MLT-2471: IMMUNOHEMATOLOGY & SEROLOGY

Cuyahoga Community College

Viewing: MLT-2471 : Immunohematology & Serology

Board of Trustees:
2013-06-27

Academic Term:
2013-08-26

Subject Code
MLT - Medical Laboratory Technology

Course Number:
2471

Title:
Immunohematology & Serology

Catalog Description:
Study of immunohematologic (blood banking), immunologic and serologic principles and the application of testing procedures. Antigen-antibody reactions for ABO antigens, Rh (Rhesus) and other major blood group systems, compatibility testing, component therapy and production, acceptable donor criteria, transfusion transmitted diseases, diagnostic uses of serological tests. Performance of associated laboratory tests. Analysis of case studies, problem solving and clinical significance of results in diagnosis.

Credit Hour(s):
5

Lecture Hour(s):
3

Lab Hour(s):
6

Requisites

Prerequisite and Corequisite
MLT-2501 Clinical Chemistry.

Outcomes

Course Outcome(s):
A. Relate the mechanisms that protect the body from disease or injury and explain the function of each.

Objective(s):
1. 1. Explain the difference between active and passive immunity (natural resistance and acquired immunity.)
2. 2. Describe the differences between cell mediated and antibody mediated immunity.
3. 3. Evaluate the roles of lymphocytes and phagocytic cells in cellular immunity.
4. 4. Compare the role of B cells vs T cells in acquired immunity.
5. 5. List the four key events of the inflammatory response.
6. 6. Describe the effects of an immunization on the body.

Course Outcome(s):
R. Summarize the criteria for the selection and screening of blood donors.

Objective(s):
1. 1. Relate the importance of providing educational material to prospective donors.
2. 3. Discuss indications for transfusion and expected results for commonly used blood components.
3. 1.Compare the advantages and disadvantages of each blood component chosen.
4. 1.Document the time and conditions observed when blood components are maintained out of the lab.
5. 1.Determine suitability for reissue of blood components.
6. 1.Explain why records of transfusion reactions have to be maintained over the past 5 years.

Course Outcome(s):

5. List tests routinely performed on all donor bloods identifying results that would defer the blood from use in a transfusion.

Course Outcome(s):

S. Perform antibody screens and correctly interpret antibody screens by analyzing simulated patient and/or donor history, i.e. case studies.

Course Outcome(s):

T. Summarize the collection, preparation, acceptable anticoagulants, storage requirements, time restrictions, effects of storage and use of blood components.

Course Outcome(s):

U. Discuss regulation and accreditation of blood and transfusion centers.

Objective(s):

1. 1.List all the agencies involved in the regulation, monitoring and accreditation of blood and transfusion centers.
2. 1.Identify regulatory agencies involved in the safety of health care workers.
3. 1.Compare and contrast the regulating and accrediting agencies of blood and transfusion centers.

Course Outcome(s):

D. Explain the importance of the major histocompatibility complex (MHC) in transplant/transfusion.

Course Outcome(s):

V. Describe the role of quality control, quality assurance and continuous quality improvement in a blood center or transfusion service.

Objective(s):

1. 1.List procedures used in the laboratory to assure good quality testing.
2. 1.Differentiate between quality assurance, quality control and continuous quality improvement.
3. 1.Perform and interpret quality control procedures applicable to assays, screens, tests and procedures performed in the laboratory.
4. Distinguish correct vs. incorrect results based on appropriate control.
5. 1.Define appropriate documentation practices used in the clinical laboratory.
6. 1.List retention times for documents according to Food and Drug Administration (FDA) and America Association of Blood Banks Guidelines (AABB)
7. Utilize Current Good Manufacturing Practices (GMP) in the correction of clerical errors as indicated in the AABB Guidelines.
8. 7. Utilize Current Good Manufacturing Practices (GMP) in the correction of clerical errors as indicated in the AABB Guidelines.
9. 8. Discuss reporting of FDA Blood Product Deviations and the how the use of auditing is helpful in the Blood bank.

Course Outcome(s):

E. Compare and contrast the serological principles of precipitation and agglutination including hemagglutination and latex agglutination.

Course Outcome(s):

F. Differentiate the methods of immunofluorescence, immunodiffusion, neutralization and complement fixation.

Course Outcome(s):

G. Perform immunological assays used in the Blood Bank and Serology Laboratories.

Course Outcome(s):

H. Differentiate various antigens and antibodies in selected clinical procedures and discuss the assay's clinical significance.

