



MICROBIOLOGY NEWSLETTER

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**THERE ARE NO NORMAL VALUES IN MICROBIOLOGY!
AN IMPROPERLY COLLECTED SPECIMEN MEANS UNINTERPRETABLE RESULTS!**

Diagnosis of Lower Respiratory Tract Infections: Difference is Analysis Between Sputum Samples from Patients With and Without Cystic Fibrosis (CF)

Sputa samples must be properly collected in order to be clinically relevant and provide a quality culture and susceptibility result for your patients. Sputa specimens should be collected from the lower respiratory tract by deep expectoration. Patients who cannot or are not able to reliably produce sputa are more likely to provide poor quality (saliva) samples. Ideally, sputa should be collected first thing in the morning before the patient has eaten or brushed their teeth. Patients may rinse their mouth with water prior to collection. Sputa samples are coughed out into a sterile, screw capped container and promptly transported to the laboratory.

This newsletter outlines the important differences between the analysis of sputa specimens from patients with and without CF. 'CF cultures' **should not be ordered** on patients who do not have this disease since the results (due to the different analysis) may provide erroneous results.

1. Routine Sputa Cultures (Non-CF Patients)

An accurate microbiological diagnosis of a lower respiratory tract requires the submission of a high quality sputum sample. To determine whether a sputa sample is suitable for culture (i.e. not highly contaminated with saliva), a gram stain is read microscopically and scored using a Quality (Q)-score that assesses the presence and amount of cells and bacteria present. This microscopic scoring and evaluation is only performed on sputa for patients who **do not** have cystic fibrosis (CF) (also not done on bronchoalveolar lavages, endotracheal tube aspirates or sputa collected from children ≤ 14 years of age).

a) Initial Sputa Quality Assessment: The Q-score consists of a quantification of the squamous epithelial cells (cells lining the mouth). If there are >25 epithelial cells and <10 polymorphonuclear leukocytes (PMNs) microscopically per low-power field (lpf), the sputa sample will not be suitable to culture and no further analysis is done. The presence of heavy amounts of squamous epithelial cells and low amounts of PMNs (pus) in a sputa sample indicates gross oropharyngeal contamination by saliva. Further culture analysis of poor quality sputa would provide the physician with erroneous information.

b) Cultured Sputa Gram Stain: If there are <25 squamous epithelial cells and >10 PMNs microscopically per lpf, the testing proceeds. All sputa specimens deemed to be suitable for culture based on their initial microscopic quality assessment are inoculated to culture media. Cultured sputa Gram stains also assess the presence and amount of cells (squamous epithelial cells, PMNs and RBCs), but the presence of potential bacterial respiratory pathogens are also assessed and their amounts semi-quantitatively graded and compared to the presence and amount of background normal oropharyngeal flora. The types and amounts of respiratory pathogens and normal oropharyngeal flora grown in culture is also correlated with the initial specimen Gram stain to ensure that all clinically relevant organisms have been recovered and analyzed.

c) Limitations of This Approach: Quality assessment of sputa cannot be used if pulmonary infections caused by fungi, mycobacteria, Legionella species, or viruses are suspected. In addition, the significance of PMNs as an indicator of lower-respiratory tract inflammation may be erroneous in a patient with neutropenia, in patients who are otherwise immunosuppressed and cannot mount an inflammatory response, and in those with a foreign body in the airway that is irritating the respiratory mucosa (i.e., intubation).

2. Cystic Fibrosis

Cystic fibrosis is a chronic, progressive disease affecting the exocrine (secretory) glands with variable dysfunction seen in the lungs, pancreas, male reproductive system, liver and exocrine sweat glands. CF is inherited in an autosomal recessive manner occurring in approximate 1:2000 live births in North America (mostly Caucasian population). One in twenty people carry the abnormal gene, which codes for the Cystic Fibrosis Transmembrane Regulator (CFTR), on the 7th chromosome. The median life expectancy for patients with CF is 37 years, which has been steadily increasing with the advent of more modern and aggressive approaches in management.

a) CF Microbiology: The hallmark of CF is pulmonary dysfunction with increased, more viscous sputum providing an ideal environment for infections creating persistent inflammation furthering the problem of increased sputum production and mucous plugging. The chronic infections and inflammation damage the lung tissue producing bronchiectasis and progressive pulmonary failure. Common organisms, early in life, include *Staphylococcus aureus* and *Hemophilus influenzae*. As the patient ages and the disease progresses, *Pseudomonas aeruginosa* becomes the dominant pathogen in most patients and is a major risk factor for faster progression towards pulmonary failure. A small subset of patients may acquire *Burkholderia cepacia*, which, like *P. aeruginosa* is linked to faster progression of illness and poorer outcomes. Other pathogens may include unusual Gram-negative organisms, atypical Mycobacteria (mycobacteria other than *Mycobacterium tuberculosis*), and *Aspergillus spp.*

b) CF Sputa Cultures: Cystic fibrosis cultures do not provide any microscopic analysis and thus are helpful in identifying the presence or absence of certain organisms that are of concern in the context of cystic fibrosis. Cystic fibrosis cultures use specific media that support the growth and identification of uncommon organisms such as *Burkholderia cepacia* complex, *Stenotrophomonas maltophilia*, *Achromobacter xylosoxidans* and other non-lactose fermenting gram-negative bacilli. These organisms are not routinely implicated in community-acquired pneumonia nor are they the usual causes of nosocomial or ventilator associated pneumonia.

In adult patients, the cystic fibrosis cultures are diluted and are thus results are less reliable in the “normal” patient presenting with pneumonia. The quantifying of organisms with a dilution method is potentially misleading as sputum samples represent a random lung sampling and not a stable sample on repeated collection, thus making quantification problematic.

3. Recommendations

It is important to order the right test to adequately diagnose and treat your patient. **All patients**, except those with Cystic Fibrosis and Bronchiectasis (as defined by those followed and cared for by the CF teams), **should receive routine respiratory cultures**. This will ensure they get the best possible diagnostic work-up for their condition. It is the clinician’s responsibility to order the appropriate viral testing in addition to the sputum culture when a viral etiology may be causative or contributory as sputum samples are not the ideal specimen for viral diagnostics. The Medical Microbiologists and Infectious Diseases Specialists (both adult and pediatric) can be valuable resources in assisting clinicians in the ideal microbiologic work-up of patients with respiratory tract infections.

**IF YOU HAVE ANY QUESTIONS OR COMMENTS ABOUT HOW THE LABORATORY WORKS,
PLEASE CALL US AT 770-3215 (Sandra Corbett, Manager, Microbiology) or
770-3762 (Dr. Dan Gregson, Division Head, Microbiology)**