

Virginia Western Community College

MDL 140

Clinical Urinalysis

Prerequisites

Successful completion of BIO 101 or equivalent.

VWCC Course Description

This course provides an in-depth study of urinalysis, focusing on the physical, chemical, and microscopic examination of urine. Students will learn the principles and techniques used to evaluate urine specimens, including macroscopic assessment, reagent strip chemistry, and detailed microscopic analysis of formed elements. Emphasis is placed on correlating laboratory findings with normal physiology and disease states. The course highlights the clinical significance of abnormal results and prepares students to accurately perform, interpret, and troubleshoot urinalysis procedures within the medical laboratory setting.

Semester Credits: 2

Lecture Hours: 1

Laboratory Hours: 3

Required Materials

Textbook

Graff's Textbook of Urinalysis and Body Fluids, 3rd Edition; by Lillian Mundt (Author), Kristy Shanahan (Author). ISBN-13: 978-1284221411

VWCC COURSE OUTCOMES

- Analyze the physiology and pathophysiology of the human renal and urinary systems.
- Describe proper collection and storage procedures for urine samples.
- Explain how to instruct a patient on collection and storage of specimens.
- Perform a complete urinalysis including macroscopic, chemical, and microscopic examinations.
- Correlate supplemental chemical reactions in urine tests to urine dipstick methodology.
- Evaluate the results of a urine dipstick test, considering various brands and types

available.

- Analyze abnormal dipstick results to infer possible clinical conditions, such as the presence of blood cells, hemoglobin, or proteins in urine.
- Differentiate types of cells that can appear in urine, including red and white blood cells and epithelial cells.
- Classify types of renal casts in urine and correlate their appearance to various disease states.
- Detect the presence of bacteria and parasites in urine and identify specific parasite types.
- Distinguish between normal urine artifacts/contaminants and abnormal cells, casts, and parasites.
- Categorize acidic and basic urine crystals and amorphous solids.
- Explain types of automation used in urinalysis and outline protocols for proper instrument quality control.
- Perform set up of and calculate results from manual cell counts for (simulated) body fluids.
- Evaluate cerebrospinal, synovial, and amniotic fluids test results using established knowledge base.

VWCC TOPICAL DESCRIPTIONS

Urinalysis Clinical Laboratory Operations

1. Define compliance and discuss how it relates to urinalysis and body fluid analysis.
2. List four categories of clinical laboratory testing under CLIA '88 and which personnel may perform laboratory tests in these categories.
3. Discuss external accreditations and CLSI standards and their importance in laboratory management and compliance.
4. Describe legal and ethical concerns related to the clinical laboratory.
5. Summarize the scope of and importance of quality assessment.
6. Explain how the components of quality assessment are implemented in the clinical laboratory.

Collection and Preservation of Urine

1. Compare the methods of urine collection.
2. Suggest appropriate urine collection method depending on testing ordered.
3. Compare urine preservation methods.
4. Select appropriate urine collection method depending on testing ordered.
5. Explain what changes occur in unpreserved urine over time.

Urinary System Anatomy and Physiology and Urine Formation

1. List the six major functions of the kidney and urinary system.
2. Sketch the urinary tract, labeling each of the four basic anatomical components.
3. Diagram the kidney and the structures it contains.
4. Identify the main functional unit of the kidney.
5. Identify the structures and components of the nephron.
6. Describe the functions of the glomerulus, the tubule, and the loop of Henle.
7. Describe the process of glomerular filtration and list what is filtered and what is not filtered from blood.
8. Describe what happens to the glomerular ultrafiltrate as it becomes the urine that is excreted.
9. Define renal threshold and countercurrent mechanisms.
10. State the renal threshold range for glucose.
11. Discuss the reabsorption process and what is reabsorbed.
12. Explain the role of the kidney in ion secretion and acid-base balance and identify the roles of hydrogen ions, bicarbonate ions, and ammonium ions in accomplishing this balance.
13. Describe the effect of each of the following and their effect on urine production: a) aldosterone, b) renin, and c) vasopressin.
14. List the major organic and inorganic constituents of urine.
15. List three areas of patient's renal function assessment.

16. Suggest appropriate urine collection method depending on testing ordered.
17. Compare urine preservation methods.
18. Discuss the formula for the classic creatinine clearance and discuss its value.
19. List three factors that can affect classical creatinine clearance testing.
20. Name three method for calculating an estimated glomerular filtration rate (eGFR)
21. List and discuss additional tests to assess kidney function (cystatin C, microalbumin, and β 2-micralbumin)
22. Name tests for assessing tubular secretion functions and renal secretory function.

