



Bermuda Hospitals Board

King Edward VII Memorial Hospital

DEPARTMENT OF PATHOLOGY

Anatomic Pathology and Clinical Laboratory Services

**LABORATORY
CLIENT SERVICES
MANUAL**

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INTRODUCTION

Mission Statement

“Excellence is not just our goal, it’s our standard!”

The Department of Pathology will maintain excellence in performance while continuously striving to improve the quality of patient care we provide. Our services will be delivered within a professional environment that is patient-focused, caring toward employees, team oriented, and upholds the values of the Bermuda Hospitals Board.

About Us

Our pathology staff includes physicians certified in anatomic and clinical pathology as well as the subspecialties of anatomic pathology, biochemistry, cytology, transfusion medicine, hematology and a consultant in microbiology.

The internal organization of the laboratory consists of the following laboratory sections:

- Accessioning and Specimen Handling
- Anatomic Pathology (Histopathology, Cytology and Mortuary Services)
- Biochemistry (routine, including blood gases, immunoassay, infectious diseases and therapeutic drug monitoring.
- Blood Donor Center
- Blood Bank and Transfusion Services:
- Consultation Services (chemical pathology, hematology, transfusion and microbiology)
- Courier Service
- Hematology
- Microbiology
- Out Patient Phlebotomy
- Referred Testing (Reference Laboratory Services)

We are dedicated to providing accurate information in a timely manner to our physicians, private laboratories, caregivers and other customers.

Your regular and effective use of the information in this Laboratory Client Services Manual will contribute significantly to the quality and safety of patient care within Bermuda Hospitals Board healthcare system.

Accreditations and Affiliations

The Department of Pathology adheres to the Accreditation Canada Standards, Joint Commission International (JCI) Accreditation Standards for Clinical Laboratories and participates in the College of American Pathologists (CAP) Proficiency Testing Programs and United Kingdom National External Quality Assessment Service (UK NEQAS).

Laboratory Services Directory

Dr. Clyde Wilson

Chief of Pathology

KEMH - 1st Floor, Room 1097

441 239- 1011

Kathy Stephens, BSci, MT (ASCP), MA

Pathology Manager

KEMH – 1st Floor, Main Laboratory

441 239-1481

LABORATORY SECTION	EXTENSION	LOCATION at KEMH 1st Floor Main Laboratory
Accessioning and Specimen Handling	1738/1198	Main Laboratory
Anatomic Pathology: Cytopathology	1751	Room 1080
Histopathology	1382	Room 1081
Secretaries	1877/1740	Room 1069
Biochemistry	1732/1485	Main Laboratory
Blood Donor Center (BDC)	1398/2219	1st Floor, Room 1068
Blood Bank and Transfusion Services	1818/1419	Main Laboratory
Consultants:		
Dr. Eyitayo Fakunle BDC Medical Director, Hematology and Transfusion Services	1418 704-7720	Main Laboratory
Dr. Emyr Owens Cytology and Anatomic Pathology	1677	Room 1096
Dr. Marva Vanessa Phillips-Williams Biochemistry, Cytology and Anatomic Pathology	1381 737-0808	Room 1097
Dr Clyde Wilson, Microbiology	1011/504-6037	Room 1097
Courier Service	1738/1198	Main Laboratory
Hematology	1732	Main Laboratory
Laboratory Information System (LIS)	1739/1004	Room 1098
Microbiology	1297/1643	Main Laboratory
Mortuary	1404/1587	Basement
Out Patient Phlebotomy	1298	Main Laboratory

Hours of Operation

The laboratory provides service 24 hours/day, seven days a week. Hours for providing routine service and restricted service are as follows:

<p>BIOCHEMISTRY / HEMATOLOGY / BLOOD TRANSFUSION / MICROBIOLOGY</p> <p>Monday to Friday (excluding Public Holidays) 8:00 a.m. – 12:00 midnight (routine service) Midnight – 8:00 a.m.</p> <p>Weekends 8:00 a.m. – 4:00 p.m. (restricted out-patient service-stats, inpatients) 4:01 p.m. – 7:59 a.m. (restricted out-patient service-stats, inpatients)</p> <p>Public Holidays (restricted out-patient service – stats, inpatients)</p>
<p>HISTOLOGY/CYTOLOGY</p> <p>Monday to Friday (excluding Public Holidays) 8:00 a.m. – 4:00 p.m. (routine service)</p>
<p>CLIENT SERVICES - SPECIMEN RECEPTION</p> <p>Monday to Friday (excluding Public Holidays) 8:00 a.m. - 4:30 p.m. (routine service)</p>
<p>CLIENT SERVICES - PHLEBOTOMY OUTPATIENTS</p> <p>Monday to Friday (excluding Public Holidays) 7:00 a.m. - 4:00 p.m. (routine service)</p>
<p>MORTUARY SERVICES</p> <p>Monday to Friday (excluding Public Holidays) 8:00 a.m. - 4:30 p.m. (routine service)</p>

BLOOD DONOR CENTER

Tuesday, Wednesday, Thursday (excluding Public Holidays)
8:30 a.m. – 3:00 p.m.

Therapeutic and Autologous Donations
Tuesday, Wednesday, Thursday (excluding Public Holidays)
8:30 a.m. – 3:00 p.m.

Clinical Consultation

Pathologist consultation is available to all clients, including assistance in interpreting laboratory test results or recommending appropriate laboratory testing. Request for pathologist consultation may be directed to the appropriate pathologist.

Referral Testing Policy

The Department of Pathology selects and uses qualified licensed reference laboratories to perform those tests not available at the King Edward VII Memorial Hospital. Reference laboratories are selected based on the quality of service provided.

Clinical Laboratory Staffing Structure

The Department of Pathology is fully staffed during the day and evening shifts. There is limited number of staff during the Public Statutory Holidays and midnight shift.

Specimen Submission Requirements

Specimen Labeling Policy

Label all specimens submitted for testing with:

- Patient's complete name,
- Unique identifier (date of birth or medical record number), and
- Date and time the specimen was collected and initials of the individual who collected the specimen.

Blood Bank Specimens

All Specimens for group and hold and or cross match must:

- Have Completed Transfusion Services Request form submitted along with specimens
- Specimens must be submitted with the 3 following patient identifiers:
 - Patients full name
 - Medical Record Number
 - Date of Birth

- Date and time the specimen was collected and the initials of the individual who collected the specimen

Note: Specimens for group and hold and or cross match are taken in accordance with the Nursing Blood/Blood Product policy.

This will ensure positive identification and optimum integrity of patient specimens from the time of collection until testing has been completed and results reported. Clients (refers to any person(s) that use our services) will be notified of inappropriately labeled specimens and the specimen will not be returned to the client. Tests will not be performed on unlabeled or incompletely labeled specimens.

