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# Molecular epidemiology of South African serotype 3 and serotype 19A pneumococcal isolates

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# MOLECULAR EPIDEMIOLOGY OF SOUTH AFRICAN SEROTYPE 3 AND SEROTYPE 19A PNEUMOCOCCAL ISOLATES

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A dissertation submitted to the Faculty of Science, University of the Witwatersrand, Johannesburg, in fulfillment of the requirements for the degree of Master of Science.

Johannesburg, 2007

**DECLARATION**

I declare that this dissertation is my own unaided work. It is being submitted for the degree of Master of Science (Dissertation) in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in other University.

_____

(Signature of candidate)

_____ day of _____ 200____

**ABSTRACT**

The clonality of a random sample of 102 invasive pneumococcal serotype 3 strains isolated from Gauteng Province during January 2000 to December 2003 was investigated. Pulsed-field gel electrophoresis (PFGE) and multilocus sequence typing (MLST) revealed a heterogeneous population with several PFGE clusters and sequence types (STs). The largest PFGE cluster comprised 36/102 (35%) isolates including seven that belonged to ST458, a clone that is not common in other parts of the world. The global clone (ST180) which is common in the United States and other countries was found in a cluster that represented only 14/102 (14%) of isolates examined.

The first multidrug-resistant pneumococcal serotype 19A strain that was isolated in South Africa in 1977 was compared with invasive serotype 19A multidrug-resistant strains isolated in South Africa during June 1999 to December 2004. PFGE analysis of these isolates demonstrated clonal diversity among the isolates. MLST of 16 randomly selected isolates revealed several STs, none of which was the same ST as the 1977 clone.

Both serotype 3 and 19A were not associated with increased mortality or HIV seropositivity compared to other serotypes.

**DEDICATION**

In memory of my father

Ramosalioahae Mothibeli

1944-2003

and

my brother

Kgosietsile Mothibeli

1969-2003

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**LIST OF ABREVIATIONS**

| | |
|---|---|
| *Pneumococcus* | *Streptococcus pneumoniae* |
| *S. pneumoniae* | *Streptococcus pneumoniae* |
| IPD | invasive pneumococcal disease |
| CSF | cerebrospinal fluid |
| HIV | human immunodeficiency virus |
| AOM | acute otitis media |
| DNA | deoxyribose nucleic acid |
| bp | base pair |
| PCR | polymerase chain reaction |
| PFGE | pulsed-field gel electrophoresis |
| MLEE | multilocus enzyme electrophoresis |
| MLST | multilocus sequence typing |
| DLV | double-locus variant |
| SLVs | single-locus variants |
| ST | sequence type |
| RAPD | random amplified polymorphic DNA assay |
| REP | repetitive extragenic palindrome |
| RFLP | restriction fragment length polymorphism |
| PMEN | Pneumococcal Molecular Epidemiology Network |
| PVC | pneumococcal conjugate vaccine |
| $^{o}$C | degrees celsius |

| | |
|---|---|
| V/cm | volts per centimeter |
| s | seconds |
| g | gravitational force |
| UV | ultra violet |
| EDTA | ethylenediaminetetra-acetate |
| TBE | Tris-borate-EDTA |
| TE | Tris-EDTA |
| NaCl | sodium chloride |
| CTAB | hexadodecyltrimethyl-ammonium bromide |
| RNAse | ribonuclease |
| P | penicilin |
| R | rifampicin |
| M | trimethoprim-sulfamethoxazole |
| T | tetracycline |
| E | erythromycin |
| C | Chloramphenicol |
| L | Clindamycin |
| *aro E* | shikimate dehydrogenase |
| *gdh* | glucose-6-phospate dehydrogenase |
| *gki* | glucose kinase |
| *recP* | transketolase |
| *spi* | signal peptidase I |
| *xpt* | xanthine phosphoribosyltransferase |

| | |
|---|---|
| *ddl* | D-alanine-Dalanine ligase |
| WC | Western Cape |
| KZ | KwaZulu-Natal |
| GA | Gauteng |
| EC | Eastern Cape |
| NP | Limpopo (previously Northern Province) |

**LIST OF SYMBOLS**

| | |
|---|---|
| % | percent |
| < | less than |
| ≥ | greater or equal to |
| µl | microlitre |