Safety in the Clinical Laboratory

1. Explain the responsibility of laboratories to develop and publicize safety policies and procedures.
2. Identify and describe six types of safety risks that exist in the clinical laboratory.
3. Identify the components of the chain of infection and give examples of each, describe infection-control procedures used to break the chain, and identify four functions of infectioncontrol programs.
4. Describe proper procedures for hand hygiene and putting on and removing protective clothing.
5. Describe standard and transmissionbased precautions and identify the organizations that developed them.
6. State safety rules to follow when working in the laboratory.
7. List examples of blood-borne pathogens and describe their means of transmission in a healthcare setting.
8. Discuss the major points of the bloodborne pathogens (BBP) standard, and identify key elements of a BBP exposure control plan.
9. Describe hazards, identify warning symbols, list actions to take if incidents occur, and specify rules to follow for proper biological, electrical, fire, radiation, and chemical safety.
10. Comply with standard precautions, proper use of PPE, handling of hazardous materials, and disposal of sharps in the laboratory.
10. Compare chemical labeling symbols.
11. Interpret the meaning of various safety symbols and pictograms

Automation

1. Discuss rationales for using automated systems for urinalysis and body fluids examination.
2. List some available automated systems.

Physical Examination of Urine

1. Explain what is included in physical examination of urine.
2. Identify normal and abnormal urine color and clarity.
3. Suggest causes for urine odor, color, and clarity.
4. Describe the methods for measuring urine concentration.
5. State normal values for urine concentration.

6. Suggest causes for abnormal urine concentration.

Chemical Examination of Urine

1. Describe the principle and procedure, for each chemical test
2. Compare and contrast the reagent strip characteristics among manufacturers.
3. Interpret the results of urine chemistry tests.
4. Define normal expected values.
5. Suggest the causes for abnormal findings.
6. Identify the sources of error.
7. Suggest appropriate confirmatory tests.
8. Correlate results of chemical tests with those of physical examination.
9. Predict findings of microscopic examination for the Confirmatory Urine Tests.
10. Describe the principle and procedure for each chemical test performed.
11. Interpret the results.
12. Suggest appropriate clinical applications.

Microscopic Examination of Urinary Sediment

1. Compare methods of specimen preparation.
2. Describe the procedure for proper microscopic examination and enumeration of urinary sediment.
3. Identify causes for altered appearance and distribution of urinary sediment on the slide.
4. Describe characteristics of urine sediment.
5. Recognize sources of error in identification of urine sediment.
6. Suggest methods to confirm the identification of urine sediment (staining, alternate microscopy, solubility tests).
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Renal Disease

1. Define the following: Glomerulonephritis, nephrosis, glomerulosclerosis, cystitis, and pyelonephritis.
2. Describe and discuss the typical signs and symptoms of kidney stones, the types of stones, and laboratory tests that may be ordered for patients with stones.
3. Categorize the various renal diseases in this as to whether they are glomerular, tubular, interstitial, or vascular in origin.
4. Describe how immunological processes damage the kidneys.

5. Match urinalysis findings with urinary tract and kidney diseases.
6. Differentiate between findings in cystitis and kidney diseases.
7. Differentiate between membranous and membranoproliferative glomerulonephritis.
8. Discuss the course of disease for IgA nephropathy and the associated laboratory findings.
9. Name a urinary finding that is diagnostic of renal tubular damage.
10. Discuss diabetic nephropathy and the development of end-stage renal disease in diabetic patients.
11. Differentiate between diabetic nephropathy, diabetes insipidus, and syndrome of inappropriate antidiuretic hormone.

Urine Screening for Metabolic Disorders

1. Differentiate between findings in cystitis and kidney diseases.
2. Differentiate between membranous and membranoproliferative glomerulonephritis.
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4. Name a urinary finding that is diagnostic of renal tubular damage.
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Introduction to Body Fluids

1. Describe the composition of body fluids
2. Describe the main function of body fluids.
3. Explain the process of fluid accumulation in body cavities.
4. Name the procedure used to collect fluid from each body cavity.
5. List the tests that are normally performed on body fluids.
6. List the causes for abnormal appearance of body fluids.
7. Explain the use of a hemocytometer in performing body fluid cell counts.
8. Correlate diluents that may be used during hemocytometer counts with the fluid for which they most likely would be used.
9. Explain the use of a centrifuge in preparing smears.
10. Suggest techniques to minimize cell destruction during smear preparation

Cerebrospinal Fluid

1. Explain the utility of cerebrospinal fluid analysis in evaluating the central nervous system.
2. Explain the function of cerebrospinal fluid (CSF).
3. Explain the function of the blood-brain barrier.
4. List the indications and contraindications for performing a CSF analysis.
5. Describe the anatomy of the central nervous system.

6. Explain the formation, circulation and reabsorption of CSF.
7. Name and describe the procedure for collection of CSF.
8. Compare and contrast CSF chemistry results in health and disease.
9. List the normal constituents of CSF and their normal levels.
10. Discuss the mechanism for maintenance of normal CSF chemical levels.
11. Suggest tests on CSF to diagnose central nervous system disorders (meningitis, hemorrhage, etc.)
12. Differentiate between uncompromised and compromised CSF results (hemorrhage vs. trauma tap, side effects created by test procedures and interventions)
13. Use chemistry test results to evaluate the integrity of the blood-brain barrier.
14. Identify cells normally present in CSF.
15. Explain the pathophysiology resulting in abnormal cellular constituents in CSF.
16. Suggest appropriate microbiology procedures for the detection of microorganisms in CSF.
17. Explain the use of immunologic procedures in diagnosing central nervous system disorders.
18. Interpret CSF analysis results.
19. Correlate CSF analysis results to possible etiologies for central nervous system disorders.

