Assisting in the Analysis of Urine
Urinalysis

Why is Urine is analyzed?

• To detect extrinsic conditions—those in which the kidney is functioning normally, but abnormal end-products of metabolism are excreted (as a result of an imbalance in homeostasis).

• To detect intrinsic pathological conditions that involve the kidneys or urinary tract themselves.

• English? To detect what does or does not belong in the kidneys.
Anatomy of the Urinary System

• Two kidneys
• Two ureters
• The urinary bladder
• The urethra.
Physiology of Urine Formation

• Urine is formed through a filtration and reabsorption mechanism in the kidney via the nephrons.
• It is stored in the bladder and voided through the urethra.
Collecting a Urine Specimen

• With sterile containers

• 6 Methods of collection:
  – Random sample (freshly voided urine)
  – First morning specimen
    (These 2 specimens are most concentrated and are best for nitrite, protein, bacterial culture, pregnancy, and microscopic exams).
  – 2-hour postprandial urine specimens (done 2 hours after a meal; used to screen diabetes).
  – 24-hour urine specimen (for quantitative chemical analysis, ie. for hormone levels or creatinine clearance which evaluates glomerular function).
  – Second voided specimen (collected to test for gluclose levels).
  – Clean catch
Clean-Catch Specimen

• Physician suspects a urinary tract infection; orders urine culture for examination of microorganisms

• To remove microorganisms from the urinary meatus the patient is instructed to thoroughly cleanse the area around the meatus and to flush out the distal portion of the urethra

• If a urine culture is ordered the urine is collected by either catheterization or the clean-catch method into a sterile container

• Procedure is found in 52-2 page 1102. (READ!)
Handling and Transporting a Specimen

• Chemical and cellular components of urine change if allowed to stand at room temperature
• Urine specimens should be kept refrigerated and processed within 2 hours of collection
• If specimen is transported to a referral laboratory transfer sample into a BD Vacutainer cherry red/yellow-stoppered tube
  – Sent to laboratory in a plastic biohazard bag that zips closed and contains an outside pocket where the laboratory request is placed
• Culture and sensitivity testing should be performed within 72 hours
  – Must use sterile container
Handling and Transporting a Specimen

Courtesy Becton, Dickinson & Company, Franklin Lakes, NJ.
Urine Specimen Collected at Home

- Do not put anything but urine into the bottle.
- Do not pour out any liquid or powdered preservative from the container.
- If you accidentally spill some of the preservative on yourself, immediately wash with water and call the testing center or designated laboratory.
- Always keep the collection bottle cool. Refrigerate or keep the bottle in an ice-filled cooler or pail.
- Keep the cap on the container.
The Routine Urinalysis

• Physical examination of urine (What to assess):
  – **Appearance**: color and turbidity (dense, thick, cloudy).
  – **Volume**: polyuria, oliguria (scant), anuria
  – **Foam**: small bubbles that persist after shaking
  – **Odor**: changes may be caused by disease, the presence of bacteria, or diet
  – **Specific gravity**: rough measurement of concentration of substances dissolved in urine. What substances should be there or not there, or too much there.
  – Your job is to assess...Not diagnose.
Measuring Specific Gravity

- Urinometer – sealed glass float with a calibrated paper scale in its stem; spun in urine sample; value read at meniscus
- Refractometer – measures refraction of light through solids in a liquid; refractive index is specific gravity (Procedure 52-4 page 1107)
- Reagent strip or a “dipstick” – CLIA-waived test; pad on strip contains a chemical that detects specific gravity in the range of 1.005 to 1.030 (normal values).
Chemical Examination of Urine

• Usually performed with reagent strips – plastic strips to which one or more pads containing chemicals are attached

• Strips available for pH, specific gravity, vitamin C, leukocyte esterase, protein, ketones, glucose, blood, bilirubin, nitrite, urobilinogen, phenylketones, etc.

