I. GOALS AND OBJECTIVES

Upon completion of the 1st month of Hematology rotation, resident should be able to:

1. Gather clinically relevant information and recognize normal peripheral blood morphology.
2. Develop an understanding of automated hematology, reticulocyte counts, erythrocyte sedimentation rates, arterial blood gas analyzers, urinalysis instruments, and hematology interpretations.
3. Begin evaluating body fluid cytologies with an emphasis on clinical correlation.
4. Answer question sets covering normal peripheral blood and bone marrow, anemias of decreased production, anemias of increased destruction and benign WBC abnormalities.

By the end of the 2nd month of Hematology rotation, resident should:

1. Handle routine administrative tasks with the Medical Director.
2. Recognize abnormal cytology on body fluids and make recommendations for further testing.
3. Answer question sets covering benign lymphoid disorders, acute non-lymphocytic leukemias, neoplastic lymphoproliferative disorders, myelodysplastic syndromes and myeloproliferative disorders.
4. Display higher degrees of competency for all goals from 1st rotation, as listed above.

II. GENERAL COMPETENCIES

During the Hematology rotation, the resident is expected to develop and implement the following competencies:

Patient Care
Gather essential information about patients using available modalities. Develop patient-specific diagnostic plans based on specific clinical questions and available clinical and pathology information, as well as general algorithms for clinically common or important diagnoses. Follow-up and interpret unusual or unexpected test results. Consult attending and house staff when additional testing will assist with diagnosis or treatment of patients.

Medical Knowledge
Evaluate evidence-based information using relevant information resources.
Develop a knowledge base in Hematology for effective consultation with clinicians
Demonstrate clinically optimal yet cost-effective testing strategies.
Recognize the variation in reference ranges for Hematologic tests based on age, gender, ethnicity and other population characteristics.
Understand the standards used for method development as generated by organizations such as the Clinical Laboratory Standards Institute (formerly NCCLS) and College of American Pathologists.

Practice-Based Learning and Improvement
Critically assess scientific literature and apply the principles of evidence-based medicine.
Understand the quality control and quality assurance procedures as required and the steps taken when problems arise.
Develop an understanding of the function of proficiency testing programs, such as those available from the College of American Pathologists, and participate when possible in the testing, review of results and construction of a response (as necessary).
Use laboratory problems and clinical inquiries to improve laboratory processes, provide education for laboratory personnel and establish lifelong learning practices.

Interpersonal and Communication Skills
Construct articulate, legible, concise, but comprehensive and informative consultation notes, including differential diagnosis and recommendations for additional studies when appropriate.
Communicate clinically important information to clinicians in a timely and professional manner.
Demonstrate skills in educating clinicians, colleagues, healthcare professionals and, if necessary, patients and their families through consultations, formal conferences, informal educational sessions and other methods.
Develop abilities to work with laboratory personnel and establish relationships to communicate problems or possible methods of improvement.
Present case studies at the weekly Clinical Pathology conference.

Professionalism
Be professional, punctual, dependable and responsive in laboratory related interactions.
Comply with the principles and practices of patient confidentiality.
Demonstrate a dedication to the needs of the patients that supersedes self-interest.
Assume responsibility to contact clinicians, initiate action, problem-solve and research medical records as knowledge and experience increase.
Behave professionally without bias or discrimination for religious, gender, ethnic or educational differences, yet demonstrating cultural sensitivities.

Systems-Based Practices
Understand the laboratory regulatory environment, including agencies such as Joint Commission of Accreditation of Healthcare Organizations (JCAHO), College of American Pathologists and federal, state and local public health authorities.
Advocate quality and cost-effective laboratory usage.
Continually strive to improve patient and laboratory personnel safety.
III. DURATION OF THE EXPERIENCE

Core rotation is six months in length and includes 2 months experience in the Hematology lab rotation. A third month will be focused on Hemostasis and thrombosis (see separate objectives), but review of abnormal peripheral smears and write-up of Hematology consults will be continued in this third month and while on-call.