General Specimen Rejection Criteria

Specimens will be rejected and the tests and charges canceled under the following conditions:

- Unlabeled
- Leaking specimen
- Broken container
- Incorrect specimen submitted for test requested (such as specimen with wrong anticoagulant)
- Insufficient volume (QNS)
- Improper specimen transport temperature
- Age of the specimen, depending on the analyte requested
- Hemolyzed blood specimen, depending on the analyte requested
- Specimens not transported in the proper holding container

Specimen Handling and Transport

Submission Requirements

- Complete a Test Request Form for each patient (Please print). Record all required patient information.
 - Patient's full name, medical record number or birth date
 - Collection date and time, and collector's initials
 - Ordering physician name and signature. If there is a Locum in the office, please put the name of the Locum and the physician for whom he/she is standing in.
 - If the report is to be sent to someone other than requesting physician, list facility, for example, the name of a nursing home.
 - Call back/fax information if applicable.
 - Complete insurance information. This is particularly important if sample is being drawn in outside location and being sent to the laboratory. Name should appear as it does on the insurance card. This is especially important if the patient will not be available for Department of Pathology staff or Admitting staff to verify information. This should include the Insurance Company, Group Number, and Policy Number.
 - Laboratory test(s) ordered, with ICD-9 codes or the relevant clinical diagnosis appropriate for each test. If test does not appear on requisition, write in the name of the test.
 - If you have any questions, please call the laboratory.

- Write patient name legibly on specimen containers. Be sure that the name and other identifier written on specimen exactly matches name on test request form.
- Unlabeled specimens will be rejected.
- Place labeled specimen(s) in the sealed portion of specimen bag. Place the folded test request form into the outer portion of specimen bag. Do not place specimen and requisition in same bag. Samples that leak in transit will not be tested.

Note: If possible, all specimens from a single requisition are to be placed in the same plastic transport bag. There should be only one set of patient samples placed in each bag.

Special Requests

- **STAT Test Requests:** Certain laboratory tests are available on a STAT or emergency basis (meaning results will be available in the computer within one hour of receiving the specimen in the laboratory). A complete listing of tests available on a STAT basis is provided below.

If the sample is in the laboratory and you wish to change the order to STAT, contact Central Processing at extension 1738.

Following is a list of tests that may be performed STAT:

CHEMISTRY

Alcohol	Lithium
Acetaminophen	Magnesium
Blood gases	Neonatal Bilirubin (direct and total)
Chemistry Profile	Phenobarbital
Carboxyhemoglobin	Salicylates
Digoxin	Tegretol
Dilantin	Theophylline
EDPR	Troponini
Lactic Acid	Valproic acid

HEMATOLOGY/COAGULATION

CBC
 PT INR
 APTT
 Fibrinogen
 D Dimer

TRANSFUSION

Cross match- Can take approximately 60 minutes if no atypical antibodies are found.
 Group and Hold

- **Add-On Test Requests:** All requests for additional testing to be added to a specimen already in the laboratory should be directed to Accessioning or the relevant laboratory department. Your request will be processed providing there is a sufficient amount of the correct type of sample for the additional tests requested. Patient reports will be generated under the original order, with a comment and the additional tests requested.

Specimen Storage: In most cases, specimens are transported to the laboratory for processing and storing. However, in those circumstances where a specimen cannot be transported to the laboratory within the required time for the test, please follow specimen processing, storage and transport requirements. Call the laboratory if there are questions about processing and storage instructions.

- **Storage:** Client specimens should be stored in one of the following three thermal environments depending on the client, specimen, and test requirements:
 - Ambient or room temperature
 - Refrigerated
 - Frozen

The viability of each specimen depends upon how well the thermal environment is maintained throughout the specimen transport process. All specimens must be maintained at the proper temperature to prevent the need to recollect due to thermal damage or deterioration. The temperature of each specimen should be clearly defined by the client and the location, as well as how the specimen was stored at the drawing location.

Laboratory specimens are to be packed in primary, secondary, and tertiary containers for transportation.

- Primary = tube, cup, or slide
- Secondary = biohazard bag
- Tertiary = courier bag

Frozen Specimens: Serum or plasma specimens need to be frozen only if specifically stated in the specimen requirement. In these cases, it is essential to freeze the specimen as soon as it is separated from the cells. Always freeze specimens in plastic tubes unless specifically instructed otherwise. Glass tubes are not acceptable. Lay the tube in the freezer at a 45° angle to avoid tube breakage caused by expansion during freezing. Apply labels to the tube with ends overlapping to prevent detachment of label from tube during freezing. Submit a separate specimen for each test that must be frozen. Thawed samples are not acceptable for analysis. Indicate if the specimen is plasma or serum on both the specimen and the test request form.

Courier Service: The laboratory has a courier service that picks up specimens at physicians' offices in the area. This service also delivers laboratory reports. This occurs during the week except holidays. Couriers are also equipped with the necessary materials to ensure proper transport of specimens in compliance with standard guidelines.

Health and Safety Precautions

- Handle all specimens as if they are infectious. The greatest dangers to health care workers exposed to blood and body fluids are the Hepatitis B, Hepatitis C and HIV viruses.
- All specimens should be properly sealed prior to being transported. Leaking containers pose a health hazard. The courier will not accept any samples if the specimen container is contaminated or leaking.
- Do not submit needles attached to syringes. Specimens with needles attached will not be transported.

Errors in Orders and Misidentified Specimens

Errors in Orders: When an ordering error is discovered, call the laboratory immediately to avoid the expense of unnecessary testing and ensure the patient is credited. The following information is required:-

- **Patient name, location and identification number**
- **Date / Time of specimen collection.**
- **Test(s) and reason for cancellation.**
- **Name / title of person authorizing the cancellation.**
- **Name / title of person requesting cancellation (if different from above).**

The laboratory does not delete tests from the computer; unwanted tests are answered with an appropriate comment to provide a permanent record on the patient's medical record.

In the case where the specimen and the requisition cannot be "unequivocally associated" the laboratory, in the interest of patient safety and for reasons of legal liability, shall reject the specimen.

Mismatched Specimens

These are defined as specimens, which are submitted with a requisition on which the identifying information does not exactly match that which appears on the specimen. There may be a mismatch of either the first name or surname. For instance, the requisition may bear the patient's nickname while the specimen label, bears the patient's full name. (As an example, "Margaret" may be known as "Peggy" to her physician) or the requisition bear the patient's name in his native language while the specimen has the patient name using the English name. (As an example, "Mei Li" may also be known as "Melissa.) Or, the patient may be identified by a married name or hyphenated name on the requisition and by their maiden name on the specimen or vice versa.

In the instances noted above, the laboratory will contact the physician's office to verify that the requisition and specimen pertain to the same patient. The date, time and results of the conversation will be recorded and a note added to the requisition indicating that the change has been made, consistent with the physician's instructions. If no contact can be made with the physician, the laboratory should do the testing and add a disclaimer to the report to the physician, indicating that the specimen and requisition did not match and that the results of tests should be interpreted with care.

