LaFleur Brooks' Health Unit Coordinating

7th edition

Chapter 14

Laboratory Orders

Lesson 14.1

Introduction to Laboratory Procedures

1. Define the terms in the vocabulary list.
2. Write the meaning of each abbreviation in the abbreviations list.
3. List two general purposes of laboratory studies.
4. Name three major divisions and five other divisions of the laboratory.
5. Identify five specimens that may be studied in the laboratory and list at least three specimens that would be obtained by an invasive procedure.

Lesson 14.1

Introduction to Laboratory Procedures (cont'd)

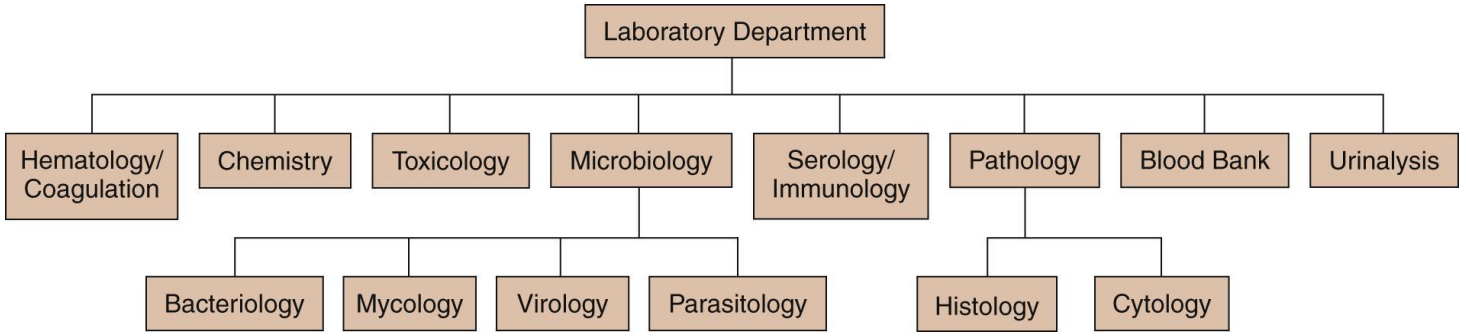
6. List six invasive procedures that would require a consent form signed by the patient.
7. Describe the health unit coordinator's responsibilities in ordering laboratory tests and sending specimens to the laboratory when EMR is used and when paper charts are used and describe how routine, stat, daily, and timed studies would be ordered and performed.
8. List three tests that would be performed at the bedside (POCT) to detect occult blood in gastric and stool specimens.

Laboratory Studies

- Two purposes:
  - Diagnostic evaluation
  - Evaluation of treatment

Divisions of Laboratory

- Three major divisions: Hematology, Chemistry, and Microbiology
- Other divisions are as shown here:



Specimens Studied by Lab

- Blood: collected by nurse or lab tech
- Urine: collected by CNA
- Stool: collected by nurse or CNA
- Sputum: collected by nurse, CNA or respiratory tech

