Chest physiotherapy improved the detection of Pseudomonas aeruginosa in airway secretions from non-expectorator CF children

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Objective: Airway secretions (AwS) could be routinely collected after chest physiotherapy (CP), however only oropharyngeal swabs (OP) has been validated. This study proposed to compare the results of AwS cultures obtained by OP or CP.

Methods: This powered prospective study included in 16 French CF tertiary reference centres: CF patients who should undergo a routine AwS culture, aged <18 years and unable to spontaneously expectorate. AwS were consecutively obtained first by OP and then by CP. CP drained AwS to the lower pharynx, cough was provoked and sputum was quickly collected by a gentle suction through the mouth. Microbiological cultures were performed as recommended and the current analyses aimed Pseudomonas aeruginosa (PaA), Haemophilus Influenzae (HI) and Staphylococcus aureus (SA). The results were compared by the McNemar’s test with a significant level at p < 0.05.

Results: 299 CF children (54.4% boys), median age 7 years, participated to the study and 295 were analysed. The difference between positive OP and CP cultures were 9.7% vs 15.2% for PaA (p = 0.002), 14.8% vs 19.9% (p = 0.013) for HI and 49.2% vs 53% (p = 0.15) SA. OP Spe, Se, PPV and PNV were 97.6%, 50%, 78.5% and 91.5% (PA); 95.2%, 55.1%, 74.4% and 89.5% (HI); 81.7%, 76.7%, 17.5% and 75.7% (SA).

Conclusion: CP should be preferred to OP in the routine microbiological survey of non-expectorator CF children. It allowed identifying 88% of patients colonized with PaA whereas OP missed 44% of them.

Biofilm growth normalizes mutation frequencies and does not increase mutant prevention concentrations in Pseudomonas aeruginosa from cystic fibrosis patients

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Background: Biofilms play a relevant role in the persistent bacterial colonization of the respiratory tract in cystic fibrosis (CF) patients. Biofilms are also associated with antibiotic resistance, whereas mutation frequency variations have not been well explored. We explore the possible differences in the mutation frequency, antibiotic susceptibility and mutant prevention concentration (MPC) values in CF Pseudomonas aeruginosa isolates under planktonic and biofilm modes of growth.

Material and Methods: A defined collection of 42 P. aeruginosa isolates from 10 CF-patients was studied. Rifampin mutation frequency (I), antibiotic susceptibility, and MPC were determined in triplicate on cells under planktonic or biofilm mode of growth. Statistical tests were applied to analyze the results.

Results: Unlike the MPCs, the proportion of resistant strains and MICs for ciprofloxacin, tobramycin, imipenem and ceftazidime increased in biofilm mode of growth. Overall, mutation frequency was significantly higher in planktonic (1.1 × 10^{-8}) than in biofilm conditions (9.9 × 10^{-9}) (p < 0.015). A more detailed analysis indicates that isolates categorized as hypo-mutable increase its mutation frequency from 3.6 × 10^{-9} in planktonic to 6 × 10^{-8} in biofilm, whereas normo-mutators (from 9.4 × 10^{-8} to 5.3 × 10^{-8}) and hypermutators (from 1.6 × 10^{-6} to 7.7 × 10^{-7}) decreased their mutation frequencies in biofilm mode of growth, which might explain the stability in MPC values.

Conclusion: High and low mutation frequencies in planktonic growth converge into normo-mutable category under biofilm mode of growth of CF-P. aeruginosa, leading to stabilisation in MPC values.