MLT-2472: IMMUNOHEMATOLOGY

Cuyahoga Community College

Viewing: MLT-2472 : Immunohematology

Board of Trustees:
November 2024

Academic Term:
Fall 2025

Subject Code
MLT - Medical Laboratory Technology

Course Number:
2472

Title:
Immunohematology

Catalog Description:
This course explores immunohematology's fundamental principles and practices. Students will delve into the intricacies of antigen-antibody interactions within major blood group systems, acquire proficiency in compatibility testing, and develop an understanding of component therapy. Additionally, the course will address donor selection criteria, transfusion-transmitted diseases, and the diagnostic applications of serological tests in the blood bank setting. Through hands-on laboratory exercises and case study analyses, students will gain essential technical skills and critical thinking abilities vital to transfusion medicine.

Credit Hour(s):
4

Lecture Hour(s):
2

Lab Hour(s):
6

Requisites

Prerequisite and Corequisite
MLT-1001 Introduction to Medical Laboratory Science, and MLT-1352 Problem Solving for the Medical Lab, and MLT-2461 Hematology, and MLT-2490 Immunology and Serology.

Outcomes

Course Outcome(s):
A. Explain donor types, collection, and processing of the donations, including safety measures and quality control procedures.

Objective(s):
1. Assess the suitability of potential donors based on established screening criteria.
2. List the different donor categories and the associated eligibility criteria for each.
3. Recognize, assess, and manage adverse donor reactions.
4. List the criteria for donor deferrals along with the associated time of the deferral.
5. List the tests completed on donor blood to help prevent the spread of infectious diseases.
6. List the anticoagulants and preservative solutions used in the collection and storage of donor units.
7. Describe the required maintenance of donor records.

Course Outcome(s):
B. Describe the principles and procedures for preparing and storing different blood components.

Objective(s):

1. Describe the processes for separating whole blood into components and preparation that may need to be completed on other components.
2. Discuss apheresis techniques in donation collection.
3. Discuss additional preparations of donor units for patients with special transfusion needs.
4. Explain the storage parameters and expiration for each component.
5. Describe the biochemical changes that occur during the storage of components.
6. Explain the principle of pathogen inactivation for platelets and plasma products.
7. List the required information that needs to appear on blood component labels.
8. Describe the required quality control measures of storage equipment used in the Blood Bank.

Course Outcome(s):

C. Discuss the clinical indications for blood component therapy, emphasizing the potential benefits and risks for individual patients.

Objective(s):

1. For each blood component, describe the therapeutic effects on patients.
2. Based on clinical presentation, determine the appropriate blood component therapy.
3. List and explain the steps in a preliminary investigation of a suspected hemolytic reaction.
4. Determine the need for additional testing to identify alloantibodies implicated in hemolytic transfusion reactions.
5. Discuss non-hemolytic post-transfusion reactions that may occur in transfusion patients.

Course Outcome(s):

D. Explain, perform, and interpret blood group serological testing, including special methods.

Objective(s):

1. Evaluate the suitability of specimens for testing, recognizing rejection criteria and potential sources of error.
2. Discuss specific factors that affect serological reactions.
3. Prepare red blood cell suspensions using proper techniques and equipment.
4. Perform, document, and interpret tube and gel blood banking serological tests.
5. Describe the criteria and applications for elution techniques.
6. Select and apply appropriate special testing methods, explaining their principles and interpreting their results.
7. Explain the selection of reagents and cells used in special testing.

Course Outcome(s):

E. Conduct, analyze, and evaluate the antiglobulin test.

Objective(s):

1. Explain the principles of direct and indirect antiglobulin tests.
2. Describe the purpose and use of IgG-sensitized cells.
3. Explain the appropriate controls used in antiglobulin testing.
4. Perform and interpret antiglobulin testing, including using both polyspecific and monospecific antisera.
5. Explain when false-positive and false-negative results may occur and the resolution methods used.
6. Discuss and perform antigen testing.

Course Outcome(s):

F. Describe the characteristics and behavior of blood group antigens and the correlating antibodies.

Objective(s):

1. List the characteristics of red cell antigens and their corresponding antibodies.
2. Identify resources for information on rare, unexpected antibodies.

3. Apply knowledge of blood group antigens to interpret antibody identifications and assess the clinical significance of antibodies in transfusion safety.
4. Explain the effect of complement on hemagglutination reactions.

Course Outcome(s):

G. Discuss performing, interpreting, and labeling in pre-transfusion testing to ensure safe and compatible blood transfusions.

