MLT-1491: URINALYSIS AND BODY FLUIDS

Cuyahoga Community College

Viewing: MLT-1491 : Urinalysis and Body Fluids

Board of Trustees:
1/30/2025

Academic Term:
Fall 2025

Subject Code
MLT - Medical Laboratory Technology

Course Number:
1491

Title:
Urinalysis and Body Fluids

Catalog Description:
This course explores urinalysis and body fluid analysis, crucial diagnostic tools for patient care. It covers accurately performing and interpreting laboratory tests on urine, CSF, and other body fluids. The physiology of the renal system is covered in-depth so students can correlate urinalysis results with disease states.

Credit Hour(s):
3

Lecture Hour(s):
2

Lab Hour(s):
3

Requisites

Prerequisite and Corequisite
BIO-1500 Principles of Biology I and HTEC-1060 Medical Terminology I; or BIO-2341 Anatomy and Physiology II; and MLT-1001 Introduction to Medical Laboratory Science.

Outcomes

Course Outcome(s):
A. Demonstrate safe and accountable behaviors within the laboratory setting.

Objective(s):
1. Apply knowledge of personal protective equipment (PPE) and Standard Precautions to ensure personal safety and prevent contamination.
2. Operate laboratory equipment safely and correctly to minimize risk and achieve accurate results.
3. Adhere to laboratory safety protocols and procedures to maintain a secure working environment for oneself and others.

Course Outcome(s):
B. Demonstrate ethical and professional behaviors within the laboratory setting.

Objective(s):
1. Document laboratory findings accurately, and with appropriate identifying information.
2. Apply proper procedures for correcting laboratory documentation, ensuring transparency and traceability.
3. Practice clear and concise communication in lecture and laboratory settings.
4. Actively listen to and respectfully address questions, concerns, and feedback from others in the laboratory.

5. Foster a collaborative and inclusive environment by valuing diverse perspectives and contributions.
6. Reflect on personal performance and identify areas for improvement.

Course Outcome(s):

C. Describe the anatomy and physiology of the renal system.

Objective(s):

1. Identify the major anatomical structures of the renal system and describe their functions.
2. Explain the processes of glomerular filtration, tubular reabsorption, and tubular secretion.
3. Define renal threshold.
4. Describe the mechanisms that regulate acid-base balance and maintain the osmotic gradient in the renal medulla.
5. Summarize the role of antidiuretic hormone (ADH) in water reabsorption.
6. Describe the renin-angiotensin-aldosterone system (RAAS) and its role in blood pressure and electrolyte balance.
7. Define terminology related to urine volume.

Course Outcome(s):

D. Discuss proper specimen collection and storage.

Objective(s):

1. State the effects of inappropriate collection and storage on urinalysis and body fluid results.
2. Instruct others in proper urine specimen collection techniques.
3. Describe different types of urine specimens (random, first morning, timed) and their appropriate uses.
4. Evaluate the acceptability of urine specimens based on labeling, volume, collection time, storage conditions, and appearance.

Course Outcome(s):

E. Perform and interpret routine and specialized urinalysis procedures.

Objective(s):

1. Compare and contrast the principle of urinalysis methods including sensitivity, specificity, and sources of error.
2. Perform macroscopic urinalysis, including assessment of color, clarity, and odor.
3. Perform chemical urine analysis using reagent strips and confirmatory tests.
4. State the principles of the tests on the reagent strip and identify potential interfering substances for each.
5. State the principles of confirmatory tests.
6. Correlate physical and chemical results with microscopic findings, recognize discrepancies, and discuss procedures for resolution.
7. Interpret the macroscopic and chemical urinalysis results, correlating findings with clinical significance.
8. Use established terminology to report urinalysis results accurately and clearly.

Course Outcome(s):

F. Discuss laboratory tests to assess renal function.

Objective(s):

1. Describe common renal function tests.
2. Differentiate between the advantages and disadvantages of different renal clearance tests.
3. Explain the principle of creatinine clearance and factors that influence the results.
4. Calculate creatinine clearance and eGFR using appropriate formulas.
5. Interpret renal function test results, considering patient demographics and medical history.

