BLOOD BANK CORE ROTATION

Introduction
The core rotation in blood banking is designed to expose the resident to a wide range of transfusion medicine and coagulation problems and provide training in solving these problems. The objectives of this rotation are:

1. To permit the resident to attain expertise in the methodological, diagnostic and scientific aspects of transfusion medicine and coagulation.

2. To permit the resident to integrate the diagnostic test results, and arrive at the proper diagnostic conclusions necessary for diagnosis and treatment of transfusion medicine and coagulation problems.

3. To permit the resident to develop the professional and managerial skills necessary to function as a pathologist with transfusion medicine responsibilities including, investigative, therapeutic and administrative roles.

4. The resident should become familiar with methods of quality control and quality assurance relevant to blood banking and should be aware of the FDA, AABB, and JACHO regulatory environment of the blood bank.

Guidelines for the Blood Bank Core Rotation

1. Education Goals

The resident will be expected to demonstrate acceptable progress in the following areas by the end of the initial 3 month rotation:

a. Obtain a clinical history, perform a physical examination and develop an assessment and plan of therapy for patients requiring therapeutic apheresis procedures.

b. Obtain a clinical history, perform a physical examination and develop an assessment for patients with coagulation disorders and develop a plan for therapy which can include blood components, blood derivatives and drugs.

c. Integrate the diagnostic test results of patients with platelet refractoriness and make an interpretation with a plan for platelet therapy which will give the greatest platelet increment.

d. Integrate the diagnostic test results of patients with immunohematology problems and develop a plan to further identify the antibody present and recommend the blood that would be needed for transfusion.

e. Analyze the clinical and immunohematologic aspects of transfusion reactions and develop a plan for management and prevention of further transfusion reactions.

f. Be familiar with the blood bank procedures which may require a deviation from standard procedure in emergency situations such as emergency release of uncrossmatched group 0 negative red blood cells for a trauma patient.

g. Inform the requesting clinician of the immunohematologic or coagulation diagnosis in an appropriate concise manner, and suggest follow-up diagnostic tests if necessary.

2. Responsibilities

The Blood Bank resident is expected to attempt to problem solve all therapeutic apheresis, immunohematology, coagulation and blood component therapy problems on the blood bank core rotation in a timely fashion. The resident is expected to develop an assessment and plan for these problems and discuss these with the senior pathology resident on the blood bank senior rotation and with the guidance, positive feedback and training provided by the transfusion medicine service attending.
The resident shall:

a. fill out the blood bank morning report form and be prepared to discuss problems in CP Morning Report.

b. review blood and component inventory; and note actual or impending shortages and heavy users. The resident shall allocate blood components during periods of shortage.

c. compare the type and screen orders for surgery patients with the prescribed action on the MSBOS schedule. If a disparity exists the resident will call for a type and screen specimen.

d. evaluate patient and consult with physician on treatment of patients requiring massive transfusion.

e. evaluate patient and consult with physician on appropriate tests and components for patient with coagulation disorders and develop a plan for blood component therapy or drug therapy.

f. evaluate patients with signs, symptoms, and or laboratory results suggestive of transfusion reaction. Order appropriate follow-up tests as needed. Consults with patient's physician on clinical intervention and treatment.

g. evaluate patients for autologous blood collections.

h. evaluate patient for therapeutic phlebotomy.

i. evaluate patients for appropriateness of apheresis procedures. Order necessary tests, record procedure in progress notes, order necessary replacement fluids and components, necessary pharmaceutical therapy, and direct treatment of reactions.

j. evaluate donor reactions. Direct necessary therapy.

k. evaluate clinical requests for all special components, such as whole blood, fresh blood, greater than 4 units of FFP, more than one dose of platelets (greater than 6 random donor units or one apheresis unit), and requests for coagulation factor concentrates.

l. review blood product release log and component audit log. Initiate component audit process. Know UAMS transfusion criteria to assure blood bank compliance with these standards.

m. review recipient serology, including antibody work-ups, DAT studies, fetal-maternal studies daily; assist the blood bank attending physician in necessary follow-up.

n. consult on antibody and crossmatch problems.

o. consult on use of uncrossmatched and emergency release components.

p. coordinate with VAMC transfusion service on component or blood needs.

q. communicate with weekend apheresis on-call supervisor as to scheduling of any special procedures or urgent patient cases.

r. coordinate specialized coagulation testing with the UAMS lab or special coagulation lab at the VAMC as needed.