Specimens Studied by Lab, cont'd

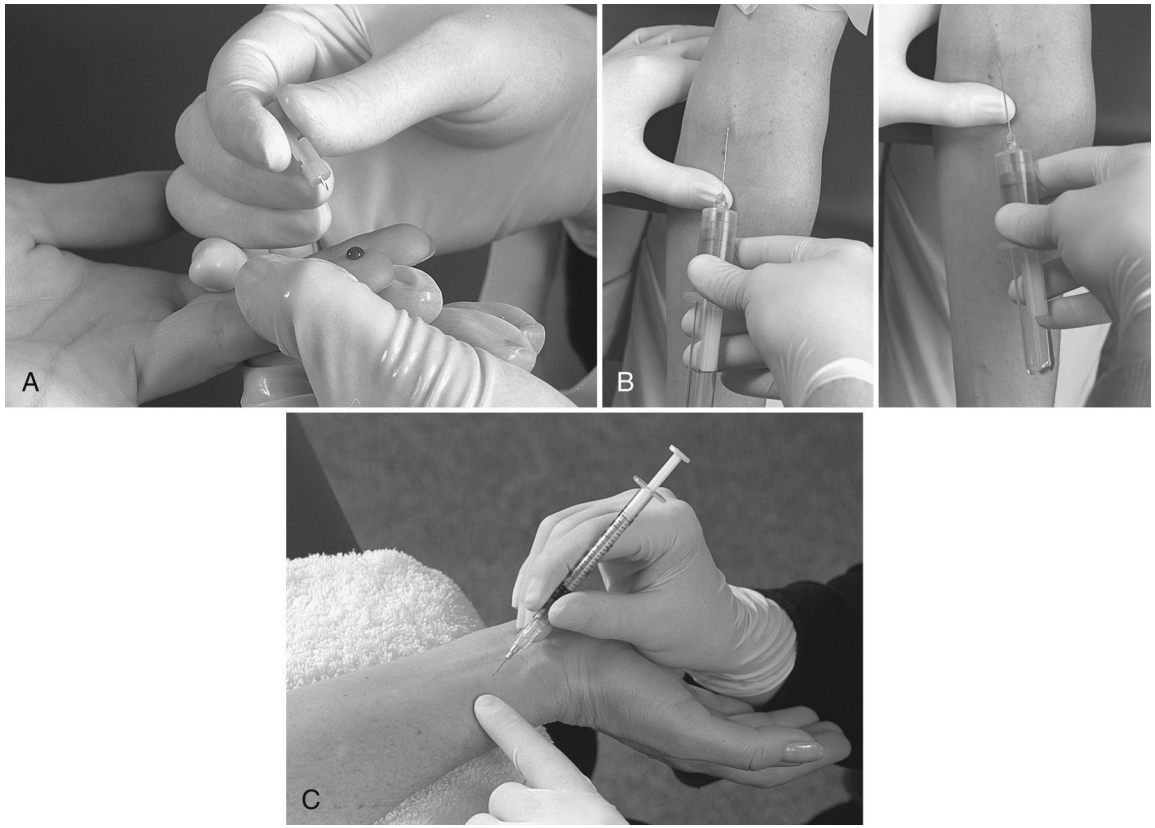
- Wound drainage: collected by nurse or doctor
- N/P smear: collected by nurse or doctor
- Gastric washings: collected by nurse or doctor
- Sweat: collected by lab tech

Methods of Collecting Blood

- Venipuncture (puncture into the vein)
- Finger-stick (puncture into a capillary)
- Peripheral arterial or venous lines

Three Methods of Collecting Blood

- Capillary, Venous, Arterial



Various Specimen Containers

Specimens Collected by Invasive Procedures

- Some specimens collected require a consent form to be signed because of the invasiveness of the procedure:
  - Spinal fluid: lumbar puncture/spinal tap
  - Bone marrow: sternal puncture/bone marrow biopsy
  - Abdominal cavity fluid: abdominal paracentesis
  - Pleural fluid/thoracic cavity fluid: thoracentesis
  - Amniotic fluid: amniocentesis
  - Biopsy specimen: biopsy of a part of the body

Ordering Lab Tests and Sending Specimens: EMR

- When EMR with CPOE is implemented, doctors' orders are entered into the patient's EMR and are automatically sent to the appropriate departments.
  - Tests are performed as ordered.
  - The HUC may need to order laboratory test using a code.
- The health unit coordinator may also be expected to telephone the lab in the case of stat laboratory orders regardless of whether the hospital uses EMR and CPOE.

Ordering Lab Tests and Sending Specimens: EMR, cont'd

- Other HUC tasks may be indicated by an icon next to the appropriate patient's name on the computer census screen. Example:
  - "Hold a patient's tray for a glucose tolerance test.'"
- The HUC is responsible for sending labeled and bagged specimens to the laboratory department after they have been collected by nursing staff, residents, or doctors

Ordering Lab Tests and Sending Specimens: Paper Charts

- Laboratory tests are communicated to the laboratory department by the HUC through the ordering step of transcription.
- It is necessary for the HUC to interpret terms the doctor may use to write laboratory orders such as:
  - Routine: usually would indicate that the test will be performed within a four-hour period
  - Daily: requisitioned every day or entered into the computer for multiple days in advance by the HUC until the order is discontinued

Ordering Lab Tests and Sending Specimens: Paper Charts, cont'd

- Stat: the laboratory is usually notified by phone or verbally, and the appropriate nursing personnel are also notified (the patient's nurse often performs stat lab tests).
- Timed Specimen: an order for a test that must be drawn at a specified time

Ordering Lab Tests and Sending Specimens: Paper Charts, cont'd

- It is essential that the HUC check the patient's name on the specimen and computer order screen to compare with the doctor's order.
- Mislabeled specimens usually are discarded and the patient redrawn, causing a delay in diagnosis and treatment, and causing the patient additional discomfort.

