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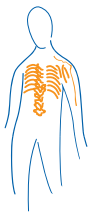

Laboratory Diagnosis of Infectious Diseases

Kimberle Chapin

INTRODUCTION

The ability to diagnose a greater number of infectious diseases rapidly and accurately represents a significant recent advance in medicine. Diagnosis has become readily available with point-of-care (POC) testing that is automated, molecularly based, and technologically advanced. At the same time, specimen acquisition, test selection, test performance parameters, and result interpretation have become more complex.

Up to 70% of individual patient medical diagnoses are made with the aid of a laboratory test result. Implementation of the right diagnostic technology can affect patient safety, morbidity, mortality, and health care costs. Examples of how test results can optimize patient care have been published for *Clostridium difficile* toxin molecular testing and infection control practices; algorithms for identification and treatment of sepsis to reduce morbidity and mortality; screening for colonization with methicillin-resistant *Staphylococcus aureus* (MRSA) and *S. aureus,* allowing decontamination and targeted antibiotic therapy in high-risk surgical procedures; and use of rapid molecular testing to aid in successful anti-infective intervention and stewardship programs.

This chapter highlights significant components of testing for infectious diseases and the trends in the laboratory and diagnostic technology that affect patient care. More information is available in the 2013 American Society for Microbiology (ASM) and Infectious Disease Society of America (IDSA) guideline on use of the microbiology laboratory for the diagnosis of infectious diseases. This excellent resource summarizes laboratory diagnosis of infectious diseases by basic disease categories (e.g., respiratory, genital) and contains numerous tables for rapid access of information. The document is well referenced and is updated on a regular basis; it is now available as part of the Sanford Guide–Lab Diagnosis of Infectious Diseases (http://www.sanfordguide.com/).

SPECIMEN COLLECTION AND PROCESSING

Collection of the specimen and its preservation during transportation are components of infectious disease diagnosis that are often overlooked. As part of their accreditation and inspection process, laboratories have collection procedures and criteria for rejection of specimens that are deemed inappropriate to process. These evidenced-based protocols ensure that results can reliably be used to treat patients. Examples include rejection of a sputum specimen after initial smear evaluation shows the specimen is contaminated with squamous epithelial cells and indicates normal mouth flora rather than a deep respiratory specimen. Another example is rejection of a hard stool for *C. difficile* toxin testing because it is inconsistent for a person with *C. difficile* infection, which produces watery diarrhea.

All personnel (e.g., physicians, nurses, phlebotomists) collecting specimens should be familiar with the appropriate collection devices, recommended collection techniques, and requirements for transportation to the laboratory to ensure optimal identification of the pathogen. If the practitioner requests a microbiology test not typically performed, such as for anaerobic organisms from a cerebral spinal fluid (CSF) specimen, a call should be made to the laboratory to clarify the order.

RAPID DIAGNOSTIC METHODS

Rapid or *STAT* is no longer a term foreign to direct testing for infectious diseases and the microbiology laboratory. All major areas of diagnostic testing, including direct visualization of specimens; detection of organism-specific antigens, proteins, and nucleic acids; and cell counts and biomarkers can be performed in 1 to 4 hours. Test results are often available during the time a practitioner is involved with the patient.

Table 87-1 lists the most common U.S. Food and Drug Administration (FDA)–cleared direct testing methods used in laboratories for primary specimens. Examples include Gram stain for bacteria and yeast, fluorescent calcofluor staining for fungi, *Legionella* urinary antigen for legionnaires disease, and polymerase chain reaction (PCR) for enterovirus in CSF.

Direct and *rapid* do not necessarily equate to high predictive values for a true positive or negative test result. As a result, tests commonly used in the past (e.g., bacterial antigen and India ink in CSF) are no longer routinely recommended because false-positive results are common.

DIRECT SMEAR INTERPRETATION

A direct smear interpretation can be exceedingly helpful in confirming a suspected cause (e.g., Gram stain of sputum for pneumococcal pneumonia) and can be performed usually in a few minutes to hours from receipt in the laboratory. High sensitivity and specificity, however, depend on specimens being collected appropriately (e.g., obtained before antibiotic administration) and sometimes on knowing the immune status of the patient.

Fluorescent staining with calcofluor (Fig. 87-1) and auramine have increased sensitivity for direct detection of fungal elements and acid-fast bacilli (AFB), respectively. Direct fluorescent antibody staining for parasites, viruses, or *Pneumocystis jirovecii* is specific and rapid compared with staining of histologic tissue