Unlabeled Specimens/No Requisition

Unlabeled specimens submitted without an accompanying laboratory requisition **will be rejected**. The laboratory may, if the physician can be identified, telephone the physician to inform him or her that unlabelled specimens have been received, without an accompanying requisition. **No test will be done and no report generated.**

Unlabeled Specimens/Requisition

Unlabeled specimens received with a laboratory requisition **will be rejected**. The laboratory should contact the **physician** to inform him or her that unlabeled specimens have been received with a requisition. The laboratory will not seek confirmation that the specimens are associated with the requisition. The receipt of unlabeled specimens with a requisition will be documented and **the laboratory report will indicate that no testing was done for the specimens.**

Labeled Specimens/No Requisition

The laboratory will **contact the physician**, if the physician can be identified, to inform him or her that labeled specimens have been received but without an accompanying laboratory requisition. The laboratory may, in consultation with the physician, develop a requisition and proceed with testing. Reports will be issued and the laboratory will forward the requisition to the physician for signature. **If the physician cannot be identified, the specimen will generally be rejected.**

Difficult to Collect and Irretrievable Samples

Procedures for difficult to collect or irretrievable samples are necessarily different from those for samples which may readily be recollected. The following listing is not exclusive but indicates those difficult to collect or irretrievable samples, to which special attention should be paid by both the physician and the laboratory:

- Histopathology / cytology specimens (other than PAP smears, urines and sputum)
- Synovial fluid
- Blood cultures in height of fever

- Biopsies
- Kidney Stones
- IUD's for culture
- CSF
- Samples from young children and special care baby units

For the above mentioned specimens submitted unlabeled, the laboratory may consider testing. The laboratory will **contact the physician's office or nursing unit**, if the identity of the physician can be determined, to advise that unlabeled specimens have been received. The laboratory should make no effort to verify the identity of the patient. An oral report of the results of testing of the unlabeled specimen will be provided but a note should be made on the written test report indicating that unlabeled specimens were received and test reports must be interpreted with caution. The written report may be released upon the request of the physician in consultation with the appropriate Consultant Pathologist.

Specimen Collection and Preparation

The quality of results from laboratory testing depends greatly on the proper collection and handling of the specimen submitted for analysis. Correct patient identifier, preparation, specimen collection, specimen packaging and transportation are essential factors; it is important that all specimens and requisitions be properly labeled with the name of the patient, date of birth, collection date, time and the origin (source or body site) of the specimen, when applicable.

If there is any doubt or question regarding the type of specimen that should be collected, it is imperative that the Hospital Laboratory be called to clarify the order and specimen requirements.

Specific specimen requirements for each determination, including specimen volume are provided in the Alphabetical Test Listings section. To avoid additional delay and inconvenience, please make sure that you have submitted at least the quantity specified for the rest requested.

NOTE: After the tube has been filled with blood, immediately invert the tube several times in order to prevent coagulation.

Specimen Collection Tubes:

Some tests require specific tubes for proper analysis. Please contact the hospital laboratory prior to patient draw to obtain the correct tubes as identified in the individual test listings.

Specimen Requirements: Specific specimen requirements for each test are provided in the test directory. Submit the quantity specified for each test requested. Tests will be canceled as “QNS” (Quantity Not Sufficient) when the sample volume is inadequate and will be indicated as such on the report. As a general rule, the volume of blood drawn should equal 2-1/2 times the amount of serum/plasma required. For example, to obtain 4mL serum or plasma, draw at least 10mL blood. When inappropriate or insufficient specimens are submitted, the laboratory will store them and contact the requesting facility to request that the specimen be recollected. Documentation of this action will appear on the report.

NOTE!! NOTE!! NOTE!! NOTE!! IMPORTANT!!

The ‘Minimum Specimen’ is not the quantity desired for routine work. The ‘Minimum Specimen’ is the smallest quantity from which results can usually be obtained.

THE “MINIMUM SPECIMEN IS FREQUENTLY NOT ENOUGH.”

If the patient has an elevated hematocrit, or if a dilution and repeat determination is necessary because of an elevated value, the minimum specimen is frequently not enough.

For routine work, it is helpful to have 50% to 100% more than the stated minimums **with the exception of blue top tubes.**

The “Minimum Specimen” is the answer to the question: “What is the least specimen which is usually adequate for a valid result?”

If the “substance” listed for the test is blood or any blood component (plasma, serum, platelets, erythrocytes, leukocytes), the volume given in milliliters for “minimum specimen” is the volume of whole blood needed.

Micro-specimen requirements are listed where applicable as the number of polyethylene micro-centrifuge tubes needed. These “micro tubes” have a capacity of 0.4 – 0.6 ml blood per tube.

Serum Separator Tubes: For **most** tests requiring serum, the laboratory recommends the use of serum separator collection tubes. However, **refer to the individual test for specific requirements** since certain tests preclude their use.

When using a serum separator tube, follow these instructions:

1. Perform venipuncture as with any other blood collection vehicle.
2. Invert the tube gently no more than five times (further inversion may cause alterations in sample integrity).
3. Do not remove the stopper at any time. If the blood cannot be transported to the laboratory expeditiously, allow the blood to clot for at least 15 minutes but not longer than 1 hour. Do not centrifuge immediately after drawing blood.
4. If you are processing the blood, centrifuge at 3000 rpm for at least 7 minutes.

5. Transfer the clear serum to a labeled plastic vial for transport to the laboratory.
6. Make sure the plastic vial is clearly labeled as being serum.

Coagulation Testing Requirements

Coagulation Collection to Obtain Platelet-Poor Plasma: For most coagulation tests and factor assays, use the following instructions. For individual requirements, refer to the specific tests. In order to produce valid results for coagulation tests and factor assays, specimen integrity is crucial and must be maintained. All specimens sent for testing must be collected in the following manner:

1. Obtain venous blood by drawing a clearing tube prior to obtaining the specimen. Draw the specimen in a light blue top sodium citrate tube. Avoid stasis and contamination of the specimen by tissue thromboplastin.
2. Mix blood with anticoagulant (3.2% or 3.8% buffered sodium citrate) by gentle inversion. Use 0.5mL sodium citrate for every 4.5mL blood. An exact ratio of 9 parts blood to 1 part coagulant should be maintained.
3. Blood should be transported to the laboratory as soon as possible.

Criteria for Rejection of Citrated Samples: Citrated samples will be rejected and the tests canceled under the following conditions:

1. The specimen is not labeled properly.
2. The sample is spilled or the tube is broken.
3. Abnormal results are found in a hemolyzed specimen.
4. A clot is found in the sample.
5. The tube is inadequately filled.
6. The hematocrit of the sample is 50% or greater. In this case, the sample must be redrawn, using an adjusted whole blood to sodium citrate ratio. In cases where the hematocrit is greater than 50%, contact the laboratory for instructions.

Blood Collection from Infants

Successful Heel sticks

Prewarm the heel. Everybody knows this but it's amazing how few actually use this technique on a regular basis. Exposure to a warm compress (no more than 42 degrees Celsius) for three to five minutes works miracles. Those who don't have time usually waste at least that much time milking the heel for a specimen that will probably be rejected anyway. Pre-warm the heel. It'll save you both some grief.

Keep the heel down. If someone is holding the infant, have them angle the baby partially upright so the feet are downward. When the feet are below the center plane of the body, gravity works to keep more blood in the capillary beds of the heel.

Point the puncture site downward. When you do a heel stick, do you end up with more blood on the heel than in the tube? If you point the puncture site downward to the floor you can collect every drop because the blood has nowhere to run but into the tube.

Work these techniques into your heel stick routine on a regular basis and the job of collecting neonate heel stick specimens will become much simpler. Your technique will yield a better specimen and be less traumatic for you and the infant.