Course Outcome(s):

G. Analyze urinalysis results and correlate them with renal and systemic diseases.

Objective(s):

1. Describe common renal diseases and their pathophysiology.
2. Explain the formation of renal calculi and the factors influencing their formation.
3. List common extrarenal diseases that affect urine composition.
4. Correlate abnormal urinalysis findings with specific renal diseases.
5. Interpret urinalysis results in the context of systemic diseases.
6. Identify and interpret the presence of non-bacterial organisms in urine.
7. Recognize and evaluate discrepancies or contradictory findings in urinalysis results.
8. Utilize critical thinking skills to troubleshoot and resolve discrepancies.
9. Apply renal physiology and pathophysiology knowledge to determine appropriate follow-up testing and treatment recommendations.

Course Outcome(s):

H. Describe the methods used in routine body fluid analyses and correlate results with normal and disease states.

Objective(s):

1. Describe the formation and function of various body fluids.
2. Identify the different elements that can be found in body fluids.
3. Discuss elements found in body fluids and their clinical significance.
4. Interpret body fluid analysis results, correlating findings with clinical conditions and differentiating between transudates and exudates.

Course Outcome(s):

I. Apply principles of quality control and assurance in urinalysis and body fluid testing.

Objective(s):

1. Describe various QC procedures used in urinalysis and body fluid testing.
2. Identify and interpret QC failures and implement appropriate corrective actions.

Methods of Evaluation:

1. Written assignments
2. Group activities
3. Projects
4. Discussions
5. Case studies
6. Skills assessments
7. Lab exercises
8. Quizzes
9. Exams
10. Lab Practicals

Course Content Outline:

1. Safety
   a. Personal protective equipment (PPE)
   b. Standard Precautions
   c. Laboratory equipment
   d. Safety protocols and procedures
2. Professionalism
   a. Ethical conduct
   b. Professional conduct
   c. Accurate documentation
   d. Accurate communication
   e. Collaboration

- f. Inclusivity
- g. Self-reflection
- h. Continuous improvement

3. Renal anatomy
   - a. Kidneys
   - b. Cortex
   - c. Medulla
   - d. Pyramid
   - e. Papilla
   - f. Calyx
     - i. Major
     - ii. Minor
     - iii. Pelvis
   - g. Ureters
   - h. Bladder
   - i. Urethra
     - i. Females
     - ii. Males
   - j. Nephrons
     - i. Bowman's capsule
     - ii. Proximal convoluted tubule
     - iii. Loop of Henle
       1. Descending limb
       2. Ascending limb
     - iv. Distal convoluted tubule
     - v. Collecting tubule/duct
     - vi. Blood circulation
   - k. Glomerulus
     - i. Mesangium
     - ii. Capillary endothelium
     - iii. Basement membrane
     - iv. Podocytes
   - l. Renal tubules
4. Renal physiology
   - a. Glomerular filtration
     - i. Forces
       1. Hydrostatic
       2. Oncotic
     - ii. Barrier
       1. Capillary endothelium
       2. Basement membrane
       3. Podocyte filtration diaphragms
   - b. Tubular reabsorption
   - c. Tubular secretion
   - d. Renal threshold
5. Mechanisms
   - a. Acid-base balance
     - i. Bicarbonate
     - ii. Titratable acids
     - iii. Ammonium ions
   - b. Osmotic gradient maintenance
   - c. Antidiuretic hormone (ADH)
   - d. Renin-angiotensin-aldosterone system (RAAS)
     - i. Blood pressure
     - ii. Electrolyte balance
6. Volume terminology
   - a. Anuria
   - b. Oliguria