Objective(s):

1. Discuss the needed compatibility testing based on the component and the type of transfusion.
2. Perform and interpret type and screen testing on specimens.
3. List compatible blood product types for each ABO group.
4. Select donor units based on patients' needs for compatibility units.
5. Discuss discrepancies seen in ABO typing and the methods used to resolve them.
6. Perform and interpret routine antibody screening and identifications.
7. Choose, perform, and interpret special reaction techniques for routine antibody identification.
8. Explain the importance of checking patient blood bank testing and transfusion history as part of pretransfusion testing.
9. Prepare donor samples from segments and perform the appropriate crossmatching test.
10. Identify and resolve causes of incompatible crossmatch results.
11. Discuss the proper procedures for releasing compatible units for transfusion and the associated records required.
12. Explain the appropriate labeling of units for patient transfusions.

Course Outcome(s):

H. Explain and apply the principles of the direct antiglobulin test.

Objective(s):

1. Explain the principle and correctly perform a direct antiglobulin test.
2. Describe the use of monospecific antiglobulin sera versus polyspecific serum in selected patient testing.
3. Explain how to investigate patient history and test results for explanation with a positive direct antiglobulin test.
4. Explain the steps taken in prenatal testing and why they occur.
5. Discuss neonatal testing in the blood bank and how it differs from testing on a child or adult.
6. Describe the immune process that causes Hemolytic Disease of the Fetus and Newborn.
7. List antibodies that are implicated in Hemolytic Disease of the Fetus and Newborn.
8. Discuss when to perform prenatal and neonatal testing for Hemolytic Disease of the Fetus and Newborn.
9. Explain the proper characteristics of the blood needed for intrauterine and neonatal exchange transfusion.
10. Discuss the compatibility testing for exchange transfusions for Hemolytic Disease of the Fetus and Newborn.
11. Discuss the testing required postnatally for evaluating the use of RhIg for the prevention of Hemolytic Disease of the Fetus and Newborn.
12. Determine the necessity of RhIG administration and calculate the appropriate dosage.
13. Discuss testing to screen and quantitate fetal-maternal hemorrhages.

Course Outcome(s):

I. Describe HLA antigens' and antibodies genetic origin, biological functions, and clinical significance.

Objective(s):

1. Describe HLA antigens' genetic origin, cell distribution, and biological functions.
2. Discuss the clinical importance of identifying HLA antigens or antibodies in disease association, transplantation, and platelet transfusion.

Course Outcome(s):

J. Describe quality assurance practices in the blood bank laboratory.

Objective(s):

1. Discuss good manufacturing practices within the blood bank.
2. Explain the reason for maintaining standard operating procedures for all procedures.
3. Discuss the importance of process improvement indicators.
4. Explain and perform quality control procedures on reagents and controls.
5. Perform quality control testing and discuss corrective actions.
6. Explain the need to maintain accurate inventory records.
7. Explain the need to record and report all errors and adverse outcomes.
8. Students will be able to identify the major regulatory agencies overseeing blood bank operations.
9. List the length of time that patient and donor unit samples must be held in the lab and explain the reasoning.

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. Blood Donation and Component Preparation
    a. Donor Types and Collection
        i. Allogeneic
        ii. Autologous
        iii. Apheresis
    b. Component Processing and Preparation
        i. Anticoagulants
        ii. Preservatives
        iii. Separation of whole blood
            1. Red blood cells (RBCs)
            2. Plasma
            3. Platelets
        iv. Preparation of special units
            1. Leukocyte-reduced
            2. Washed
            3. Irradiated
            4. Apheresis and fractionation products
    c. Donor Screening
        i. Physical status
        ii. Weight
        iii. Temperature
        iv. Pulse
        v. Blood pressure
        vi. Hemoglobin/hematocrit
        vii. Questionnaire
    d. Donor phlebotomy
        i. Standard
        ii. Adverse
    e. Deferrals criteria
        i. Temporary
        ii. Permanent
    f. Infectious Disease Testing

i. Hepatitis Band C
ii. West Nile Virus
iii. Babesia
iv. Chagas
v. Syphilis
vi. HIV 1,2
vii. HTLV 1,2
viii. CMV

g. Donor Records
i. Accurate records
ii. Procedures

2. Blood Component Storage and Quality Control
a. Component Storage
i. Whole blood
ii. Packed RBCs
iii. Plasma
iv. Platelets
v. Cryoprecipitate
vi. Special consideration
vii. Rare blood groups
viii. Phenotyping
ix. Irradiated units

b. Storage Parameters and Expiration
i. Temperature
ii. Agitation
iii. Transportation conditions
iv. Shelf life

c. Biochemical changes
i. Blood
1. Changes in 2,3-DPG
2. Hemoglobin-oxygen dissociation

ii. Platelets
1. Platelet storage lesion
2. Metabolic changes

d. Pathogen Inactivation
i. Principles
ii. Effectiveness
iii. Labeling

e. Quality Control (QC) of Storage Equipment
i. Routine QC
ii. Backup QC
iii. Documentation
iv. Troubleshooting

3. Blood Transfusion Therapy and Reactions
a. Clinical Indications
b. Therapeutic Effects
c. Adverse Transfusion Reactions
i. Hemolytic
ii. Nonhemolytic
iii. Symptoms
iv. Investigation
v. Management