Newborn Screening

Instructions for Specimen Collection

- To prevent specimen contamination, do not touch any of the filter paper circles before or after collection.
- Select puncture site and cleanse with 70% isopropanol.
- Use a sterile, disposable lancet with 2.0mm, or less, point to perform a swift, clean puncture.
- Keep the heel in a horizontal position (heel down) at or below heart level.
- Wipe away the first blood drop.
- Allow a second LARGE blood drop to form and apply to the surface of filter paper circle. If not completely filled, add a second LARGE drop immediately. NOTE: Heparinized capillaries can be used to apply blood to the filter paper. Apply blood immediately upon filling and do not touch the filter paper surface with the capillary. Do not use blood collection devices that contain EDTA.
- FILL all required circles. FILL from only one side of the filter paper. Circles must be completely filled when observed from both sides of the filter paper.
- Dry specimen at room temperature 3 – 4 hours in HORIZONTAL position.
- Forward the specimen to the lab within 24 hours.
- **IMPROPERLY COLLECTED SAMPLES WILL BE REJECTED.**
- If problems occur during collection, repeat collection using another form. Original form can be returned for replacement.

Tips for Newborn Screening Specimen Collection

- Complete each item on the newborn screening collection form.
- Closely follow the collection instructions on the back of the request form. (Reference: NCCLS Document LA4 – A2)
- Warm heel with a warm towel and hold the heel at or below the heart.
- Sampling after a feeding promotes better blood flow.
- Fill one circle at a time.

- If capillaries are used to transfer blood from heel to paper:
- Capillaries must be heparinized **(DO NOT USE EDTA)**
- Mix capillaries well before applying blood to filter paper.
- Apply blood to filter paper immediately after filling.
- Do not touch capillary to filter paper
- Forms should be returned to the laboratory within 24hrs. **Do not stockpile completed forms on the nursing unit.**

Urine Specimen Collection

Random

The normal composition of urine varies considerably during a 24-hour period. Most reference values are based on analysis of the first urine voided in the morning. This specimen is preferred because it has a more uniform volume and concentration, and its lower pH helps preserve the formed elements. Submit a first morning specimen whenever possible. Urine for pregnancy testing should be a first morning voiding, or a random specimen with a specific gravity of at least 1.010. Note the time of collection of the specimen on the test request form and on the label of the container. Submit urine for pregnancy testing in a plastic vial with no preservative. Refer to the Test Directory for specific analyte requirements. To reduce contamination, the specimen submitted for urinalysis should be a clean catch “midstream sample.”

24-Hour Urine Collection

Proper collection and preservation of 24-hour urine specimens is essential for accurate test results. Patients must be carefully instructed in the correct procedure. Refer to the Test Directory for specific analyte information.

Give a collection container and detailed instructions to the patient. If a urine preservative is required, it is important that the designated preservative be in the urine collection container at the start of the collection. Caution the patient that the preservative may be toxic and/or caustic and that it should not be spilled or discarded. Record any medication that the patient is receiving on the test request form. If the total 24 hour urine is not to be transported to the laboratory, mix the urine well, measure the volume of the 24-hour collection and record volume on both the test request form and the transport vial. Transfer the required volume into a plain urine transport vial. Add any additional required preservative and mix well.

Note: For those analyses requiring the addition of 6N HCl or other preservatives, add the preservative at the start of collection. Have the patient collect each specimen in a smaller container and carefully pour the urine into the 24-hour container to avoid any possible acid burns to the patient. **Be sure to mix urine thoroughly before removing the aliquot.**

Instructions to the Patient for 24-Hour Urine Collection

1. Do not discontinue medications unless instructed to do so by your physician. Inform the laboratory which medications you are taking.
2. Do not exceed your normal intake of liquids or change your dietary habits during the day before and the day of your collection unless your physician gives you specific instructions to do so.
3. Empty bladder (void) into the toilet on the morning of the collection day. Do not include the first urine specimen of the day. Note date and time on the container label.
4. Collect all subsequent urine voided for the next 24 hours and add to the container provided by the laboratory. The last sample collected should be the first specimen of the following morning at the same time as the previous morning's first voiding. Note date and time on the container label.
5. Keep the urine in a cool place. Refrigerate if possible.
6. Deliver to the BHB Laboratory promptly.
7. Preservative may have been added to this container. This may be caustic. Please be careful not to spill any of the preservative.

24-HOUR URINE PRESERVATIVE LIST

Test	Preservative	Special Instructions
Aldosterone	10 grams Boric Acid which may be added after collection is complete (especially if other tests requiring other preservatives are ordered)	Refrigerate specimen during collection if no boric acid is added
Arsenic	Acid washed container. Refrigerate specimen during collection.	Avoid work site collection. NO SEAFOOD for one week prior to and during collection. PH to be adjusted in Biochemistry Laboratory after collection.
Bence Jones Protein	No Preservative	Check patient's records and do a screen if this is first request. Some patients may be having regular testing done – do 24 hour collection
Calcium	Generally NO additive if ordered with non-additive tests. Can use specimen acidified with 25 ml 6N HCL	Will be acidified in Biochemistry Laboratory on completion of collection
Test	Preservative	Special Instructions
Citrate	20 ml 6N HCL	Adjustment of pH by biochemistry laboratory
Cortisol	12.5 ml 50% Acetic Acid OR 5 gm Boric Acid. Refrigerate	pH to be adjusted by Biochemistry Lab.

	specimen during collection.	
5HIAA (5-Hydroxyindoleacetic Acid)	25 ml Acetic Acid OR 0.5 ml 6N HCL. Refrigerate specimen during collection.	Dietary restrictions (see instruction sheet). Drug restrictions according to Doctor's instructions for 72 hours prior to during collection.
Heavy Metals (Arsenic, Lead, and Mercury)	Acid-washed container (Urine will be acidified in the Biochemistry Lab)	Avoid work site collection. NO SEAFOOD for one week prior to and during collection.
17-Ketogenic Steroids (Fractionated)	25 ml 50% Acetic Acid	For children 5 years and older , use 15 ml of 50% Acetic Acid
Lead	Acid-washed container	Avoid work site collection. Urine will be acidified by Biochemistry Lab
Mercury	Acid Washed Container	Avoid work site collection. Urine will be acidified by Biochemistry Lab
Metanephrines, fractionated	Refrigerator specimen during collection.	<u>Drug restrictions according to doctor's instructions for one week prior to and during collection.</u>
Osmolality	-----	Can be done with acidified specimens
Oxalate	20 ml 6N HCL	Patient should discontinue use of Ascorbic Acid (Vitamin C) pH adjustment done in Biochemistry Lab
Porphyrins	Refrigerate specimen during collection. Protect from light.	
Protein Electrophoresis	-----	-----
VMA (Vanillylmandelic Acid)	Refrigerate during collection.	Return to lab promptly to prevent container warming up. Drug restrictions according to doctor's instructions for one week prior to and during collection.

Laboratory Blood Sample Requirements

The quality and integrity of all samples collected for testing has a direct impact on the test results obtained. It is important that samples submitted for testing meet the specific predetermined requirements of tube type and sample volume.