3. Training Schedule
The resident is expected to adhere to the daily schedule:

**Blood Bank Rounds** (07:45 to 08:00 Monday through Friday). The resident on service will fill out the Blood Bank Morning Report form after talking to the blood bank technical supervisors and the transfusion medicine service attending in the transfusion service.
Clinical Laboratory Morning Report (On Monday, Wednesday and Friday at 08:30 in the UAMS Clinical Laboratory Library, on Tuesday at 08:30 in the VAMC Pathology conference room and on Thursday at 08:00 in the VAMC Pathology Conference Room).

The resident presents the Blood Bank Morning Report form which contains the following sections of information:
1) blood components issued,
2) blood components in inventory,
3) large users of blood products with corresponding coagulation lab results,
4) infectious disease positive autologous blood,
5) Maximal Surgical Blood Ordering Schedule (MSBOS) disparities,
6) RBC antibodies or problems,
7) transfusion reactions,
8) deviations from standard procedure,
9) platelet antibodies or problems,
10) therapeutic phlebotomies,
11) therapeutic apheresis procedures,
12) coagulation consults,
13) intraoperative cell saving procedures, and
14) other procedures or problems. During the Clinical Laboratory Morning Report all Clinical Pathology Attendings review the day's work and give guidance in the treatment of the patients on the transfusion medicine service.

Operations Meeting (09:30 to 10:00 Monday through Friday). The transfusion medicine service attending along with the blood bank clinical manager, quality assurance officer, chief technologist, technical supervisor, training and compliance officer and therapeutic apheresis nurse discuss the operational problems of the day. The residents are encouraged to participate in the meeting to gain administrative, regulatory (FDA, AABB and JACHO) and operational skills.

Rotation Lecture (11:00 to 12:00 Monday through Friday). The rotation lectures are divided over the 12 weeks and are one hour lectures given in a small group discussion format. The resident is given an opportunity to have any questions answered. At this time, the pending consults and therapeutic apheresis procedures for the day are discussed.

Noon Conference (12:00-13:00 Monday through Friday). Their is either a pathology or internal medicine conference daily that the resident is encouraged to go to. On the 1st and 3rd Tuesdays of every month their is a Transfusion Medicine Conference where one chapter of a transfusion medicine textbook is read by the resident in advance, discussed by the transfusion medicine service attending, and the residents are given an opportunity to have their questions answered on this subject or other subjects in transfusion medicine.

Afternoon Session (13:00 to 16:00 Monday through Friday). During the afternoon session, the resident, depending on rotation month (1st, 2nd or 3rd) will be spending the time
1) performing immunohematology transfusion service benchwork,
2) participating in training at the American Red Cross Donor Center,
3) participating in training by the VAMC specialized coagulation lab or
4) performing clinical work on the transfusion medicine service.

Transfer of Duties to Pathology On-Call Resident (16:00 to 16:30) The blood bank resident will finish up on any left over tasks and report back to the transfusion medicine service attending. If their is a continuing patient care problem the blood bank resident will notify the pathology on-call resident of the continuing problem. On Friday there is an afternoon checkout in the clinical laboratory library at 16:15.
Training Objectives

The blood bank core rotation consists of three months. The training during the 3 months (12 weeks) consists of:

1) rotation lectures,
2) discussion of board type questions in transfusion medicine and coagulation,
3) immunohematology benchwork,
4) donor center experience, and
5) coagulation laboratory benchwork. The rotation lectures are divided over the 12 weeks and are one hour lectures given in a small group discussion format.