c. Polyuria
d. Nocturia

7. Pathophysiology
   a. Glomerular
      i. Nephrotic syndrome
      ii. Acute glomerulonephritis
   b. Tubular
      i. Acute tubular
      ii. Cystinosis
      iii. Cystinuria
      iv. Fanconi Syndrome
   c. Interstitial
      i. Acute pyelonephritis
      ii. Cystitis
   d. Vascular
      i. Renal calculi
         1. Composition
         2. Chemical salts
         3. pH
         4. Stasis
         5. Foreign body seed
8. Extrarenal diseases
   a. Amino acid
      i. Cystinuria
      ii. Cystinosis
      iii. Alkaptonuria
      iv. Phenylketonuria
      v. Maple syrup urine disease
      vi. Tyrosinuria
      vii. Melanuria
   b. Carbohydrate
      i. Diabetes mellitus
      ii. Galactosuria
   c. Metabolic disorders
      i. Diabetes insipidus
      ii. Porphyrin disorders
9. Specimen Collection
   a. Patient instructions
   b. Urine collection
      i. Routine void
      ii. Midstream clean void
      iii. Catheterization
      iv. Supra pubic aspiration
      v. Pediatric collection bags
   c. Types
      i. Random
      ii. First morning void
      iii. Timed
         1. 2-hour
         2. 12-hour
         3. 24-hour
   d. Fluids
      i. CSF
      ii. Pleural
      iii. Peritoneal
      iv. Pericardial
      v. Synovial
      vi. Amniotic

vii. Seminal
viii. Sweat

10. Specimen Storage
    a. Urines
    b. Fluids
        i. CSF
        ii. Pleural
        iii. Peritoneal
        iv. Pericardial
        v. Synovial
        vi. Amniotic
        vii. Seminal
        viii. Sweat
    c. Improper Handling
        i. Effects on results
        ii. Loss of speciality collections
11. Specimen evaluation
    a. Labeling
    b. Volume
    c. Collection time
    d. Storage
    e. Temperature
    f. Light
    g. Preservatives
12. Appearance
13. Contamination
14. Skills
    a. Identify hazards in the lab and take proper action.
    b. Demonstrate proper use of personal protective equipment.
    c. Document test results following laboratory protocol.
    d. Evaluate sources of error in laboratory testing.
    e. Perform chemical analysis of a urine specimen.
    f. Perform microscopic analysis of a urine specimen.
    g. Perform macroscopic analysis of a urine specimen.
    h. Perform microscopic analysis of a body fluid.
    i. Perform confirmatory testing on a urine specimen.
    j. Perform quality control when conducting a urinalysis.
15. Urinalysis Procedures and Interpretation
    a. Specimen
        i. Temperature
        ii. Homogenous
    b. Instruments
        i. Refractometer
        ii. Osmometer
        iii. Microscope
            1. Optimum viewing
                a. Condenser height
                b. Field iris
                c. Condenser aperture
            2. Polarizing filter
        iv. Reagent strip reader
        v. Automation
    c. Macroscopic Urinalysis
        i. Color
            1. Interfering medications
            2. Specimen concentration
        ii. Clarity

1. Effecting substances
2. Clinical significance

iii. Odor

d. Chemical Urinalysis
   i. Tests
      1. Principles
      2. Interfering substances
      3. pH
         a. pH meter
         b. Reagent strip
         c. Indicator papers
      4. Heme moiety
         a. Reagent strip
            i. Blood
            ii. Myoglobin
      5. Leukocyte esterase
         a. Reagent strip
      6. Nitrate
         a. Reagent strip
      7. Protein
         a. Reagent strip
         b. Precipitation
      8. Carbohydrates
         a. Reagent strip
         b. Copper reduction
      9. Ketones
         a. Reagent strip
         b. Nitroprusside tablet
      10. Bilirubin
         a. Reagent strip
         b. Diazo tablet
      11. Urobilinogen
         a. Reagent strip
         b. Azo-coupling reaction
         c. Ehrlich's reaction
      12. Ascorbic acid
         a. Reagent strip
      13. Microalbumin
         a. Reagent strip
      14. Creatinine
         a. Reagent strip
   ii. Confirmatory tests
      1. Copper reduction
      2. Diazo
      3. Nitroprusside
      4. Watson-Schwartz test
      5. Hoesch test

e. Microscopic
   i. Crystals
   ii. Microbes
      1. Bacteria
      2. *Trichomonas spp.*
   iii. Fibers
   iv. Mucous

f. Correlation
   i. Macroscopic vs Chemical vs Microscopic
   ii. Discrepancy recognition
      1. Resolution