NOTES

- Hematology and Transfusion DO NOT SHARE SAMPLES
- When ordering more than a CBC & ESR (3ml tube) take a second specimen.
- For a 'difficult' draw use a 2 ml tube. Never draw coagulation studies from an IV line
- Check IV Nurses for information on other clotting Disorder tests.
- It is essential that exact amount of blood is added to tube
- ALL DRUG LEVELS – Note time drawn and time of last dose
- Digoxin to be drawn minimum of 6 hours after last dose
- Gentamicin and Vancomycin indicate Peak, trough or random

Blood Sample Requirements

BLOOD TRANSFUSION EDTA LAVENDER TOP 5 ml	HAEMATOLOGY EDTA LAVENDER TOP 3 ml	HAEMATOLOGY SODIUM CITRATE LIGHT BLUE TOP 3 ml	BIOCHEMISTRY SERUM SEPARATOR GOLD TOP with Gel 5 mls	BIOCHEMISTRY SERUM SEPARATOR GOLD TOP with Gel 5 mls	CLOT ACTIVATOR RED TOP/Black disc and ALL tests in SST 4 ml	LITHIUM HEPARIN GREEN TOP/YELLOW disc 4 ml
Blood Group & Antibody Screen Blood Group & Hold XM Convertible Crossmatch	CBC (Hb, Hct, RBC, Platelets WBC and Diff) ESR Reticulocyte Count	Antithrombin III Activated Partial Thromboplastin Time (APTT) Coagulation Screen D DIMER	A:G Ratio ALT Albumin Alcohol Alk Phosphatase Amylase AST B12 BHCG Bilirubin Direct Bilirubin Total Bilirubin Neonatal	FreeT3 Free T4 GGT Glucose, Fasting Glucose, Random Glucose Tolerance HBAG (antigen) HBSB (antibody) HBCA (core ab) HCV (hep C) HIV Homocystein	(Note time drawn & time of last dose) Acetaminophen Dilantin Lithium Tegretol Gentamicin Peak Gentamicin Trough	TROPONIN (Green Top/Black Disc No Gel) 4 ml Blood Gases Venous Carboxyhaemoglobin (Li Heparin Syringe) Blood Gases Arterial
Cord Blood Evaluation	Sickle Cell	Fibrinogen	Blood Urea Nitrogen C3 C4 CA125 CA 153 CA199	Iron IgA iPTH LDH Magnesium Monospot PSA	Gentamicin Random Vancomycin, Peak	CSF STERILE TUBE KIT (4 tubes)
Antibody Titer (To Ref. Lab) Cold Agglutinins	*Glycosylated Hgb *Biochemistry	INR Prothrombin Time	Calcium Cardiac Profile Chemistry Profile	Phosphorous Prolactin Progesterone RHF Rubella T4 TSH	Vancomycin, Trough Vancomycin, Random Phenobarbital Salicylate	
Direct Coombs Test Kleihauer Betke	Hemoglobin Electrophoresis	Lupus Anticoagulant	Chloride CPK Cholesterol Clinic (UE, CRET, GLU URIC)	Testosterone Total Protein Triglycerides VDRL Vit D	Theophylline Valproic Acid	CSF Glucose CSF Protein
TRANSFUSE: Rhogam FFP Platelets Transfusion Reaction	Malaria Prep (Draw when pyrexial)	Protein C Protein S, Activated Protein C Resistance (APCR)	CRP hsCRP Cortisol dHDL ED Profile Electrolytes (Na, K+, Cl) Estradiol Ferritin Folate FSH	Na FLOURIDE & K OXALATE GREY TOP 4 mls Lactic Acid	(To be drawn minimum of 6 hours after last dose) Digoxin	FLUID: Sterile Container Albumin, Amylase, Bilirubin, Creatinine Glucose, LDH Na, K+, Cl Total Protein

Specimen Collection Procedures for Microbiology

General Information

Quality microbiology results depend on both the client and the laboratory. Successful isolation of potential pathogens is a factor of specimen selection and collection, proper transport and timely delivery as well as excellent microbiology practices within the testing laboratory. It is critical to refer to specimen submission requirements for specific cultures in the test directory to assure that appropriate transport media is used.

Test Request Form: Submit a completed Test Request Form for each culture requested. Information regarding the patient, the specimen, collection time and date, clinical history, symptoms and diagnosis, antimicrobial therapy (or use of any other chemotherapeutic agents) and any suspected organism(s) is essential for the optimal and appropriate processing of the specimen. **Clearly indicate the source and type of culture requested.**

Specimen Containers: Shipping containers, sterile specimen containers, transport media and swabs are available through the laboratory. Specimens are acceptable for processing only when collected and submitted in the appropriate container. Specimen containers must be tightened securely to obviate any leakage.

Labeling: Clearly print the patient's complete name (as listed on the test request form) on the culturette or other specimen transport media. (Labeling of only the outside container is not acceptable).

Transport: Deliver specimens to the laboratory within 24 hours. Prompt processing minimizes loss in viability of potential pathogens and insures a more accurate appraisal of flora present.

Results Reporting: Preliminary and final results for Microbiology are included on the patient report. Preliminary results will be called to the client on any positive, significant culture (e.g., blood, CSF, sterile body fluid and Salmonella or Shigella isolates) or stain. Other results will be called to the client if the client writes "Call Results" on the test request form and indicates a phone number to which results should be called. Results or interpretations of results may be obtained by contacting the laboratory.

Rejection Criteria: Unacceptable specimens may result in test cancellation or delay. The Client Services staff will contact the client with such information and will also document the fact on the report. Listed below are general causes of such action.

- Incomplete patient information on the test request form
- Missing source
- Improper or missing labeling on specimen
- Conflicting labeling information between the specimen and the test request form
- Inappropriate specimen for culture requested
- Improper specimen container or transport media
- Leaking or spilled containers

- Specimen age

Antibiotic Susceptibility Testing

Antibiotic susceptibility testing will be performed using the automated Vitek Antimicrobial test system which is an automated test methodology based on the MIC technique

Antibiotic susceptibility testing will be also be performed using the disk diffusion test (disks impregnated with the specific concentration of the desired antibiotic are placed on the surface of an inoculated Mueller Hinton Agar plate). If the organism is susceptible, the microbial growth around the periphery of the disk is inhibited. If the organism is resistant, growth is not inhibited. The zones of inhibition are measured, correlated with minimum inhibitory concentration (MIC) values, and compared to CLSI interpretive criteria to determine the degree of susceptibility.

Occasionally, for very resistant organisms or for pathogens not defined by the CLSI guidelines, results will be reported using the ETEST method. The method employs a plastic strip which contains a predefined and continuous antibiotic concentration gradient.

The results for these three testing methods will be reported as sensitive(S) intermediate (I) or resistant(R)

The selection of antimicrobial agents for testing and reporting depends on the resistance patterns (antibiograms) of microorganisms, availability of different microbial agents in the drug formulary, clinical efficacy and indication of antimicrobial agents.

A complete list of antimicrobial agents currently tested can be obtained from the laboratory.

Investigation of Catheter Tips

Thoroughly disinfect the skin, remove the catheter and place in a sterile pot and transported to the laboratory as soon as possible.

Ear Swabs

Ear swabs are collected for the diagnosis of otitis externa and otitis media.

Specimens should be collected using a sterile swab before the administration of antibiotics and sent to the laboratory within two hours .If a there is a delay in transport the specimen should be refrigerated.

Eye Swabs

Eye, conjunctiva or eyelid swabs are collected for the diagnosis of conjunctivitis is and blepharitis. Specimens should be collected using a sterile swab and sent to the laboratory as soon as possible. If a there is a delay in transport the swabs should NOT be refrigerated but left at room temperature.

Tissues and Biopsies

Investigation of tissue and biopsy specimens is indicated for chronic or deep seated infections and burn specimens.

Using sterile equipment, collect the specimen according to the Wound Care Tissue Collection Protocol. Tissue biopsies must be sampled from the leading edge of the wound after debridement.

Specimens should be sent to the laboratory as soon as possible.