The board type questions in transfusion medicine and coagulation are discussed to ascertain the understanding of the material by the resident so that any areas of misunderstanding can be explained. The immunohematology benchwork consists of one week of afternoon sessions during the first month of the blood bank core rotation. The American Red Cross donor center experience consists of three weeks of afternoon sessions on Monday, Tuesday, Wednesday and Thursday during the second month of the blood bank core rotation. The VA coagulation laboratory benchwork consists of one week of afternoon sessions during the third month of the blood bank core rotation. In addition, on the 1st and 3rd Tuesdays of each month a noon conference on transfusion medicine is presented where one chapter in the transfusion medicine textbook P. Mintz, 1st Ed. Transfusion Therapy: Clinical Principles and Practice. AABB Press, Bethesda, MD., 1999, is discussed and resident questions are answered. This noon conference alternates with the infectious disease noon conference given on the 2nd and 4th Tuesdays of each month.

First Month (Core Rotation)

**Week I**

1. RL 302 Theory of Plasma Exchange
2. RL 303 Plasma Exchange for TTP/HUS, 303-B Clinical Pathway for TTP/HUS
3. RL 304 Therapeutic Phlebotomy
4. RL 401 DAT, IAT and Crossmatch
5. RL 402 RBC Antigen Characteristics

**Week 2**

1. RL 201 Blood Component Indications
2. RL 202 Red Blood Cell Transfusions
3. RL 403 ABO and Le System
4. RL 404 Rh and LW system
5. RL 204 Massive Transfusion

**Week 3**

1. Immunohematology Benchwork
2. Immunohematology Benchwork
3. Immunohematology Benchwork
4. Immunohematology Benchwork
5. Immunohematology Benchwork

**Week 4**

1. RL 306 Photopheresis
2. RL 216 Non Infectious Transfusion Reactions
3. RL 405 MnSs, P, Lu systems
4. RL 406 Kell, Kidd, Duffy systems
5. RL 208 Platelet Refractoriness and Platelet Transfusion
Second Month (Core Rotation)

Week 5
1. RL 207 Transfusion of Albumin, FFP and Cryoprecipitate
2. RL 205 Transfusion of Leukocyte Reduced, Washed, CMV Negative or Irradiated Blood Components
3. RL 213 RhIg and Hemolytic Disease of the Newborn
4. RL 214 Neonatal and Pediatric Transfusion
5. RL 215 Ob and Perinatal Transfusion

Week 6
1. RL 101 current Good Manufacturing Practice/American Red Cross Donor Center
2. American Red Cross Donor Center
3. RL 102 Blood Donor Selection/American Red Cross Donor Center
4. American Red Cross Donor Center
5. RL 305 Perioperative Autologous Transfusion, Intraoperative Blood Salvage

Week 7
1. RL 103 Infectious Disease Testing, Infectious Transfusion Reactions I ARC Donor Center
2. American Red Cross Donor Center
3. RL 104 Autologous and Directed Donation I American Red Cross Donor Center
4. American Red Cross Donor Center
5. RL 211 Granulocytes, Collection, Testing, Transfusion

Week 8
1. RL 105 Donor Apheresis I American Red Cross Donor Center
2. American Red Cross Donor Center
3. RL 106 Blood Component Preparation I American Red Cross Donor Center
4. American Red Cross Donor Center
5. RL 224 Transfusion Committee, RL 205 Transfusion Guidelines

Third Month (Core Rotation)

See following description of American Red Cross Afternoon Rotation Donor Room Rotation

A. Duration: 3 weeks / afternoons
B. Location: American Red Cross Donor Room, UAMS and American Red Cross Blood Center, 401 South Monroe, Little Rock, AR.

Objectives: Residents are to gain an understanding of the regulatory requirements associated with blood donation, processing, component preparation, and release of products to a transfusion service. In addition, they will review the medical history required of blood donors as well as all aspects of infectious disease testing associated with blood donors. The rotation will also include exposure to donor platelet apheresis collection and granulocyte pheresis.