IV. DUTIES AND RESPONSIBILITIES

A. Residents Review:
   1) All abnormal peripheral blood smears
   2) All abnormal body fluids
   3) Crystal exam of synovial fluid

B. Provide clinical correlation to laboratory technologists
C. Consult with clinicians
D. Teach technologists
E. Teach fellow residents
F. Attend monthly laboratory directors meeting
G. Attend 2nd and 4th week Leukemia-Lymphoma conference
H. Attend weekly Bone Marrow Transplant conference
I. Attend weekly Hemostasis-Thrombosis meeting

V. TOPICS
The resident is expected to read about and meet with the director to discuss these topics:

Automated hematology analyzers
Normal peripheral blood smear and normal bone marrow
Anisocytosis (micro- and macrocytic and dimorphic populations)
Color alterations (hypo- and hyperchromic and polychromatophilic)
Poikilocytosis (acanthocytes, keratocytes, echinocytes, spherocytes, codocytes, drepanocytes, stomatocytes, elliptocytes, dacrocyes and schistocytes)
Inclusions (basophilic stippling, Howell-Jolly bodies, Pappenheimer bodies, Heinz body, hemoglobin H inclusions, reticulocytes, hemoglobin CC and SC crystals, malaria and babesia)
Rouleaux versus agglutination
Anemias of decreased production
Nutritional anemias (iron, B12 and folate deficiencies)
Stem cell failure (aplastic anemia, pure RBC aplasia)
Alterations of heme production (hereditary or acquired porphyria and lead poisoning)
Multifactorial causes (chronic inflammation, sideroblastic anemia, marrow infiltration, renal disease, HIV and congenital dyserythropoietic anemias)
Anemias of increased destruction
Hereditary intracorpuscular defects (membrane defects, enzyme defects and qualitative and quantitative hemoglobinopathies – thalassemias, Hb C, Hb E, Hb M and sickle cell disease)
Acquired intracorpuscular defects (paroxysmal nocturnal hemoglobinuria, allo/auto immune hemolytic anemias and drug- induced hemolytic anemias)
Non-neoplastic WBC disorders
Hereditary abnormal morphology (Alder Riley, May Hegglin, Chediak Steinbrinck Higashi, Pelger-Hüet, hereditary hypersegmentation, lymphocytic vacuolization, and bone marrow histiocytic disorders - Gaucher, Niemann Pick and sea blue histiocytosis)
Hereditary functional abnormalities with normal morphology (chronic granulomatous disease, leukocyte adhesion deficiency and myeloperoxidase deficiency)
Acquired disorders (toxic/hypo granulation, Döhle bodies, nuclear hypo-/hypersegmentation, large granular lymphocytes, atypical lymphocytes, Ehrlichiosis, hemophagocytosis, emperiploesis and hematogones)
Quantitative abnormalities (increased/decreased lymphocytes, monocytes, eosinophils, neutrophils and basophils)
Benign disorders of lymphoid cells (normal lymph node architecture, benign reactive lymphadenopathy – follicular, sinus, interfollicular/diffuse and mixed patterns)
Neoplastic lymphoid disorders (ALL, CLL, prolymphocytic leukemia, hairy cell leukemia, non-Hodgkin lymphoma, Hodgkin lymphoma and plasma cell dyscrasias)
Neoplastic disorders of myeloid lineage (AML, CML, myeloproliferative disorders and myelodysplastic syndromes)
Platelet disorders
Thrombocytopenia (decreased production, increased loss or destruction – nonimmunologic and immunologic)
Thrombocytosis (essential thrombocythemia and reactive thrombocytosis)
Qualitative inherited (Bernard Soulier, Glanzmann, von Willebrand disease, gray platelets, Chediak Higashi)