Urinalysis

The laboratory provides a two step approach to urinalysis:

1. Macroscopic examination using reagent strips and the Clinitek 500 urine chemistry analyzer, which is a semi automated instrument designed to read Bayer Reagent strips.
 - a. The tests analyzed are Glucose, Bilirubin, Ketone, Specific Gravity, Blood, PH, Protein, Urobilogen, Nitrite, Leukocyte, Color and clarity are also reported.
2. Microscopic examination is performed using an inverted microscope and micro well trays. 10 fields are examined and an average or grading is reported.
 - a. Formed elements seen and reported in the urinary sediment are Epithelial Cells, Leucocytes, RBCs Casts, Crystals, Spermatozoa, Yeast, and Parasites.

First morning or random collected urine is the specimen of choice, specimens should be at room temperature no longer than two hours before testing. The urine should be collected in a sterile screw cap container. If there is a delay in transport the specimen should be refrigerated.

Antinuclear Antibody

The ANA.Hep-2 test System is an indirect fluorescent antibody test for the qualitative detection of antinuclear antibodies in sera of patients with SLE and other connective tissue disorders.

Fresh drawn serum, free from anticoagulants or preservatives should be used for this assay-red top tube.

The test is batched on Tuesday and Thursday and is resulted as negative (at a screening concentration of <1:40) or positive (for titers >1:40)

For patients who have a positive screening test, the serum is sent to the reference laboratory for titer and staining pattern.

Helicobacter Pylori

This is a rapid latex agglutination for the qualitative detection of Helicobacter pylori total antibodies. The test is batched on Tuesday and Thursday and is reported as positive or negative.

A normal venous blood sample should be taken and the serum separated.-red top tube.

Syphilis Serology

Syphilis serology screening is performed using the TPPA test-a passive particle agglutination test for the detection of antibodies to Treponema pallidum and the RPR test which detects an antibody-like substance presence in the sera of syphilitic patients. A titer for this test is performed if the screen is reactive.

If either or both the screening tests are reactive then an FTA confirmatory test is performed which also tests for antibodies to Treponema pallidum by indirect immunofluorescence.

These tests are batched on Tuesday and Thursday

A normal venous blood sample should be taken and the serum separated-red top tube.

RPR Visa

RPR Test run for immigration requirements.

A normal venous specimen is required-red top tube.

Rotavirus Detection

This is a rapid latex agglutination for the detection of Rotavirus antigen in stool specimens.

Stool specimens collected within the period of 3-5 days after the onset of symptoms are required in sterile screw top containers.

Results are reported as reactive or non-reactive.

CULTURE TYPES AND GUIDELINES

Complete a Test Request Form, indicating the specific source of the specimen, diagnosis and organisms(s) suspected. Label the specimen appropriately. Record the date and time the specimen was collected.

Blood Cultures

The detection of microorganisms in blood has great diagnostic and prognostic importance. A completed test request form (particularly time of collection, diagnosis, and antimicrobial therapy) is essential for timely and appropriate laboratory processing of the specimen. Both the request form and the specimen must have the collection site noted. It has been recommended that two sets be taken for diagnosis of infection, each set from a different site

Routine adult blood culture collection consists of two sets of blood cultures. The first set consists of two BACTEC bottles (one for aerobic and the other for anaerobic cultures), taken from a single venipuncture site. The second set consists of an aerobic bottle and anaerobic bottle. Also taken from a separate site

For infants, two sets of blood cultures are drawn. Each set consists of a single aerobic BACTEC paediatric bottle.

All organisms isolated from blood cultures will be identified, and susceptibility tests are performed, if appropriate, and stock cultures are made, with the exception of an isolate considered to be a skin contaminant. Stock cultures will be held for one year.

Unless otherwise indicated (not isolated from other sites), single cultures/sets of the following organisms should be considered contaminants:

- Bacillus species
- Corynebacterium species
- Micrococcus species

- Propriobacterium species
- Coagulase-negative staphylococci

Minimal identification is required to rule out non-pathogenic species. Susceptibility results are not required.

Collection Requirements for Blood Cultures

1. Each set of blood cultures should be drawn from a separate venipuncture site or at different times.
2. Disinfect IV site with 2% w/v Chlorhexidine Gluconate and 70% v/v Isopropyl Alcohol Swab (apply in a circular motion from procedure site outward), and allow area to dry.
3. Remove protective plastic cap from each BACTEC bottle and disinfect the rubber septum with 70% alcohol only. Allow to dry.
4. Use the butterfly blood culture system to collect blood directly into bottles. This system can then be used to draw other blood vials (e.g., CBC).
5. To identify collection sets, label bottles with
 - Patient's first and last name
 - Chart number
 - Date, Time, and Collection Site

Blood Volume Requirements

1. There are five types of BACTEC media bottles: *Aerobic*, *Anaerobic*, *Aerobic plus* and *Anaerobic plus (for patients on antibiotics)* and *Paediatric*.
2. The Paediatric optimal draw is 1 – 3 mL per bottle, with 0.5 – 5 mL per bottle being the outer limits.
3. Adult optimal draws are 8 – 10 mL per bottle. If you are unable to draw 16 – 20 mL total, distribute blood as follows:

TOTAL BLOOD VOLUME	VOLUME FOR AEROBIC BOTTLE	VOLUME FOR ANAEROBIC BOTTLE
16 – 20 mL	Split equally	Split equally
13 – 16 mL	8 mL	5 – 8 mL
10 – 12 mL	5 – 7 mL	5 mL
5 – 9 mL	Entire amount of blood	NONE

- **DO NOT** put amounts in excess of 10 mL into a bottle as false positive readings may occur.

Timing of Blood Collection (Blood Cultures)

1. Adults – Routine Collection – both sets can be taken at the same time from different sites before therapy is initiated.
 - Both sets consist of aerobic and anaerobic bottles
2. Adults – Query Subacute Bacterial Endocarditis (SBE) or *Brucella* spp. The three sets need to be taken within 24 hours at the start of a fever, from different IV sites, before therapy begins.
 - The first set consists of aerobic and anaerobic bottle.
 - Second and third set consist of aerobic and anaerobic bottle- also, usually 30 minutes apart ideally from at least two different sites
3. Paediatric – Routine Collection – Two single paediatric bottles collected from two different sites before therapy begins.

Transport of Blood Cultures

Specimens should be transported to the laboratory as soon as possible and loaded into the BACTEC 9240 instrument. **NOTE: If a delay in transport or processing is anticipated, DO NOT refrigerate the bottles – leave them at room temperature.**

Special Requests for Blood Cultures

1. Acid-fast Bacilli

- *Specialty Laboratory* supplies Isolator “Isostat” tubes (preferred) for whole blood culture collection and transport. SPS (yellow top blood tubes) or heparin (green top) are also acceptable.
- Collect one Isolator a day for 3 consecutive days.
- Send each specimen separately to *Specialty* within 24 hours of collection. Do not hold first and second specimens until third specimen is collected.
- Ship whole blood specimens at ambient temperature.

2. Fungus Culture

- *Specialty Laboratory* supplies Isolator “Isostat” tubes (preferred) for whole blood culture collection and transport. SPS (yellow top tubes) or heparin (green top) are also acceptable.
- Collect one Isolator tube only for fungal culture.
- Send all specimens to *Specialty* within 24 hours of collection.