Point-of-Care Testing (POCT)

- Lab test/specimen can be collected and analyzed on hospital unit.
- Results are obtained via several methods including:
  - Analysis by portable automated analyzers
  - The use of reagents (chemicals)
  - Microscopic visualization

POCT: Portable Automated Analyzers

- Portable automated analyzers may be used in departments that require immediate results.
  - Decreases need for stat specimens to be sent to lab
- Tests that use this method:
  - Electrolytes
  - Blood glucose
  - Blood urea nitrogen (BUN)
  - Hemoglobin
  - Hematocrit

POCT: Reagent-Based Tests

- Human chorionic gonadotropin (hCG)
- Activated clotting time (ACT)
- Helicobacter pylori (CLO test): a bacterium that has been indicated in ulcers of the gastrointestinal system
- CLO test: uses a biopsy specimen obtained in the endoscopy department and may yield positive results within two hours
- Blood glucose monitoring
- The D-Dimer coagulation study (may also be done with a fingerstick specimen)
- Blood and urine monitoring for the presence of ketones and for levels of glucose

Point-of-Care Testing: Reagent-Based Tests, cont'd

- In some facilities, these tests are considered point-of-care:
  - Guaiac
  - Gastroccult
  - Hemoocult
- These tests use reagents to detect occult blood in gastric and stool specimens.

Point-of-Care Testing

- Use of both a reagent and microscopic visualization:
  - Fern test: performed to indicate the presence of amniotic fluid
    - The reagent portion uses a strip of paper that indicates acidity (pH paper).

Reflex Testing

- Must be approved by the medical staff on an annual basis
- Laboratory personnel must consult with the medical director, pathologist, or clinical consultant to determine the tests and criteria for reflex testing.
- Only tests documented as approved by the medical executive committee may be reflexed and must be medically necessary.

Reflex Testing, cont'd

- Physicians must be informed of those tests that are reflexed and be given the option to order the test without the reflex test.
- CBC with auto diff
  - Only example of a test that is “reflexed”
  - Not considered a reflex test for billing purposes
  - Results of the auto diff indicate a manual diff needs to be performed

Lesson 14.2

Divisions within the Laboratory

9. List three tests that would be performed at the bedside (POCT) to detect occult blood in gastric and stool specimens.
10. Describe the general purpose of the hematology division of the laboratory and list six studies that would be performed in the hematology division.
11. Describe the general purpose of the chemistry division of the laboratory.

Lesson 14.2

Divisions within the Laboratory (cont'd)

12. Identify at least three chemistry tests that would require the patient to be fasting and explain the difference between fasting and NPO.
13. List four tests that are included in electrolytes.
14. Describe the general purpose of the toxicology department and explain the procedure for ordering peak and trough drug levels.

Hematology

- Hematology division performs tests related to:
  - Physical properties of blood
  - Clotting and bleeding disorders
  - Coagulation (clotting) studies
- Most of these tests are done on a blood specimen.
  - However, bone marrow and spinal fluid can also be studied in this division.

Common Tests Ordered from Hematology

- CBC (Complete Blood Cell Count) or Hemogram
  - CBC or hemogram is composed of a number of tests, including:
    - RBC; Hgb; Hct; RBC indices
    - WBC; and Diff, blood smear, and platelet count.
- The number of tests included in a CBC may vary among hospitals.