Objective(s):

1. 1. Discuss the principles of the methods used for the detection of antigen and antibodies.
2. 2. Perform procedures employing antigens and antibodies in the detection of disease following protocol as specified by the instructor.
3. 3. Interpret and discuss the clinical significance of the diagnostic test results obtained through diagnostic testing or upon case study review.
4. 4. Define titer and correctly make a serial dilution employing proper pipetting techniques.

Course Outcome(s):

K. List the etiologic agent for other diseases potentially transmitted by transfusion including but not limited to malaria, West Nile Virus, HIV and Human T Lymphotropic Virus.

Course Outcome(s):

L. Compare and contrast the mode of inheritance of the major blood groups and methods of identification recognizing discrepancies.

Objective(s):

1. 1. Discuss complement binding in red cell antigens/antibodies.
2. 2. Illustrate by diagram the methods of ABO grouping (cell and serum).
3. 3. State specific characteristics of the antibodies that define the system and the reason for the use of each specific reagent.
4. 4. Perform and interpret ABO blood typing by tube, gel and solid phase.
5. 5. List by priority the blood types compatible with each ABO group.
6. 6. Recognize patient ABO discrepancies.
7. 7. Analyze patient history and diagnosis to resolve ABO discrepancies.
8. 8. Compare and contrast the inheritance and antigen frequency of major blood groups, secretor blood group substances and major antigens as related to different cultures.

Course Outcome(s):

M. Compare and contrast the basis of Rhesis (Rh) Blood Group nomenclature including tests used for Rh detection and identification.

Objective(s):

1. 1. Compare and contrast Fisher-Race, Wiener and Rosenfield nomenclature.
2. 2. Examine the most probable genotypes.
3. 3. Explain the test principles employed in the detection and identification of antigens and antibodies of the Rh/Hr Blood group system.
4. 4. Compare the interpretation of Rh with saline reagent vs protein reagent in tube.
5. 5. Perform weak D testing when appropriate and correctly interpret results.
6. 6. Apply properties of antibodies to determine the presence of expected antibodies.
7. 7. Apply properties of antibody production to a primary or secondary response.

Course Outcome(s):

N. Summarize the principle of the test procedures, compare and contrast procedures, and state the clinical significance of the antiglobulin tests (direct and indirect).

Objective(s):

1. 1. Differentiate between a direct Coomb's test performed on an infant versus an adult.
2. 2. Identify autoimmune hemolytic anemia by recognizing and confirming serological results which may suggest the presence of autoimmune hemolytic disease.
3. 3. Discuss mechanisms which may be responsible for a drug-induced positive direct anti-globulin test.
4. 4. Name one drug specific for each drug-induced positive antiglobulin test mechanism.
5. 5. Discuss, evaluate and confirm techniques used if clinically significant allo-antibodies are present in a serum containing an auto antibody and/or the cause of a positive direct-antiglobulin test.
6. 6. Explain the use of IgG sensitized cells as a control for the Anti-human Globulin (AHG) test.
7. 7. Describe conditions requiring the use of Polyspecific or Monospecific AHG.
8. 8. Perform and correctly interpret the direct antiglobulin test given a blood sample.
9. 9. Determine if a sample contains antibody from an in vitro or in vivo source.
10. 10. Detect antibodies by interpreting results from tube, gel and solid phase procedures.
11. 11. Use and interpret controls in tube, gel and solid phase procedures.
12. 12. Summarize the effects of the presence of warm autoimmune hemolytic anemia and cold hemagglutinin disease on laboratory tests.

Course Outcome(s):

O. Explain the principle, discuss the significance and perform the procedure(s) used in antibody and antigen identification for blood transfusion.

Objective(s):

1. 1. Compare and contrast the serologic and immunologic characteristics of antibodies in the ABO, Rh, Lewis, P1 I, Kell, Duffy, Kidd, MNSs, Lutheran and Xg blood group systems.
2. 2. Establish a probability value when proving the presence of an antibody.
3. 3. Describe the properties and clinical significance of different classes of immunoglobulins.
4. 4. Apply the properties of antibodies to perform antibody identification (multiple).
5. 5. Discuss the effects of complement on antibody expression.
6. 6. Discuss the effects of zygosity (dosage) on antibody detection.
7. 7. Discus the clinical significance of individual antibodies.
8. 8. Describe the process of antibody identification of antibody identification at different temperatures.
9. 9. Describe antibody identification with different enhancements.
10. 10. Interpret antibody screens by applying properties of red cell antigens.
11. 11. Compare the effect of different conditions (temp, potentiators etc.) on red cells.
12. 12. Identify antibodies by evaluating and interpreting panel results.
13. 13. Identify the most commonly encountered antibody.
14. 14. Identify the most commonly occurring atypical antibody.
15. 15. Verify antibody screening and identification by phenotyping patient cells.
16. 16. Type for antigens using weakly positive control cells on a blood sample.
17. 17. Summarize tests routinely used to identify antigens and antibodies.
18. 18. Determine the need for compatibility testing.
19. 19. Recognize compatibility problems based on antibody ID.
20. 20. Describe and perform the immediate spin cross match to detect ABO incompatibility.
21. 21. Describe the use of a full AHG cross match.
22. 22. List the data needed for a computer cross match.
23. 23. State the retention time of patient and donor samples.
24. 24. Select blood for cross match antigen negative for patients' significant antibodies.
25. 25. Describe labels and tags on donor unit for compatible, incompatible, and emergency uncrossmatched transfusions.
26. 26. Confirm patient ID, check ABO, Rh of patient unit, document time of issue for transfusion.

