

## ENVIRONMENTAL RESERVOIR, PERSISTENCE AND EPIDEMIC SUCCESS OF *PSEUDOMONAS AERUGINOSA* POPULATIONS IN A HOSPITAL

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*Pseudomonas aeruginosa* is an environmental pathogen that grows in water and plumbing systems. In hospital, the rate of healthcare associated infections (HAIs) and outbreaks caused by *P. aeruginosa* raised questions about the cycle of its transmission to human beings in the hospital environment. *P. aeruginosa* epidemiology at the Montpellier Academic Hospital allowed to collect 884 strains isolated over a 9-years period. This collection is representative of various environmental niches and two marked epidemiological periods. Clinical strains involved in outbreak events and serious infections were also included in the study. Genetic and phenetic analysis were performed with the aim to understand structure, dynamics and persistence of *P. aeruginosa* populations in various hospital reservoirs as well as the relationships between environmental reservoirs and epidemic success of *P. aeruginosa*.

The experimental study, organized in 3 parts, produced the following major results. Medical and technological reservoirs of *P. aeruginosa* are highly dynamic and clonal emergence occurs in these systems, particularly in relation with networks decontamination by biocides. At the hospital scale, environmental reservoirs are directly involved in outbreak events. Physical barriers between water and patients cut the cycle of transmission from environment to human and markedly changed the epidemiology with a decrease of outbreaks in frequency and incidence. Moreover, the most ubiquitous strains that also persists in environment correspond to Epidemic High Risk (EHR) clones that succeed locally and globally. Population structure of *P. aeruginosa* within the hospital is similar to the worldwide population or to more local populations previously described: an epidemic structure with a background of recombinations involved in lineages emergence. The major EHR clone ST308 is more resistant to antibiotics than other prevalent clones not involved in outbreaks. However, the study of 46 strains in ST308 showed extreme within genotype variability, particularly various behaviours against antimicrobial agents. Increased ability to form biofilm and decreased motility have been described in literature as specific traits of EHR clones but it is not observed in this study. Our main hypothesis is that epidemic success of EHR clone ST308 in the hospital was linked to its diversity and versatility rather than to specific characters shared by all EHR strains.

This study provides strong arguments in favour of the involvement of *P. aeruginosa* environmental reservoirs in HAI outbreaks. For a better control of these outbreaks, a surveillance of EHR clones of *P. aeruginosa* should be implemented independently to their antibiotic resistance. Moreover, barriers between environment and patient should be established as soon as an environmental reservoir of EHR clone is detected.

**Key words:** *Pseudomonas aeruginosa*, Healthcare Associated Infections, outbreak, environment, water network, population structure, epidemic high risk clone, resistance to antibiotics, biofilm, motility, intraclonal variation, adaptation.