Qualitative acquired (MPD, uremia, ASA, alcohol, paraproteinemias, coronary bypass machines)
Miscellaneous Hematology Tests (ESR, reticulocyte count, Heinz Body, sickle screen, mononucleosis screen, smear for eosinophils)
Body Fluids (Pleural, Peritoneal, Pericardial, CSF and Synovial fluids)
Urinalysis and body fluid lectures will be covered by Dr. Ellis during the Cardinal Glennon Hospital Clinical Pathology rotation

VI. RESIDENT ACTIVITIES

Self-Study:
1. Histogram booklet
2. Hematology II CD
3. Unknown peripheral blood smears and body fluids
Kodachrome sets for Hematology, urinalysis and body fluids
Collect, perform CBC, manual smear, manual differential, spun hematocrit, Hemacue and erythrocyte sedimentation rate on the resident’s own peripheral blood
MTS: University of Washington Lab Training Web Site

Daily Lab Activities:
1. Review abnormal smears independently or with senior technologist and obtain clinical correlation when indicated
2. Review abnormal smears with director
3. First call for problems in the lab, 8 AM-5 PM
Graduated responsibility: See Goals and Objectives above.

Weekly Activities:
Present a topic to present every Tuesday at Clinical Pathology Noon Conference
Meet twice a week for one-two hours with medical director to discuss hematology topics

VII. TEACHING STAFF

Gretchen S. Johns, MD, SLUH CP Office 268-5324, Beeper #: 490-0937
Leonard Grosso, MD, Hematopathology department 4th floor Med School or 3rd floor Cancer Center, 977-7875 or 577-8482, Beeper # 419-6725
Michael Creer, MD, SLUH CP Office, 577-8387, Beeper # 294-6865
Hematology Laboratory Staff

VIII. SUGGESTED READING AND KODACHROMES


IX. MANNER OF SUPERVISION AND EVALUATION

Residents are supervised throughout their rotation by the attending pathologists on service in the Hematology laboratory. Residents are evaluated based on their diagnostic and technical ability, their problem solving skills and participation in laboratory activities. Residents will be evaluated using the Pathology Core Lab resident evaluation form. The evaluation will be completed and discussed with the resident at the end of the rotation. The Hematology staff using a clinical pathology staff evaluation form will also evaluate residents periodically. The residents will be evaluated on interpersonal and communication skills, promptness and follow-up on clinical cases or problems and professionalism.
Residents are responsible for obtaining an evaluation of competence to perform bone marrow biopsies from a hematologist. All residents must have demonstrated competence in bone marrow biopsy procedure before completing the pathology residency.

X. OUTCOME TESTING METHODS

Residency competency following completion of the rotation will be established by performance on the annual ASCP resident in-service exam. At the end of each Hematology rotation, a written quiz that includes questions on Hematology topics and Kodachromes will be given to the resident. The results of this test are included in the rotation evaluation. Throughout the rotation, the resident will be provided with opportunities to perform and review the results of analytical procedures (serologic tests, patient data, calibration and quality control data from worksheets, etc.) and to present case histories and conferences to house staff in Pathology and Medicine. The resident is also responsible for performing interpretations that are subsequently reviewed by the attending on all interpretive report requests. The resident’s ability to perform these tasks is regularly evaluated by the attending pathologist during the laboratory rotation and these competencies will be included in the resident’s rotation evaluation. A checklist will be provided to the resident to ensure coverage of the major topics and to help in preparation for pathology boards.

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Hematol Obj
HEMATOLOGY CHECKLIST