Week 9
1. RL 307 RBC Exchange and SS Disease
2. RL 308 WBC and Platelet Reduction
3. RL 309 Staphylococcal Protein A Column and ITP and RA
4. RL 310 Nerve Disease and Plasma Exchange
5. RL 311 Renal Disease and Plasma Exchange

Week 10
1. RL 501 Coagulation Overview, RL 502 Coag Notes / VA Specialized Coag Lab Benchwork
2. RL 503 Coag Review Questions, RL 504 Coag Problems / VA Specialized Coag Lab Benchwork
3. RL 505 Hemophilia A, RL 506 Hemophilia B, I VA Specialized Coag Lab Benchwork
4. RL 507 von Willebrands Disease, RL 511 BT & Plt Aggregation I VA Specialized Coag Lab Benchwork
5. RL 508 HAT, RL 509 VOD, RL 510 factor XII def / VA Specialized Coag Lab Benchwork
Week 11
1. RL 312 Miscellaneous and Metabolic Disease and Plasma Exchange, RL 512 Antithrombotic Agents
2. RL 313 Rheumatic Disease and Plasma Exchange, RL 513 Fibrinolytic Substitutes
3. RL 408 WAIHA and CAIHA
5. RL 410 Special Immunohematology Procedures

Week 12
1. RL 203 Hemoglobin Substitutes, RL 209 Platelet Substitutes
2. RL 603 Hematopoietic Growth Factors, RL 606 Gene Therapy
3. RL 219 Transfusion Support of Bone Marrow Transplant
4. RL 220 Transfusion Support of Solid Organ Transplant
5. RL 107 Tissue Banking, RL 607 Cord Blood Cells

5. Special Learning Objectives Blood Bank Core Rotation Afternoon Sessions.

Immunohematology Benchwork

During the first month of the blood bank core rotation, the resident will receive one week of afternoon sessions observing or performing techniques in immunohematology to resolve immunohematology problems. The resident will receive training from the transfusion service training officer or designee.

Date completed (O=observe procedure and participate in patient management) (P=perform procedure)

___ABOI/Rh typing (O & P)
___Type and antibody screen (O & P)
___Abbreviated crossmatch (O & P)
___Antibody identification panel (O & P)
___Absorption and elution studies (O & P)
___Lui freeze eluate (O)
___Enzymes in antibody identification panels (O & P)
___Transfusion reaction workup and interpretation (O &P)
___Patient red cell phenotyping (O & P)
___Isoagglutinin titers of IgG, IgM (O)
___Hemolysis consultation and management (O &P)
___Crossmatch and transfusion in AIHA (O)
___Platelet crossmatching (O)
___Tests for fetomaternal immunization (O)
___Kleihauer-Betke test for fetal hemoglobin (O)
___Cord Blood Examination (O)
American Red Cross Blood Donor Center

During the second month of the blood bank core rotation, the resident will receive three weeks (Monday, Tuesday, Wednesday and Thursday) of afternoon sessions in blood donor selection, blood collection, processing, storage and transportation. Training will be performed by employees of the American Red Cross.

- Telerecruiting (O & P)
- Donor selection and history taking (O)
- Donor arm prep and phlebotomy (O)
- Infectious disease testing for allogeneic blood (O)
- Donor seroconversion and notification (O)
- Donor counseling and retesting (O & P)
- Recipient seroconversion (lookback) (O & P)
- Autologous whole blood (O)
- Directed whole blood (O)
- Directed plateletpheresis (O)
- Directed granulocyte pheresis (O)
- Allogeneic plateletpheresis (O)
- Prestorage leukocyte reduction of whole blood (O)
- Preparation of buffy coat (O)
- Preparation of cryoprecipitate (O)
- Quality control of random donor platelets, plateletpheresis and RBCs (O)

Transfusion Medicine Service

During the 3 months that the pathology resident is in the transfusion service the resident will observe or perform the following:

- Best platelets interpretation (O & P)
- Calculation of Rh immune globulin dosage (O & P)
- Mock CAP / AABB inspection (P)
- Management of massive transfusion (O & P)
- Preparation of saline washed RBCs and platelets (O)
- Pooling of cryoprecipitate (O)
- Pooling of random donor platelets (O)
VA Special Coagulation Lab Benchwork

During the third month of the core rotation, the resident will receive one week of afternoon sessions observing or performing techniques in routine and specialized coagulation. The resident will receive training from the employees of the VA Special Coagulation Lab.