- Ship whole blood specimens at ambient temperature.
- 3. When other special infectious pathogens in blood are suspected, such as Bartonella, Brucella, and Cytomegalovirus (CMV), please contact the laboratory for special collection procedures.**

4. Line Sepsis Investigation

Investigation of Central Venous Catheters (CVC) for sepsis is based on differential positivity times, a method described by Blot, et. al. This compares cultures drawn from the CVC with cultures drawn from a peripheral vein. The earlier the CVC culture becomes positive compared with the peripheral culture, the higher the probability that catheter-related sepsis exists. One set from the line in question and one set peripherally

5. Subacute Bacterial Endocarditis (SBE)

- When SBE is suspected, the BACTEC culture incubation period is extended from 5 days to 14 days.

6. Sterile Fluids

- Sterile fluids should be collected and transported to the laboratory in clean, sterile containers. Occasionally, sterile fluid may be received in BACTEC bottles. These specimens are processed in the same manner as a blood culture.

Urine Cultures

Urine Culture Specimen Collection

Submit specimens in a sterile urine container. Indicate whether the specimen is from a mid-stream urine collection or is a catheterized specimen.

Patient Collection Guidelines: Clean Catch

Female	Prepare a sterile gauze pad for washing by wetting it and placing a small amount of soap on the surface. Prepare two more sterile gauze pads for rinsing by moistening. Finally, open a fourth gauze pad, but do not moisten. Wash the vaginal area from the front to the back, using the soapy gauze pad. Discard the gauze in the wastebasket. Rinse the area from front to the back, using the first moistened pad and then the second. Dry the area from the front to the back with the dry gauze pad. Lean slightly forward so that the urine flows directly down the toilet without running along the skin. After voiding the first portion of the urine, place the clean container under the stream of urine and collect the rest of the urine into the container. Transfer immediately into the urine culture transport tube.
Male	Prepare a sterile gauze pad for washing by wetting it and placing a small amount of soap on the surface. Prepare two more sterile gauze pads for rinsing by moistening. Finally, open a fourth gauze pad, but do not moisten. Use the soapy gauze pad to wash the end of the penis. Rinse, using first one moistened gauze pad and then the other, discarding them in the wastebasket. Use the fourth gauze pad to dry. Begin to urinate into the toilet. After voiding the first part, place the clean container under the stream of urine and collect the rest of the urine into the container. Transfer immediately into the urine culture transport tube.

Patient Collection Guideline: Indwelling Catheter

Obtain the specimen with a needle and syringe. Select the puncture site 1-2 inches away from the catheter tube entry point. Cleanse the area to be punctured with 70% alcohol. Aspirate exactly 5mL of urine with a sterile needle and syringe. Disinfect the rubber stopper and aseptically transfer the specimen to the urine transport tube provided. Specimens obtained from the collection bag are not suitable for analysis. Foley tips will **not** be accepted.

Specimen Labeling:

- Label the specimen with patient information – patient first and last names and date of birth.
- Indicate on the request form whether the patient is symptomatic and/or taking antibiotics. This information is critical to quantitative culture interpretation, especially urine specimens with low colony counts.

Urine Culture Transport

- Refrigerate the urine if it cannot be delivered to the laboratory within 30 minutes of collection.
- Place the specimen in the laboratory refrigerator if no one is in the laboratory to receive the specimen.

Comments:

- Do not disconnect the catheter from the catheter bag to collect the specimen, and never submit the bag contents for culture.
- Urine from pediatric bags must be cultured immediately to minimize interference from contaminants.
- Patients with indwelling catheters will probably be colonized after 48 to 72 hours, often with multiple isolates.
- The laboratory must know whether the urine is collected by any method that might introduce contamination: for example, collection at home in an unconventional container, unknown collection method (e.g., from nursing homes, etc).
- A pooled, 24 hour collection of urine is unacceptable for culture, as is more than one specimen per 24 hours.
- Routine urine samples are unacceptable for anaerobic cultures.

Respiratory Cultures

The following sites are considered respiratory specimens: nasopharyngeal swabs, sputum, bronchial and tracheal aspirations, bronchoalveolar lavage (BAL). All specimens from these sites will be screened for fast-growing aerobic pathogenic organisms.

The following organisms are examples of those not isolated by routine culture: *Neisseria gonorrhoeae*, *Corynebacterium diphtheriae* and *Bordetella species*. Specimens from the nose are the only respiratory specimens routinely screened for *Haemophilus species*. For information on culture of non-routine organisms, see the culture listing for the specific organism.

Upper Respiratory Tract Infections

Throat – (pharyngeal specimens)

These specimens are submitted primarily for the detection of group A Streptococci.

N. gonorrhoeae – Culture for this organism is not included in routine testing. Indicate this special request on the requisition and send to the lab as soon as possible. This organism will die at refrigerator temperature.

For suspected pathogens other than Streptococci. – Indicate the suspected pathogen on the request form. For example, *Haemophilus spp*, which may be reported in pediatric patients when requested, although they are part of the normal flora in children and adults.

Do not obtain throat samples if epiglottis is inflamed, as sampling may cause serious respiratory obstruction. The specimen of choice is blood for culture.

Depress tongue gently with tongue depressor.

Extend sterile swab between the tonsillar pillars and behind the uvula. (avoid touching the cheeks, tongue, uvula, or lips.)

Sweep the swab back and forth across the posterior pharynx, tonsillar areas, and any inflamed or ulcerated areas to obtain sample.

If transport is to be delayed beyond 1 hour, refrigerate the swab.

Nasal Cultures

Nasal swabs are submitted for the detection of staphylococcal carriers (MRSA).

Nasal cultures do not predict the etiologic agent of sinus, middle ear, or lower respiratory tract infections and should not be submitted in lieu of specimens from these sites.

Anaerobic cultures are not done on nasal specimens.

Insert a sterile swab into the nose until resistance is met at the level of the turbinates (approximately 1 in into the nose).

Rotate the swab against the nasal mucosa.

Repeat the process on the other side using same swab.

Transport to the specimen to the laboratory as soon as possible.

Nasopharyngeal Specimens

Submitted primarily for the detection of carriers of *N.meningitides* and to diagnose *Bordetella pertussis*.

A special transport medium is necessary if whooping cough is suspected. Contact the laboratory for a *Bordetella pertussis/parapertussis* evaluation kit. **DO NOT REFRIGERATE AFTER INOCULATION.** Specimen must arrive no later than 2pm. to ensure prompt transportation to the reference laboratory.

Specimens must be taken in a way that avoids contamination with the nasal or oral flora.

Carefully insert a flexible-wire calcium alginate-tipped swab through the nose into the posterior nasopharynx, and rotate the swab. (Keep the swab near the septum and floor of the nose.)

Transport the specimen to the laboratory quickly.

Oral Cultures

Used to culture for yeast and to prepare smears for the detection of fusospirochetal disease.

Rinse mouth with sterile saline.

Wipe the lesion with dry sterile gauze.

Swab or scrape areas of exudation or ulceration.

Lower Respiratory Tract Infections

Expectorated Sputum

Specimen quality is judged microscopically:

Lower respiratory tract secretions from infected patients are confirmed by noting the presence of large numbers of leukocytes in the absence of epithelial cells. Since epithelial cells in the specimen signals gross contamination with the oropharyngeal flora, only specimens which represent infection will be cultured.

The first, early-morning specimen is preferred. Pooled specimens are not recommended for culture.