4. Blood Group Serological Testing
a. Pre-Analytical
i. Specimen acceptance
ii. Rejection criteria
iii. Common sources of error

b. RBC suspensions

        i. Preparation
            1. 3%
            2. .08%
        ii. QC
    c. Tube methodology
    d. Gel methodology
    e. Special Serological Techniques
        i. Elution
        ii. Neutralization
        iii. Warm
    f. Selection of RBC reagents
5. Antiglobulin Testing
    a. Principles
        i. Direct antiglobulin test
        ii. Indirect antiglobulin test
    b. Procedure
        i. Reagents
            1. IgG-sensitized cells
            2. Polyspecific antisera
            3. Monospecific antisera
        ii. QC
    c. Interpretation
        i. Results
        ii. False-positive
        iii. False-negative
        iv. Invalid
6. Blood group antigens and antibodies
    a. Common blood group antigens
        i. ABO
        ii. Rh
        iii. Kell
        iv. Duffy
        v. Kidd
        vi. MNS
        vii. P1PK
        viii. Lewis
        ix. Lutheran
    b. Uncommon blood group antigens
        i. High prevalence antigens
        ii. Low prevalence antigens
        iii. Platelet-specific antigens
    c. Antibodies
        i. Characteristics
            1. Avidity
            2. Immunoglobulin class
            3. Phase of reactivity
            4. Patient age
            5. Specimen age
            6. Disease
            7. Treatments
            8. Clinical significance of antibodies
        ii. Rare and unexpected antibodies
        iii. Antibody identification
            1. Antigrams
            2. 3+3 rule
            3. 95% confidence level
        iv. Hemagglutination Reactions
            1. Principle
            2. Influencing factors

3. False-positive
4. False-negative
5. Variables

7. Pre-Transfusion Testing
   a. ABORh Type
      i. Procedures
      ii. Interpretation
   b. Antibody Screen
      i. Procedures
      ii. Interpretation
   c. Compatibility Selection & Testing
      i. Compatible blood products
         1. Criteria
         2. Selection
      ii. Crossmatch testing
         1. Test selection
            a. Electronic
            b. Immediate spin
            c. AHG
            d. Special techniques
   d. Discrepancies
      i. Common ABO
      ii. Incompatible crossmatches
   e. Releasing blood products
      i. Procedures
      ii. Documentation
      iii. Records
   f. Transfusion unit labeling
      i. Patient identifiers
      ii. Component
      iii. Type
      iv. Special handling
      v. Test results
8. Hemolytic Disease of the Fetus and Newborn (HDFN)
   a. Blood bank testing
      i. Indications
      ii. Prenatal specimen
      iii. Neonatal specimen
   b. Antibody-Antigen complex mechanism
   c. Antibodies commonly associated with HDFN
   d. Exchange Transfusions
      i. Intrauterine product requirement
      ii. Neonatal product requirement
      iii. Compatibility tests
   e. Rh Immune Globulin (RhIG)
      i. Principle
      ii. Mechanism of action
      iii. RhIG dosage and administration
   f. Fetal-Maternal Hemorrhage
      i. Rosette test
      ii. Kleihauer-Betke test
      iii. Rh-negative mothers
9. Human Leukocyte Antigens (HLA)
   a. Genetic origin
   b. Cell distribution
   c. Functions
   d. Clinical Significance

i. Disease association
ii. Transplantation
iii. Platelet transfusion

10. Quality Assurance in the Blood Bank
    a. Quality Control
    b. Procedures
    c. Reagents
    d. Equipment
    e. Competencies
    f. Good Manufacturing Practices (GMPs)
    g. Standard Operating Procedures (SOPs)
    h. Process Improvements
    i. Documentation and record keeping
    j. Regulatory agencies

Resources

Cohn, C. S., Delaney, M., Johnson, S. T., & Katz, L. M. *Technical manual*. 20th ed. Bethesda, MD: AABB, 2020.

Harmening, D. M. *Modern Blood Banking & Transfusion Practices*. 7th ed. Philadephia,PA:F.A. Davis, 2019.

Johns, G., Zundel, W., Gockel-Blessing, E., & Denesiuk. *Clinical Laboratory Blood Banking and Transfusion Medicine Practices*. 2nd ed. London:Pearson, 2023.

Polancic, J & Riding, K. *Entry Level Curriculum for Medical Laboratory Technician (MLT)*. McLean: The American Society for Clinical Laboratory Sciences, 2016.

Turgeon, M. L. *Clinical Laboratory Science: Concepts, procedures, and clinical applications*. 9th ed. St. Louis, MO: Elsevier, 2022.

Resources Other

ASCP. July 2023.Medical Laboratory Technician, MLT(ASCP) Examination Content Guideline.

Top of page
Key: 5265