Common Tests Ordered from Hematology, cont'd

- Platelet Count (Plt ct)
- Esr (Erythrocyte Sedimentation Rate)
- Retics (count of reticulocytes (immature red blood cells))
- LE Cell Prep
- Coagulation Studies
- PT/INR (Prothrombin Time with International Normalized Ratio)

Common Tests Ordered from Hematology, cont'd

- APTT (activated partial thromboplastin time)
- PTT (partial thromboplastin time)
- Bleeding Time
- Clotting Time
- Coagulation Panel (Coag panel)
- D-Dimer (Fragment D-dimer or fragment degradation product)

Chemistry

- Performs tests related to the study of chemical reactions that occur in living organisms
- When a disease process occurs, the levels of chemicals within the body fluids vary from normal.
- Any variance permits a diagnosis or evaluation of the patient's health status.
- Automated equipment permits many tests to be performed on a small sample of blood and in a short time.
- In chemistry, these automated multicomponent studies are called profiles, panels, or surveys.

Chemistry: Specimens Studied

- Blood and urine are the most common specimens.
- Other specimens for testing include urine, stool, sputum, sweat, wound drainage, discharge from body openings, and gastric washings (lavage).
- Urine chemistries may require that the urine be collected over a specified period, such as 24 hours.

NPO and Fasting

- Many blood chemistry tests require that the patient fast or be assigned NPO status.
  - Fasting: the patient is given nothing to eat for eight to 10 hours before the specimen to be tested is collected; the patient may have water.
  - NPO: nothing by mouth—food or fluid—after midnight.

Fasting and/or NPO List for Lab Studies

- Bromsulphalein (BSP)
- Cholesterol
- Electrophoresis, lipids
- Electrophoresis, lipoprotein
- Fasting blood sugar (FBS)
- Glucose tolerance test (GTT)
- Iron (Fe) and TIBC
- Triglycerides

Common Chemistry Panels Ordered

- Many chemistry tests are ordered as a group; these are called panels or profiles:
  - Lytes (Electrolytes) - Na, K, Cl, CO2
  - BMP (Basic Metabolic Panel)
  - Na, K, Cl, CO2, glucose, BUN, creatinine, and Ca
  - Renal Panel
  - Na, K, Cl, CO2, glucose, BUN, creatinine, Ca, albumin, and phosphate
  - CMP (Comprehensive Metabolic Panel)

Electrolytes (lytes)

- Sodium (Na)
- Potassium (K)
- Chloride (Cl)
- Carbon dioxide (CO2)

Toxicology

- Scientific study of poisons, their detection, their effects, and methods of treatment for conditions they produce
- Tests for detecting drug and alcohol abuse and for monitoring drug usage also are performed in toxicology.
- Special consents, handling, and labeling may be required.
- Specimens include blood and urine.

