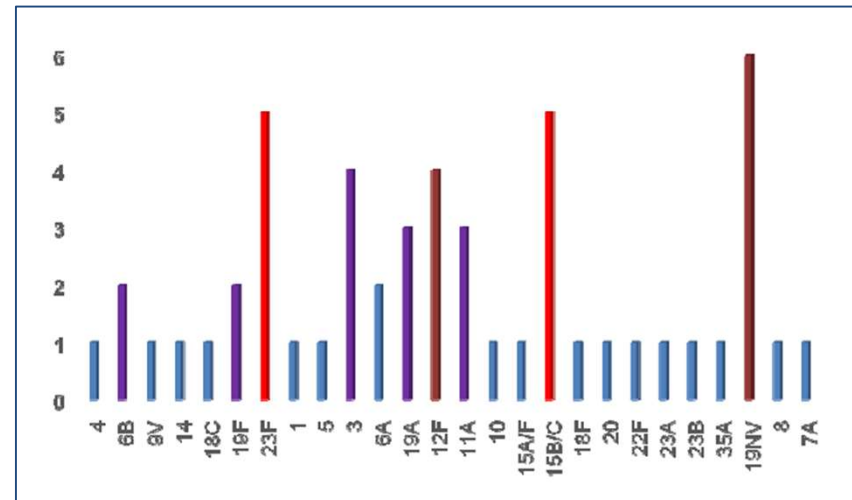


Figure 3: Distribution of Pneumococcal serotypes isolated from meningitis in children at the University Hospital of Marrakech between 2010 and 2018 (n = 54)

Q&A

0

Thank You