Course Outcome(s):

B. List common immunoglobulins and describe their structure with regards to regions/fragments and polypeptide chains.

Course Outcome(s):

P. Discuss common causes of transfusion reactions encountered in the laboratory.

Objective(s):

1. 1. Compare and contrast immune, non-immune, immediate and delayed transfusion reactions.
2. 2. List the symptoms of transfusion reactions.
3. 3. Identify the leading cause of transfusion related fatalities.
4. 4. Discuss the non-hemolytic adverse reactions to transfusion including febrile reactions, disease transmission, circulatory overload and others.
5. 5. Identify laboratory procedures used and analyze results from a transfusion reaction.

Course Outcome(s):

C. Discuss the features of antigens that determine immunogenicity.

Objective(s):

1. 1. Define alloantigens, autoantigens and heterophile antigens.
2. 2. Define haplotype, genotype, codominant alleles.
3. 3. Compare IgM vs IgG.

Course Outcome(s):

Q. Compare and contrast the mechanisms of sensitization in both Rh and ABO hemolytic disease of the newborn (HDN) and the effects of the antigen-antibody complex on the fetus.

Objective(s):

1. 1. Describe the immune process causing HDN.
2. 2. List the common antibodies responsible for HDN.

3. 3. Interpret a Type Screen on a prenatal sample.
4. 4. ID and titer the antibody in a maternal sample.
5. 5. Describe ABO/Rh and DAT for neonatal testing.
6. 6. Describe antibody ID and elution for neonatal testing.
7. 7. Determine the necessity for Rhogam to prevent HDN.
8. 8. Check patient history for antenatal Rhogam.
9. 9. Interpret ABO/Rh antibody screen on a prenatal and maternal sample.
10. 10. Identify and titer antibody.
11. 11. Interpret Rh and weak D tests on maternal and newborn samples.
12. 12. Evaluate the need for Rhogam based on the Rosette test.
13. 13. Explain the indications for use of Rh immunoglobulin.
14. 14. Select the appropriate blood type and components for transfusion to the fetus/new born.
15. 15. Calculate the correct dosage of Rh immunoglobulin in classroom case studies.
16. 16. Evaluate routine prenatal and postnatal laboratory investigation of HDN.

Methods of Evaluation:

1. Discussion Boards
2. Homework assignments
3. Case studies
4. Exams
5. Quizzes
6. Mid-term exam
7. Final exam
8. Lab practical exams
9. Individual projects
10. Participation

Course Content Outline:

A. Immunity
B. Common Immunoglobulins
 1. Structure
 2. Immunogenicity
C. Antigens and immunogenicity
D. Major Histocompatibility Complex Theory
E. Serological Principles
 1. Agglutination
 2. Precipitation
 3. Hemagglutination
F. Immunological Methods
 1. Immunofluorescence
 2. Immunodiffusion
 3. Neutralization
 4. Complement Fixation
G. Assays used in the Blood Bank and Serology Laboratories
 1. Agglutination
 2. Precipitation
 3. Hemagglutination
 4. Immunofluorescence
 5. Immunodiffusion
 6. Neutralization
 7. Complement Fixation
H. Applications of Serological testing in antigen and antibody ID
 1. Anti-streptolysin O
 2. Infectious mononucleosis
 3. C-reactive protein

4. Human Chorionic Gonadotropin (HCG)
5. Rheumatoid factor
6. Rapid Plasma Reagin (RPR)
7. Cold agglutinins.

I. Common Diseases of the human blood system
1. Classic autoimmune diseases.
2. Autoimmune hemolytic anemia.
3. Graves' disease.
4. Rheumatoid arthritis.
5. Systemic lupus erythematosus.
6. Syphilis.
7. Other bacterial diseases.
8. Hepatitis A, B, C, D, and E
9. Epstein Barr Virus (EBV).
10. Human Immunodeficiency Virus (HIV).
11. Other viral diseases.