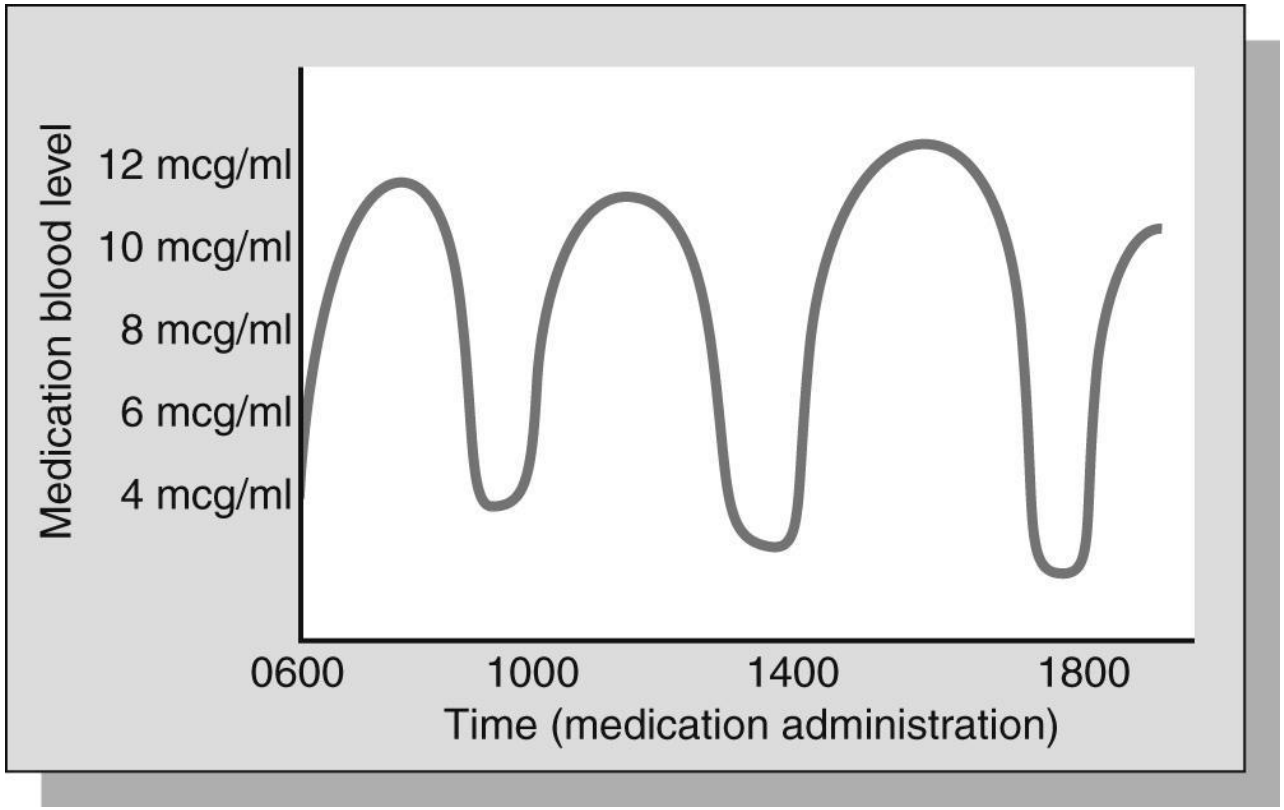
Peak and Trough

- When doctors want to check levels of certain medications the patient is receiving, they order peak-and-trough levels.
- Sometimes, toxic blood levels accumulate instead of being excreted.
- For peak levels, the blood usually is collected 15 minutes after IV infusion and 30 to 60 minutes after IM injection.

Peak and Trough, cont'd

- Trough levels usually require that blood be drawn 15 minutes before the next dose of medication is given to the patient.
- The HUC must work closely with the laboratory, nursing staff, and pharmacist to ensure proper scheduling of collections.
- When ordering peak-and-trough levels, the HUC would order them "*Timed,*" meaning that blood should be drawn stat at the specified time.
- In some cases, nursing staff will draw the peak level at the appropriate time.

Peak and Trough Levels of a Medication



Lesson 14.3

Divisions within the Laboratory and Recording Laboratory Results

15. Describe the general purpose of the microbiology division of the laboratory and list six studies that would be performed in the microbiology division.
16. Describe the general purpose of the serology and immunology division of the laboratory and list three tests performed in the serology and immunology division.
17. Describe the general purpose of the blood bank and identify the steps that must be performed to obtain blood (packed cells) for transfusion.
18. Describe the general purpose of the urinalysis division of the laboratory and identify three methods of obtaining urine specimens.

Lesson 14.3

Divisions within the Laboratory and Recording Laboratory Results (cont'd)

19. Identify the procedure that would be performed to obtain pleural fluid and cerebrospinal fluid (CSF) and explain the importance of accurate labeling and appropriate transportation of these specimens.
20. Describe the purpose of the pathology division of the laboratory and identify and describe the purpose of two subdivisions of the pathology division.
21. Describe how errors may be avoided in recording telephoned laboratory results (critical or panic values).

Microbiology

- The study of microorganisms that cause disease
- Specimens are cultured (grown in a reproducing medium) and identified with the use of biochemical tests.
- Bacteriology is often the largest division of microbiology:
  - Specimens are cultured, grown in a reproducing medium, identified with the use of biochemical tests, and then tested for antibiotic sensitivity.

Microbiology, cont'd

- Parasitology: The study of parasites
  - Fecal specimens are studied here for ova and parasites.
- Mycology: Cultures are set up to isolate and identify fungi.
  - Because a fungus must grow to produce spores, these cultures may take several weeks.
- Virology: The study of viruses that cause disease

Microbiology, cont‘d

- Almost any type of specimen may be studied in microbiology:
  - E.g., Blood, stool, urine, sputum, bronchial washes or other body fluids, catheter tips, eye/ear drainage, and wound drainage
- Fasting is not required.