16. Urinalysis Results and Disease Correlation

a. Correlation of abnormal findings
    i. Glomerulonephritis
    ii. Pyelonephritis
    iii. Renal failure
    iv. Interpretation in the context of systemic diseases
        1. Diabetes mellitus
        2. Liver disease
        3. Urinary tract infection
    v. Normal flora vs pathogenic organisms
        1. Patient sex
        2. Colony counts

17. Renal function testing
    a. Creatinine clearance
        i. Timing
        ii. Body size
        iii. Body surface area
        iv. Completeness
    b. eGFR
        i. Age
        ii. Muscle mass
        iii. Pregnancy
    c. Cystatin C
18. Body fluid formation and function
    a. CSF
    b. Pleural
    c. Peritoneal
    d. Pericardial
    e. Synovial
    f. Amniotic
    g. Seminal
    h. Sweat
19. Body fluids analysis
    a. Transudate
    b. Exudate
    c. Macroscopic
        i. Color
        ii. Clarity
    d. Microscopic
        i. Stains
        ii. Cells
            1. Red blood cells
                a. Biconcave disc
                b. Ghost
                c. Creanated
                d. Dysmorphic
            2. White blood cells
                a. Typical forms
                b. Degenerative changes
                c. Absorbed fat
            3. Epithelial
                a. Squamous
                    i. Low power
                b. Transitional
                    i. High power
                c. Renal tubular
                    i. High power
                    ii. Collecting duct cells

iii. Convoluted tubular
iv. Absorbed fat
4. Abnormal/atypical cells

iii. Casts
1. Hyaline
2. Waxy
3. Cellular
a. RBC
b. WBC
c. Renal epithelial
d. Mixed cells
4. Inclusions
a. Granules
b. Fat globules
c. Crystals
d. Hemosiderin

iv. Crystals
1. Acidic
2. Neutral
3. Basic
4. Indicative of pathology

v. Microbes
1. Bacteria
2. Yeasts
3. Parasites

vi. Contaminates
1. Starch
2. Fibers
3. Fecal matter

vii. Other
1. Clue cells
2. Fat globules
3. Hemosiderin
4. Mucus
5. Spermatozoa

e. Chemistry
f. Clinically significant and insignificant results
g. Disease correlation

20. Quality Control (QC) and Assurance (QA)
a. Procedures
b. Sources of error
i. Preanalytical
1. Incomplete timed
2. Preservatives
3. Light
4. Misidentification

ii. Analytical
1. Interfering substances
a. Ascorbic acid
b. Bilirubin
c. Medication
d. Deteriorating reagents
e. Instrument malfunction

iii. Postanalytical
1. Transcription errors
2. Data entry errors
3. LIS issues

iv. Corrective actions

Resources

Beck, S.J., & LeGrys, V.A. . (2019) *Clinical Laboratory Education*, McLean:American Society for Clinical Laboratory Science.

Mundt, Lillian and Shanahan, Kristy. *Graff's Textbook of Urinalysis and Body Fluids*. 3rd ed.,. Burlington, MA: Jones & Bartlett Learning, 2016.

Strasinger, Susan King and Di Lorenzo, Marjorie Schaub. *Urinalysis and Body Fluids*. 7th ed. Philadelphia: F. A. Davis, 2021.

Turgeon, Mary Louise. (2023) *Linne & Ringsrud's Clinical Laboratory Science: Concepts, Procedures, and Clinical Applications.*, St. Louis:Mosby/Elsevier.

Young, S. (2014) *Medical Laboratory Science Body of Knowledge*, McLean: American Society for Clinical Laboratory Sciences.

Resources Other

ASCP. July 2023. Medical Laboratory Technician, MLT(ASCP) Examination Content Guideline. 9 Sept. 2024. https://www.ascp.org/content/board-of-certification#

Instructional Services

OAN Number:

Transfer Assurance Guide OHL010

Top of page

Key: 2999