Serous Fluid

1. Define serous body fluids.
2. List the various serous body fluids and correlate to body cavity from which they are obtained.
3. Explain the formation of effusions.
4. Describe body fluid collection procedures and the risk involved during the procedure.
5. Differentiate between transudates and exudates using laboratory results.
6. Differentiate between chylous and pseudochylous effusions.
7. List causes of various effusions.
8. Select appropriate laboratory tests for the body fluid being tested.
9. Describe the appearance of normal and abnormal body fluids.
10. Compare and contrast the morphology of cells seen in body fluids.
11. Interpret laboratory results in the analysis of body fluids.

Synovial Fluid

1. Define synovial.
2. Describe the formation and function of synovial fluid.
3. Explain the collection and handling of synovial fluid.
4. Describe the appearance of normal and abnormal synovial fluids.
5. Correlate the appearance of synovial fluid and possible cause.
6. Describe tests for synovial fluid analysis.
7. Describe cells seen in synovial fluid.
8. Interpret laboratory tests on synovial fluid.

9. Suggest further testing for synovial fluid, based on preliminary results.
10. Classify joint diseases into their recognized categories.

Semen Analysis

1. Name the organs involved in the production of semen and explain the involvement of each.
2. Explain the process of spermatogenesis.
3. Explain the proper collection and specimen handling of semen samples.
4. Describe procedures for macroscopic and microscopic analysis of semen.
5. Identify normal and abnormal values for tests comprising a routine semen analysis.
6. Correlate results of semen analysis tests.
7. Identify and describe normal and abnormal spermatozoa morphologies.
8. Identify and describe various sperm motilities.
9. Identify and describe the appearance of viable and nonviable spermatozoa.
10. Classify semen using parameters of count, motility, and morphology.
11. Suggest confirmatory tests for suspected infertility.
12. Explain how confirmatory tests for infertility are performed.
13. Interpret confirmatory infertility tests.
14. Discuss the clinical significance of other cells that may be found in semen besides sperm.
15. Describe types of specimens for which sperm detection may be requested.
16. Suggest appropriate laboratory tests to detect the presence of sperm

Amniotic Fluid

1. Describe the production and components of amniotic fluid.
2. Explain the procedure and reasons for performing amniocentesis.
3. Define terminology that is associated with variation in amniotic fluid volume.
4. Discuss how to differentiate amniotic fluid from maternal urine.
5. Describe the testing available for genetic and congenital abnormalities.
6. Explain the disease process of hemolytic disease of the newborn.
7. Summarize testing available to detect hemolytic disease of the newborn.
8. Compare and contrast the amniotic fluid testing available for fetal lung maturity.
9. Discuss the risks for the fetus in preterm delivery and explain assessment of fetal risk using the Liley graph.

Gastric Fluid and Fecal Analysis

1. Describe gastrointestinal tract physiology and fecal formation.
2. Explain mechanisms of diarrhea, including its relationship to reabsorption of intestinal water and hypermotility.
3. Compare disorders of the gastrointestinal tract.
4. Describe collection procedures for gastric fluid and fecal samples.
5. Describe the appearance of normal and abnormal gastric fluid and feces.
6. Describe laboratory testing for gastrointestinal tract disorders: enzymes, fecal carbohydrates, fecal fat, occult blood.

7. Interpret laboratory findings in various gastrointestinal tract disorders.

Vaginal Secretions

1. Explain the procedure collection and handling of vaginal secretion specimens.
2. Discuss the origin of substances present in amniotic fluid used in the diagnosing of rupture of fetal membrane (ROM).
3. Describe tests for detecting amniotic fluid in vaginal secretions.
4. Differentiate among various forms of vaginitis.
5. Describe laboratory tests for detection of atrophic vaginitis, desquamative inflammatory vaginitis, bacterial vaginitis, bacterial vaginosis, trichomoniasis, and candidiasis.
6. Summarize laboratory findings in normal vaginal secretions, atrophic vaginitis, desquamative inflammatory vaginitis, bacterial vaginosis, trichomoniasis, and candidiasis.
7. Recognize sources of error when performing laboratory testing of vaginal secretions.

Miscellaneous Urine and Body Fluids Tests

1. Explain what is detected in a pregnancy test and what may affect test results.
2. Explain the importance of testing urine eosinophils.
3. Describe the collection of bronchial washings and the bronchoalveolar lavage.
4. Describe normal and abnormal findings for tests performed on bronchial specimens.
5. Describe methods for detection and identification of various microorganisms found in bronchial specimens.
6. Describe methods for testing middle ear effusions.
7. Describe the procedure for collection of vitreous fluid.
8. Suggest testing that may be performed on vitreous fluid.
9. Suggest reasons for body fluids may be tested.

[TITLE IX STATEMENT](#)

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