___Factor VIII and Factor IX consult and dosage consultation (O & P)
___Lupus anticoagulant I antiphospholipid antibody panel (O)
___Hypercoagulable panel (O)
___Von Willebrand's screen (O)
___Mixing study (O)
___Coagulation factor activity levels (O)
___Coagulation factor inhibitor levels (O)

6. Summary

The blood bank pathologist in training should develop the skills necessary to act as a clinical consultant in every aspect of Transfusion Medicine and Coagulation. The blood bank resident may wish to interview the patient, study available clinical notes, suggest additional specimens and laboratory testing. The subsequent consultative report should include an interpretive opinion with continual review during the patient's clinical course.

Follow-up in CP Morning Report is essential for achieving a maximum learning benefit from the rotation, and is of special value to the other residents. As residents progress through the 3 month core rotation, they assume graduated responsibility for consultative and quality control activities to prepare them for the required month of "Blood Bank Senior" rotation described under that heading.

7. Blood Bank Core Rotation Reference List

The following are required reading:


The following are supplemental reading:

The following are excellent references to consult on specialized book topics.

Much additional, current information can be obtained by perusing the journal Transfusion. Numerous additional learning guides, transparencies, and books are available in the blood bank director's office.

BLOOD BANK SENIOR ROTATION

Introduction

This advanced residency rotation in Transfusion and Coagulation Medicine is designed to expand the knowledge base beyond that offered in the Blood Bank Core Rotation. The objectives are essentially the same as with the core rotation, except that the focus will be on performing of consults in donor apheresis, patient therapeutic apheresis, patient stem cell apheresis and coagulation. Senior residents who show a good working knowledge of Transfusion and Coagulation Medicine will be given considerable freedom to interpret cases, suggest appropriate laboratory diagnostic tests, and interact with the clinicians. The Blood Bank Attending may act as a consultant to the suitably experienced senior resident. The blood bank medical director will evaluate the senior resident by direct observation, along with input from the blood bank technical staff The rotation will be for one month unless special arrangements are made with the blood bank director. The objectives of this rotation are:

1. To permit the further development of expertise in the methodological, diagnostic and scientific aspects of transfusion and coagulation medicine. At the completion of the rotation the senior resident will be expected to have a practical working knowledge of all of the appropriate diagnostic tests in immunohematology and coagulation and their limitations.
2. Further development of the professional and managerial skills necessary to function as a pathologist with transfusion and coagulation medicine responsibilities, including investigative, therapeutic and administrative roles. The senior resident will be expected to show initiative with the blood bank and coagulation staff in requesting appropriate diagnostic tests.
3. The senior resident will be expected to understand the methods of quality control and quality assurance relative to blood banking and should be aware of the FDA, AABB, and JACHO regulatory environment of the blood bank.
4. At the end of the rotation, the senior resident will be expected to be at a knowledge level sufficient for independent diagnosis in transfusion and coagulation medicine. The senior resident should be able to function independently, know his/her limitations, and know when he/she should request specialty consultation in transfusion and coagulation medicine from the blood bank attending.
Guidelines for the Blood Bank Senior Rotation

1. Education Goals

The senior resident will be expected to demonstrate acceptable progress in the following end of the blood bank senior rotation:

a. Become proficient in dealing with most aspects of the operation of a hospital based transfusion service, Veteran's Administration reference coagulation service, hospital based stem cell apheresis and lab service and an American Red Cross regional blood collection service.

b. Become familiar with testing in stem cell apheresis including evaluation of patients for suitability.

c. Become familiar with stem cell apheresis complications and their management.

d. Become familiar with assessment of the adequacy of the stem cells collected, including CD 34 counts.

e. Become familiar with techniques of stem cell preparation, freezing, transportation and transfusion.

f. Become familiar with quality assurance procedures, including FDA, AABB, and FAHCT regulations, of stem cell apheresis.

g. Independently obtain a clinical history from the consulting physician, including prior relevant diagnostic evaluations and therapeutic plans.

h. Independently determine a provisional transfusion or coagulation medicine diagnosis.

i. Choose the appropriate choice of immunohematologic or coagulation test or test battery.

j. Integrate the results of multiple diagnostic tests into an appropriate immunohematologic or coagulation assessment.

k. Inform the requesting clinician of the assessment and of the plan for therapy in an appropriate concise manner, and suggest follow-up diagnostic tests if necessary.

