Urine Specimens: An Overview (Part 2)

This In Focus topic is the second of a two-part series on urine specimen collection. This article covers sources of preanalytical artifact arising during urine collection, handling and transportation. As stated in part 1, urine has a long history as a specimen for analysis in clinical laboratories. After blood, urine is the most commonly used specimen for diagnostic testing, monitoring of disease status and detection of drugs. As for all clinical laboratory specimens, preanalytical error in urine specimens is often difficult to detect. Therefore, it is important for laboratories to have processes to ensure compliance with best practices in specimen collection, handling and transport.

General Considerations for the Preanalytical Phase of Urine Testing

The Clinical and Laboratory Standards Institute (CLSI) recommends the use of appropriate urine collection tubes, leak-proof containers, pipettes and standardized microscope slides with calibrated volumes for analysis of urine sediment. Tubes manufactured using clear plastic and with conical bases are recommended for microscopic analysis of urine sediment.

Consideration should be given as to whether preserved or unpreserved specimens are used. Proliferation of bacteria can be a major preanalytical issue with unpreserved specimens.

If a specimen has been refrigerated for storage or transportation, it should be allowed to equilibrate to room temperature and be well mixed prior to any type of analysis.

Many medications can interfere with testing of analytes in urine; therefore, it may be necessary to discontinue a particular medication for a period of time to enable collection of a ‘drug-free’ specimen.

Two common factors affecting urine dipstick and other testing are color and clarity of the specimen.

Urinalysis Using Urine Dipsticks (manual and automated):

A number of substances can interfere with dipstick tests and the effect of these substances will vary according to the type of test strip used. Commonly performed dipstick tests include: specific gravity (density), pH, protein, blood, nitrite, leukocyte esterase, glucose, ketones, bilirubin, and urobilinogen.

Urinalysis Using Analytical Chemistry Methods

The value of random urine testing for chemistry analytes is limited because of the lack of accumulation of these analytes at any given time in the bladder. Timed specimens provide the most valuable information for the urinary excretion or clearance of specific analytes. It should be noted that one of the most significant sources of preanalytical errors in quantitative urine analysis is the failure to collect ALL urine during the stated collection period.

Many of the preanalytical variables described in this article for urine dipstick testing apply equally to urinalysis conducted using more sophisticated analytical procedures in the laboratory. The following analytes may be associated with specific sources of preanalytical artifact: creatinine, calcium, total protein, microalbumin, uric acid, amylase, 5-hydroxyindoleacetic acid (5-HIAA), catecholamines and metanephrines, drugs of abuse (DOA), amino acids, and organic acids.

Urine Culture and Antibiotic Susceptibility Testing

Preanalytical variables that can affect microbiological culture and antibiotic susceptibility testing include:

- Contaminated collection containers (e.g., bacterial contamination from hands, skin, clothing, leaking specimen containers; contamination with antiseptics from hands, traces of bacteriostatic or bacteriocidal agents in the container).
- Type of specimen. A midstream clean catch specimen is less likely to contain bacterial contaminants than a random urine specimen. Contamination may be defined as more than 10,000 CFU/mL of two or more organisms, but each laboratory should define its own criteria based on the collection and transport methods in use.
- Delays in specimen transportation. Specimens that cannot be transported immediately to the laboratory (or unable to be refrigerated if immediate transport is not possible) or do not have a bacteriostatic preservative may undergo bacterial overgrowth, leading to falsely elevated colony counts.
- Antibiotics. False negative or reduced bacterial growth may be seen in specimens from patients receiving antibiotic medication prior to urine collection.

Resources:

- CLSI. Urinalysis; Approved Guideline – Third Edition. CLSI Document GP16-A3. Wayne, PA: Clinical and Laboratory Standards Institute; 2009.
- Skobe C. Preanalytical variables in urine testing. BD LabNotes 2006;16:1-7.
- Quality improvements in the preanalytical phase: Focus on urine specimen workflow. Stankovic A. Med Lab Obs 2010.