Automated hematology analyzers
Normal peripheral blood smear and normal bone marrow
Anisocytosis
microcytic
macrocytic
dimorphic populations
Color alterations
hypochromic
hyperchromic
polychromatophilic
Poikilocytosis
acanthocytes
keratocytes
echinocytes
spherocytes
codocytes
drepanocytes
stomatocytes
elliptocytes
dacrocytes
schistocytes
Inclusions
basophilic stippling
Howell-Jolly bodies
Pappenheimer bodies
Heinz body
hemoglobin H inclusion
reticulocytes
hemoglobin CC and SC crystals
Plasmodium and Babesia
microfilaria and hemoflagellates (trypanosomes)
bacteria and fungus
Rouleaux versus agglutination
Anemias of decreased production
Nutritional anemias
Iron deficiency
B12 and folate deficiencies
Stem cell failure
aplastic anemia
pure RBC aplasia
Alterations of heme production
hereditary or acquired porphyria
lead poisoning
Multifactorial causes
chronic inflammation
sideroblastic anemia
marrow infiltration
renal disease
HIV
congenital dyserythropoietic anemias
Anemias of increased destruction
Hereditary intracorpuscular defects
membrane defects
enzyme defects
qualitative hemoglobinopathies –Hb C, Hb E, Hb M and sickle cell disease)
quantitative hemoglobinopathies - thalassemias
Acquired intracorpuscular defects
paroxysmal nocturnal hemoglobinuria
allo/auto immune hemolytic anemias
drug- induced hemolytic anemias
Non-neoplastic WBC disorders
Hereditary abnormal morphology
Alder Riley
May Hegglin
Chediak Steinbrinck Higashi
Pelger-Hüet
hereditary hypersegmentation
lymphocytic vacuolization
bone marrow histiocytic disorders
Gaucher
Niemann Pick
sea blue histiocytosis
Hereditary functional abnormalities with normal morphology
chronic granulomatous disease
leukocyte adhesion deficiency
myeloperoxidase deficiency
Acquired disorders
toxic/hypo granulation
Döhle bodies
nuclear hypo-/hypersegmentation
large granular lymphocytes
atypical lymphocytes
Ehrlichiosis
hemophagocytosis
emperipolesis
hematogones
Quantitative abnormalities (increased/decreased)
Lymphocytes
Monocytes
Eosinophils
Neutrophils
Basophils
Benign disorders of lymphoid cells
normal lymph node architecture
benign reactive lymphadenopathy – follicular, sinus, interfollicular /diffuse and mixed patterns
Neoplastic lymphoid disorders
ALL
CLL
prolymphocytic leukemia
hairy cell leukemia
small cell lymphocytic lymphoma
mantle zone lymphoma (nodal and lymphomatous polyposis)
marginal zone lymphoma (maltoma, splenic marginal zone lymphoma and nodal)
follicular cell lymphoma
large B cell lymphoma
Burkitt lymphoma
large granular cell lymphoma (natural killer and cytotoxic T cells)
Hodgkin lymphoma
classic – nodular sclerosis, mixed cellularity, lymphocyte depleted and lymphocyte rich
nonclassic – nodular lymphocyte predominant Hodgkin lymphoma
anaplastic large cell lymphoma
Sézary syndrome
adult T-cell lymphoma / leukemia
plasma cell dyscrasias
lymphoplasmacytic lymphoma
Neoplastic disorders of myeloid lineage
AML
Genetic markers
t(8;21)
t(15;17)
inv(16)
11q23
t(1;22) in infants
t(6;9)
AML M0, M1, M2, M3, M4, M5, M6 and M7
Variants
hypogranular promyelocytic leukemia
eosinophilic variant of M4
acute monoblastic leukemia
pure erythroid leukemia
Down syndrome and AML M7
myeloproliferative disorders
CML
chronic neutrophilic leukemia
chronic eosinophilic leukemia and hyper eosinophilic syndrome
polycythemia vera
chronic idiopathic myelofibrosis
essential thrombocythemia
myelodysplastic syndromes)
refractory anemia
RA with ringed sideroblasts
Refractory cytopenia with multilineage dysplasia
RA with excess blasts
myelodysplastic syndrome, unclassifiable
myelodysplastic syndrome with isolated del(5q)
Platelet disorders
Thrombocytopenia (decreased production, increased loss or destruction –
nonimmunologic and immunologic)
Thrombocytosis (essential thrombocythemia and reactive thrombocytosis)
Qualitative inherited
Bernard Soulier
Glanzmann
von Willebrand disease
gray platelet syndrome
Chediak Higashi