2. Responsibilities

The blood bank senior resident is expected to organize and coordinate the interpretations of all immunohematologic and coagulation tests performed on the blood bank service in a timely fashion. He / she will be expected to instruct junior residents on rotation, and transfer some responsibilities in an appropriate fashion.

The senior resident shall:

a. Lead the blood bank morning report, and review the clinical / technical problems brought forward, working out solutions to these problems.

b. Review (analyze) and sign out antibody work-ups, transfusion reaction work-ups, and deviation from standard procedure work-ups.

c. Supervise other residents, rotational interns and medical students rotating through the blood bank, assist with clinical consultations, and advise on component usage questions and complex technical problems.

d. Interact with clinicians in the management of patients undergoing therapeutic apheresis, photopheresis, therapeutic phlebotomy, stem cell collection and processing, and intraoperative blood salvage.

e. In conjunction with the American Red Cross Medical Director, work with blood donors regarding, donor suitability, autologous, directed or homologous whole blood collection, donor testing, donor seroconversion and lookback, donor notification, donor retesting, donor counseling, and recipient seroconversion and be familiar with the appropriate paperwork forms and management of these problems.

f. Attend all laboratory and committee meetings attended by the medical director including laboratory morning report, hospital transfusion committee, and closing session of all regulatory agencies.

g. Assist the blood bank medical director with the transfusion committee and participate in the trend analysis of the various audits of transfusion practice.

h. Participate in the daily blood bank rotation lectures given by the blood bank medical director, answering resident questions and teaching important concepts.

i. Read the AABB standards and will conduct a mock CAP and AABB inspection using the appropriate forms and will report the results to the blood bank medical director.

j. Check out with the blood bank medical director Monday through Friday before leaving for the evening; and check out with the on-call pathology resident daily, prior to assumption of night call. Inform the on-call resident of ongoing cases or problems about which calls may be received.
3. Training Schedule

The senior resident is expected to adhere to the daily schedule:

**Blood Bank Rounds** (07:45 to 08:00 Monday through Friday).

**Clinical Laboratory Morning Report** (On Monday, Wednesday and Friday at 08:30 in the UAMS Clinical Laboratory Library, on Tuesday at 08:30 in the VAMP Pathology conference room and on Thursday at 08:00 in the VAMP Pathology Conference Room).

**Operations Meeting** (09:30 to 10:00 Monday through Friday).

**Rotation Lecture** (11:00 to 12:00 Monday through Friday).

**Noon Conference** (12:00-13:00 Monday through Friday).

**Afternoon Session** (13:00 to 16:00 Monday through Friday). During the afternoon sessions, of the 3rd week of the month, the resident will go to stem cell apheresis to observe stem cell apheresis collections and processing.

**Transfer of Duties to Pathology On-Call Resident** (16:00 to 16:30)

4. Special Learning Objectives Blood Bank Senior Rotation Afternoon Sessions

**Weeks 1, 2, and 4**

During the first, second and forth weeks the afternoon sessions will consist of performing the blood bank consults and interpretations with a greater degree of autonomy commensurate with the resident's level of experience and ability. The senior resident will work on any areas of confusion left over from the blood bank core rotation and will focus on special advanced topics from the special reference textbooks such as advanced immunohematology, autologous and allogeneic adoptive immunotherapy, cellular gene therapy and transfusion support for solid organ and bone marrow transplantation.

**Week 3**

During the 3rd week of the month, the resident will have afternoon sessions in the stem cell apheresis area and processing laboratory. The training will be performed by the stem cell staff. The training will consist of the following:

1. Stem cell donor suitability
2. Stem cell apheresis and management of complications of apheresis
3. Assessment of the adequacy of the stem cells collected, including CD 34 counts
4. Techniques of stem cell preparation, freezing, storage, transportation and transfusion
5. Stem Cell regulatory requirements by the FDA, AABB and FAHCT

5. Blood Bank Senior Rotation Reference List

The following are required reading:


The following are supplemental reading:

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