• Strips are used once then discarded; instructions must be followed exactly to obtain accurate results; color-comparison chart located on label

• To prevent contamination of the bottle, never touch a strip that has been exposed to urine to the color-comparison chart on the container label
Reagent Strips and Analyzer: Procedure 52-5

Fig. 52-9, From Bonewit-West K: *Clinical procedures for medical assistants*, ed 7, St Louis, 2008, Saunders.
9 Chemical Analysis of Urine

So what are MD’s looking for in Urine?

1. pH – degree of acidity or alkalinity of the urine; freshly voided urine has a pH range of 5.5 to 8

2. Glucose – minute quantities normally present in urine not detected; glycosuria occurs when renal tubules cannot reabsorb filtered glucose load; diabetic patients

3. Protein – proteinuria is one of first signs of renal disease

4. Ketones – end-product of fat metabolism

5. Blood – indicates infection or trauma
9 Chemical Analysis of Urine

6. Bilirubin – breakdown of hemoglobin; bilirubinuria is due to liver cell damage or obstruction of common bile duct

7. Urobilinogen – normally present in urine in small amounts; increased amounts with RBC destruction and in liver disease

8. Nitrite – due to bacterial break down of nitrate, a common component of urine; positive test result indicates UTI

9. Leukocyte esterase test – WBCs present with UTI
Microscopic Examination of Urine

- Obtained when a measured portion of urine is centrifuged
- Consists of categorizing and counting cells, casts, crystals, and miscellaneous constituents of the sediment
  - **CASTS** – protein accumulates and precipitates in the kidney tubules; takes on size and shape of tubules
  - Cells – epithelial, RBCs, and WBCs
  - Crystals – clinically significant if present in large numbers
  - Oval fat bodies – found with nephrotic syndrome
  - Yeast – vaginal contamination or urinary infection
  - Parasites – usually a vaginal contaminant
Other Testing on Urine

• **Clinitest**
  – The glucose test on the reagent strip will detect only glucose.

• **Acetest**
  – Reagent tablets provide an alternative to strip testing when the urine must be tested for the presence of ketones. Ketones build up when the body needs to break down fats and fatty acids to use as fuel. This is most likely to occur when the body does not get enough sugar or carbohydrates.

• **Urine pregnancy testing**
  – Detects the presence of human chorionic gonadotropin (hCG) which is a hormone produced only in pregnancy.
Additional Testing

• **Menopause testing**
  – CLIA-waived lateral flow tests detect FSH in the urine.
  – A positive test result indicates that a woman may be in a stage of menopause; a negative test result, along with symptoms of menopause, may indicate a woman is in perimenopause.

• **Bladder tumor-associated antigen testing**
  – Noninvasive and accurate in detecting low-grade bladder cancer.
  – Useful in monitoring for recurring bladder cancer.
  – BTA Stat Test (Bion Diagnostics) is a rapid, single-step immunoassay.

• **Ovulation testing**
  – The principle of this test is similar to that of the pregnancy test.
Urine Toxicology

- Toxicology is the study of poisonous substances and their effects on the body.
- The Instant-View Multi-Drug Screen (Alfa Scientific).
- Drug testing has legal ramifications, and thus it is often necessary to perform additional testing to ensure that samples have not been adulterated.
- Urine samples that test positive for substances should be confirmed by more specific chemical methods, which include gas chromatography (GC), mass spectrometry (MS), and/or enzyme multiplied immunoassay (EMIT).
Alcohol Testing

- Alcohol testing is not performed on urine, but CLIA-waived tests are available to detect alcohol using saliva.
- The saliva alcohol test manufactured by STC Technologies uses a Dacron swab saturated with saliva to detect ethanol.
Patient Education

• Explain collection techniques to the patient.
• Provide the patient with a clearly written instruction sheet.
• Drug testing may require adherence to certain procedures such as remaining in the restroom while the patient provides the sample, checking the sample immediately for its temperature, and ensuring that the patient does not have adulterating materials on his or her person.