J. Transmission, progression, general treatment and mechanism of prevention for diseases of the human blood system as listed in I 1-11.

K. Agents of transmission in other transfusion related diseases

L. Blood groups
1. Inheritance
2. Identification

M. Rh/Hr blood group system detection and identification.
1. Nomenclature
2. Genotypes
3. Principles of test
4. Interpretation of results

N. Principles and Procedures of the Antiglobulin test
1. Direct and indirect
2. Identification of autoimmune hemolytic anemia
3. Cells, reagents, controls and conditions of use
4. Performance and interpretation of test results
5. Clinical significance and course of action

O. Principles and Procedures for blood transfusions
1. Serologic and immunologic characteristics of blood group systems
2. Probability value for presence an antibody
3. Properties and clinical significance of different immunoglobulins classes
4. Properties of antibodies in the interpretation of test results
5. Properties of red cell antigens in the interpretation of antibody screens

a. Specificity
b. Immunogenicity
c. Zygosity (dosage)
d. Safety of components
e. Primary or secondary response
f. Form of stimulation
g. Expected vs. unexpected antibodies
h. Phase of reactivity (in vivo/in vitro)
i. Immunoglobulin class
j. Effects of complement
k. Effects of disease

6. Effect of different conditions (temp, potentiators etc.) on red cells
7. Antibody identification from panel results

8. Compatibility testing
    a. Recognition of compatibility problems
    b. Immediate spin crossmatch
    c. Full AHG crossmatch
    d. Computer crossmatch
    e. Based on results of the type of screening tests
  f. Using emergency transfusion protocol
  g. In a neotnatal transfusion
9. Retention time for patient and donor samples
10. Selection of blood for transfusion based on crossmatch
11. Labeling of donor unit
12. Patient ID and transfusion documentation protocol

P. Transfusion Reactions and Investigation
1. Type and symptoms of transfusion reaction
2. Description of adverse transfusion reactions
3. Analysis of blood to confirm a transfusion reaction
4. Interpretation of DAT in transfusion workup

Q. Hemolytic Disease of the Newborn
1. Factors causing HDN
2. Evaluation of prenatal sample
4. Analysis of a maternal sample
5. ABO/Rh and DAT for neonatal testing
6. Antibody ID and elution for neonatal testing
7. Use of Rhogam in HDN
8. Patient history for antenatal Rhogam
9. Blood type and components for transfusion to the fetus/newborn
10. Dosage calculation for Rh immunoglobulin
11. Prenatal and postnatal laboratory investigation of HDN

R. Donor requirements, screening and testing
1. Educational material
2. Uniform Donor Health Questionnaire
3. Autologus and directed donations
4. Donor reactions and the correct course of action
5. Test routinely performed on all donor bloods
6. Results that defer blood from use in a transfusion

S. Case studies
1. Antiglobuilin test
2. Atypical antibodies
3. Phenotype of patient"s cells
4. Identification of antibody in recipient"s sample
5. ABO/Rh discrepencies
6. Compatibility problems

T. Blood components and pheresis
1. Transfusion products
2. Donor selection
3. Collection, preparation and storage
4. Indications for component therapy
5. Documentation

U. Regulating and Accrediting Bodies
1. Agencies involved in the regulation, monitoring and accreditation of blood banks and transfusion centers

V. Quality assurance

1. Quality assurance
2. Quality control
3. Continuous quality improvement
4. Documentation

Resources

Turgeon, Mary Louise. *Immunology and Serology in Laboratory Medicine.* 4th ed. St. Louis, MO: Mosby, 2009.

Quinley, Eva. *Immunohematology Principles and Practice.* 3rd ed. Philadelphia, PA: LWW, 2011.

Essridge, Barbara and Reynolds, Anna. *Basic Clinical Laboratory Techniques.* 5th ed. Albany, NY: Delmar, 2008.

Harmening, Denise. *Modern Blood Banking and Transfusion Practice.* 5th ed. Philadelphia, PA: F.A. Davis, 2005.

Stevens, Christine. *Clinical Immunology and Serology.* 3rd ed. Baltimore, MD: F.A. Davis, 2009.

"MLO Articles" various.

"Advance Articles" various.

ASCLS. "Clinical Laboratory Science" various.

ASCP. "Laboratory Medicine" various.

Top of page
Key: 3008