Pneumococcal disease in South Pacific

Predominance of ST306 serotype 1 among invasive Streptococcus pneumoniae in South Pacific

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Streptococcus pneumoniae

- A Respiratory pathogen
  - nasopharyngeal colonization (50% in children < 2 years)
  - Spreading to sinuses, middle ear or respiratory tract
  - Sinusitis, otitis media, bronchitis
  - Pneumonia
  - Bacteraemia and meningitis

- Burden of pneumococcal disease in the world
  - Cause of at least 1 million deaths every year
  - Most common community-acquired pneumonia
  - First cause of bacterial meningitis in children (0-5 years)
  - Mortality rate: 10-50% for pneumonia or meningitis
  - First cause of death for bacterial infection in children < 2 years in Europe and USA
Burden of Pneumococcal disease in South Pacific Islands

*Streptococcus pneumoniae*

- **First cause of bacterial meningitis in children (0-5 ans):**
  - incidence 5-6 fold higher than in France
  - incidence 22.7/100 000 in New Caledonia
  - incidence 20/100 000 in French Polynesia

- **First cause of bacterial meningitis in adults**

- **Major bacterial pathogen in community-acquired respiratory tract infections**

- **Serotype 1 is the most important serotype with > 20% of all clinical isolates**
  - < 10% in France
  - French Polynesia, 2002-2005, M. Levy, personal data
**Streptococcus pneumoniae**

**Serotype 1**

- **Serotype 1 (among > 90 pneumococcal serotypes)**
  - **Major cause of serious pneumococcal disease**
    - Most common cause of complicated pneumonia
    - Associated with rare disease syndromes (peritonitis, salpingitis...)
  - **Very rarely carried in the nasopharynges**
    - Even in locations where serotype 1 frequently causes invasive disease
  - **High ability to cause outbreaks**
    - One of the few serotypes associated with outbreaks of pneumococcal disease in small or closed communities
    - Increases in serotype 1 disease are associated with nationwide increases in invasive pneumococcal disease
Effect of Serotype 1 properties on epidemic and invasive capacity of *Sp*

Monthly data of pneumococcal disease in New Caledonia (2000-2007)

n=1436

Serotype 1 had a high attack rate associated with outbreaks of pneumococcal disease

2 Outbreaks of IPD
due to serotype 1
Effect of Serotype 1 properties on epidemic and invasive capacity of Sp

Importance of serotype 1 among invasive pneumococcal strains in French Polynesia (2002-2005) n=136

Serotype 1 had a high attack rate associated with outbreaks of pneumococcal disease.
Collaborative study in South Pacific territories
Australia, New Caledonia, Wallis and Futuna, French Polynesia
Molecular epidemiology, serotype 1 *Sp*

- 111 strains of serotype 1 *Streptococcus pneumoniae*
  - Australia: n=6
  - Wallis and Futuna: n=6

- Macrorestriction DNA analysis (PFGE): 111 strains

- MultiLocus Sequence Typing (MLST): 32 strains
  - e-burst analysis (Based Upon Related Sequence Type)
Results

serotype 1 Sp in South Pacific territories

• Major pulsotype: 100 strains in all territories
  • MLST: ST 306 and ST 3717

• Minor pulsotype: 11 strains, Australia and French Polynesia
  • MLST: ST 304
ST306 (SLV 3717) = Major type serotype 1 (80% of all isolates, n=111)

= exclusive clonal complex in NC and WF
= prevalent in FP and Australia.

ST304

= Minor type found in Australia/FP
E-burst analysis

- Available at the MLST *Streptococcus pneumoniae* database: http://www.mlst.net

- ST 306, a predicted primary founder

- Lineage A-associated STs

- Described in Europe, USA, Canada
Conclusion
serotype 1 *Sp* in South Pacific territories

✓ Predominance of the *Streptococcus pneumoniae* serotype 1- clonal complex ST 306:
  ✓ defined as the lineage A-associated STs
  ✓ described in Europe, the United States and Canada
  ✓ high stability in this South Pacific study (1999-2008)
Impact of the results for vaccination

- **Good news**
  - Serotype 1 is the same in South Pacific, Europe and USA
  - Coverage by the 23 valent polysaccharide vaccine
  - The knowledge about the 23 valent vaccine is accurate for the South Pacific

- **Bad news**
  - Serotype 1 is predominant in the South Pacific
  - Outbreaks are observed on a territorial scale
  - Not covered by the children conjugate vaccine
• Heptavalent Pneumococcal Conjugate Vaccine
  - Developed for children < 2 years
  - Covers serotypes responsible of meningitis (70-80%)
  - Introduced in the 2000’s

• Serotype 1 is not included in the PCV7
  - Further development for is introduction in 10 or 13 valent vaccine
Number of Invasive Pneumococcal Disease in children < 2 years in New Caledonia (2000-2007)

Implementation of PCV7 2004 in NC

During outbreaks (2000 and 2007) all IPD attributable to non-PCV7 serotypes were due to the serotype 1 in non-vaccinated or vaccinated children.
Impact on the Management of pneumococcal Vaccine PCV7:
4,6B,9V,14,19F,18C,23F

Number of Invasive Pneumococcal Disease in children < 2 years in French Polynesia (2002-2008)

IPD attributable to non-PCV7 serotypes were due to various serotypes including serotype 1
In the South Pacific, the *Streptococcus pneumoniae* serotype 1- clonal complex ST 306:

- represents a hypervirulent lineage with a propensity to cause septicaemia
- invasiveness capacity: absence in nasopharyngeal carriage (Charveriat et al, 2003)
- high stability in the South Pacific (1999-2008)
- is endemic and has the potential to cause an epidemic
- is not covered by the PCV7

A continuous knowledge of the distribution serotype is essential in the South Pacific for the development of effective vaccine strategies including the future 10 or 13 valent vaccines
Thank you for your attention