Infectious Diseases

- There are many organisms with which we live that do not cause disease and are in fact beneficial to our health.
  - An immunocompromised patient can develop a life-threatening condition due to an opportunistic infection by one of those organisms.
- An infection that a patient obtains while hospitalized is called a nosocomial infection.

Infectious Diseases, cont'd

- Superbugs and *superbug nosocomial infections*
  - Pathogens that have become resistant to most antibiotics currently available
  - Often result in life-threatening infections
    - Extremely difficult to treat
- HUC plays important role in prevention of the transmission of pathogens.

Superbugs

- MRSA: Methicillin Resistant Staphylococcus aureus
- VRE: Vancomycin Resistant Enterococcus
- CRKP: Carbapenem-Resistant Klebsiella pneumoniae
- C-diff: Clostridium difficile
- MDR-TB: Multiple Drug Resistant Tuberculosis
- XDR-TB: Extensively Drug Resistant Tuberculosis

Common Studies Performed in Microbiology

- Culture and sensitivity (C&S)
- Blood Cultures (BC)
- AFB Culture (Acid-fast Bacilli)
- *C. diff* or *C. difficile (Clostridium difficile)* Toxin
- Urine for CC (Colony Count)
- Gram Stain
- Stool for O&P (Ova and Parasites)
- Mycology Culture
- Virus Culture and Virus Serology
- CMV Culture

Serology/Immunology

- Serology
  - Study of antibodies and antigens useful in detecting the presence and intensity of a current infection
    - May be useful in identifying a previous infection or exposure to an organism
    - Autoimmune diseases may be studied, and pretransplant and posttransplant conditions evaluated and treated.
- Immunology
  - Response of the body to a foreign substance
  - Production of certain proteins that neutralize the substance

Serology/Immunology, cont'd

- Most of these tests are done on the serum portion of a blood specimen.
  - Other body fluids, such as spinal fluid and mucosal transudate (cheek swab), may be tested, along with biopsy specimens and secretions from wounds.
- Antigens also may be detected in stool specimens.
- Fasting is not required.

Common Tests Performed in Serology

- ANA (Antinuclear Antibody)
- EBV Panel (Epstein-Barr Virus)
- ELISA (Enzyme-linked Immunosorbent Assay)
- FTA (Fluorescent Treponemal Antibody)
- HBsAG (Hepatitis B Surface Antigen)
- RA (Rheumatoid Arthritis) Factor
- RPR (Rapid Plasma Reagin) Test
- TB QFT-G

Blood Bank

- Types and crossmatches patient blood
- Obtains blood for transfusions
- Stores blood and blood components
- Keeps records of transfusions and blood donors
- Also performs several other blood studies such as:
  - Coombs' or DAT (the direct antiglobulin test)
  - Type and Screen
    - A specimen of blood is used.
    - Fasting is not required.

Four Major Blood Types

- A: Patients with type A blood may receive transfusions of types A and O.
- B: Patients with type B may receive transfusions of types B and O.
- AB: Patients with type AB may receive transfusions of types A, B, AB, and O.
- O: Patients with type O may receive only type O blood transfusions.

Blood Transfusion Steps

- An order for transfusion of whole blood, packed red blood cells, and some other blood components automatically indicates that blood will be typed and crossmatched.
- Blood bank orders are requisitioned via computer or by completion of a downtime requisition form.
- The number of units to be given and the names of the blood components are included on the requisition.
- A blood transfusion consent must be signed before blood or blood products are administered.

Urinalysis Division

- Studies urine specimens for color, clarity, pH (degree of acidity or alkalinity), specific gravity (degree of concentration), protein (albumin), glucose (sugar), blood, bilirubin, and urobilinogen
- Sediment is viewed microscopically for organisms, intact cells, and crystals.
- Specimen is urine.
- Fasting is not required.

Methods for Collecting Urine Specimens

- Voided urine specimen:
  - The patient voids into a clean container.
- Clean catch, or midstream, urine specimen:
  - The nursing staff uses a special cleansing technique to obtain this type of specimen.
- Catheterized urine specimen:
  - This specimen is sterile and is obtained by catheterizing the patient.

Pleural Fluid

- Obtained when the doctor performs a thoracentesis
- Patient must sign a consent form for this procedure.
- Tests that may be performed on pleural fluid include:
  - LDH, glucose, and amylase (chemistry)
  - cell count, diff (hematology)
  - C&S (microbiology)
- Fasting is not required.

Cerebral Spinal Fluid (CSF)

- Obtained when the doctor performs a lumbar puncture
- Patient must sign a consent form for this procedure.
- Tests that may be performed on CSF include:
  - Tube 1—cell count, protein, and glucose – Hematology & Chemistry
  - Tube 2—AFB and fungal culture – Microbiology
  - Tube 3—Gram stain – Microbiology
- CSF may also be sent to Serology for testing.
- Fasting is not required.

Ordering and Transporting Pleural and Cerebral Spinal Fluid

- The HUC enters information (doctor's orders) into the computer or writes it on the requisition.
- It is sometimes the HUC's responsibility to transport these specimens to the laboratory.
- It is important to label all specimens accurately and transport to the laboratory immediately.
- Because they are difficult to obtain and gathering them again would cause the patient further pain, never send the specimens via pneumatic tube.

Pathology

- Pathology: the study of the nature and cause of disease as seen in body changes
  - A pathologist is in charge of the pathology department.
- Subdivisions of the pathology department:
  - Histology: the study of the microscopic structure of tissue
  - Cytology: the study of cells obtained from body tissues and fluids to determine cell type and to detect cancer or a precancerous condition

Specimens Studied in Pathology

- Organs, tissue, cells, and body fluids obtained from biopsies, centeses, sternal punctures, lumbar punctures, surgeries, and autopsies
- Pap smears – during a pelvic examination, the doctor may remove tissue or cells from the cervix for study.

Recording Laboratory Results

- The results of laboratory tests are a valuable tool for the doctor in the diagnosis and treatment of patients.
- Stat and/or abnormal laboratory test results are communicated verbally or by telephone to the doctor by the HUC or nurse.
- The doctor may request on the doctors' orders sheet that laboratory test results be communicated to him by telephone immediately upon their completion.

Avoiding Errors When Recording Lab Results

- Always read the laboratory values you have recorded back to the person in the laboratory.
- Always have the person taking information in the doctor's office repeat recorded values back to you.
- The written report should be placed in the patient's chart in a timely manner.
- Accuracy in selection of the correct patient's chart and of the appropriate location in the chart is very important.

Telephoned Laboratory Results Form

TELEPHONED LABORATORY RESULTS

Patient's name _____ Report called by _____
Room number _____ Report taken by _____
Date _____ Time _____

HEMATOLOGY

RBC _____
Hgb _____
Hct _____
WBC _____
  lymphs _____
  monos _____
  neutros _____
  eos _____
  basos _____
PLATELETS _____
RETICS _____
SED RATE _____
OTHER

CHEMISTRY

GLUCOSE
  Random _____
  FBS _____
E'LYTES
  Na _____
  K _____
  Cl _____
  CO_2 _____
CARDIAC STUDIES
  SGOT _____
  LDH _____
  CPK _____
  BNP _____
  Troponin _____
CALCIUM _____
PHOS _____
BUN _____
CREATININE _____
OTHER _____

URINE

COLOR _____
APPEARANCE _____
PH _____
SP. GRAVITY _____
ACETONE _____
GLUCOSE _____
BACTERIA _____
WBC _____
RBC _____
CASTS _____
OCCULT BLOOD _____
OTHER

COAGULATION

BLEEDING TIME _____
COAGULATION TIME _____
PROTIME _____
  Patient _____
  Control _____
  % _____
PT
  Patient _____
  Control _____
  INR _____
PTT _____

TELEPHONED BLOOD GAS REPORT

Patient's name _____
Room number _____
Date _____ Time _____
Report called by _____
Report taken by _____

O_2 CONCENTRATION _____
O_2 TENSION _____
CO_2 TENSION _____
PH _____
ACT BICARB _____
BASE EXCESS _____
O_2 SAT _____