Anaerobic studies of sputum are not done.

For the diagnosis of **fungal** or **mycobacterial** disease, separately process three consecutive early-morning specimens.

If possible, have the patient rinse mouth and gargle with water prior to sputum collection.

Instruct the patient not to expectorate saliva or postnasal discharge into the container.

Collect specimen resulting from deep cough into a sterile screw-cap cup or other suitable sterile collection assembly.

Induced Sputum

Using a wet toothbrush, brush the buccal mucosa, tongue, and gums prior to the procedure.

Rinse the patient's mouth thoroughly with water.

Using an ultrasonic nebulizer, have the patient inhale approximately 20 to 30 ml of 3 to 10% 0.85% NaCl.

Collect the inducted sputum in a sterile screw-cap cup or other suitable sterile collection assembly.

Tracheostomy and endotracheal aspirations

Tracheostomy is followed by colonization with 24 h of insertion of the tube. Results must be correlated with clinical findings such as fever or infiltrate on chest X-ray.

Aspirate the specimen into a sterile sputum trap.

Transport the specimen to the laboratory quickly.

Bronchoscopy –Bronchial Washing

Bronchial wash and bronchoalveolar lavage specimens are generally obtained before brushing or biopsy specimens to avoid excess blood in the recovered fluid.

Bronchial brushings are preferable to washings because the washings are more dilute.

Most bronchoscopy specimens are *not* cultured for anaerobes. Consult the laboratory if testing is required.

Collect the specimen via bronchoscope.

Specify the culture to be done: routine, acid-fast bacillus, or fungal.

Transport the specimen to the laboratory quickly.

TB PCR Test

TB PCR test is available to provide rapid confirmation for the presence of *Mycobacterium tuberculosis*. This test is intended only for patients with signs and symptoms of pulmonary TB and can only be used on respiratory specimens.

Please contact the microbiology department if this test is required. The result will normally be available the same day Monday –Friday.

Wound Cultures

The name of a specific anatomic site is required. General terms like “wound”, “eye”, and “ear” are inappropriate for describing a specimen source.

The quality of a wound culture can be assessed by Gram stain. The presence of epithelial cells indicates contamination with skin flora and may invalidate the significance of culture results.

Skin decontamination is critical to proper culture interpretation.

Unruptured abscess – Do *not* swab. Decontaminate the skin overlying the abscess, and aspirate abscess contents with a syringe. After excision and drainage, submit a portion of the abscess wall for culture.

Open lesions and abscesses – The specimen of choice is taken from the advancing margin of the lesion. Remove as much of the superficial flora as possible by decontaminating the skin. Remove exudate, and firmly sample the margin of the lesion with a swab.

Burn wounds – Debride the area, and disinfect the wound. As exudate appears, sample it firmly with a swab. Submit for aerobic culture only. Submit biopsy tissue as the specimen of choice. Surface specimens usually represent only colonization.

1. Transport the specimen to the laboratory quickly.
2. Refrigerate the specimen if it is not cultured within 1 hour.

MRSA Swabs

1. See Infection Control Procedures for guidelines on screening patients and frequency of testing.
2. Appropriate swabs include nasal swabs and swabs from open wounds. Indicate wound source.

VRE Swabs

1. See Infection Control Procedures for guidelines on screening patients and frequency of testing.
2. Rectal / perineal swabs, stool specimens are collected to screen for VRE.

Genital Cultures and Specimens

It is recommended that *Chlamydia* tests be ordered with each *N.gonorrhoeae* request, since the two infections often occur together.

Anaerobic studies are limited to certain specimens: Placenta from cesarean section, Uterus (endometrium), Culdocentesis, Fallopian tube, Cervical aspirate, Ovary, and Bartholin's gland.

Vaginal Cultures

For the detection of yeast, vaginitis, vaginosis, and *Trichomonas*.

Specimens are also useful in the detection of group A streptococci in children

Collect secretions from the mucosa high in the vaginal canal with sterile pipette or swab.

Cervical / Endocervical Cultures

For the recovery of *N.gonorrhoeae*.

Contamination of cervical or endocervical specimens with vaginal secretions will interfere with the recovery of *N.gonorrhoeae*.

1. Specimens to be cultured for GC must be cultured immediately. Transport to laboratory as soon as possible.
2. Do *not* refrigerate the specimen
3. Gram stain cannot be used effectively in women to detect *N.gonorrhoeae* in cervical specimens. Other organisms that morphologically mimic this agent are present.

Urethral Swab

Cultured for GC only

Do not refrigerate the specimen.

Transport to the specimen to the laboratory immediately.

Diagnosis of GC in males can often be confirmed by Gram stain of urethral exudates.

Pelvic Inflammatory Disease (PID)

Specimens are all collected by invasive techniques. Peritoneal fluid may be collected from the cul-de-sac by aspiration through the posterior vaginal vault (culdocentesis). Material taken directly from the fallopian tubes or ovaries is collected surgically.

Intrauterine Devices (IUD)

These devices are removed surgically to prevent cervical or vaginal contamination. Place the entire device, including any exudates, into a sterile container for transport to the laboratory.

Device will be Gram stained for the presence of *Actinomyces species* only

Group B Streptococci Screening

1. One swab from vaginal introitus and anorectum.
2. Cervical cultures are not acceptable and a speculum should not be used.
3. Indicate on requisition: Screening for Group B requested.

GEN-PROBE® APTIMA® Molecular Assays for Chlamydia trachomatis and/or Neisseria gonorrhoeae

The Gen-Probe assay is run daily and resulted as positive, equivocal or negative for each organism

Collection Kit for Endocervical and Male Urethral Swab Specimens

See directions on swab packaging.

1. After collection, transport and store the swab in the swab specimen transport tube at 2° to 30°C until tested.
2. Specimens must be assayed within 60 days of collection. If longer storage is needed, store at –20° to –70°C for up to 90 days of after collection.

Collection Kit for Male and Female Urine Specimens

See directions on swab packaging.

1. After collection, transport and store urine specimen transport tube at 2°C to 30°C until tested.
2. Processed urine specimens should be assayed within 30 days of collection. If longer storage is needed, store at –20° to –70°C for up to 90 days of after collection.
3. Urine samples that are still in the primary collection container must be transported to the lab at 2°C to 30°C. Transfer the urine sample into the APTIMA urine specimen transport tube within 24 hours of collection. Store at 2°C to 30°C and test within 30 days of collection.

Semen

1. Call Laboratory for an appointment to bring in specimens. Appointments are available Monday to Thursday between the hours of 9:30 and 12 noon.
2. Specimens must arrive **within one hour of collection** and must be handed directly to lab personnel.
3. All samples must be labeled with full name, date, and time of collection.
4. ****Three days of sexual abstinence is required prior to obtaining specimen to ensure adequate sample****

Sterile Body Fluids (excluding CSF, Urine, and Blood)

1. Collect the specimen using strict aseptic technique.
2. Do not send aspirates to the lab in a syringe.
3. Inform laboratory of all pending CSF procedures.
4. Transport all fluids to the lab quickly.

CSF

1. Notify laboratory of pending procedure.
2. The specimen is collected by the physician. Suggested volumes are 1, 2, and 2ml for routine, fungal, and mycobacterial cultures, respectively.
3. The microbiology laboratory gets it first and distributes to relevant departments.
4. Hand carry the specimen to the laboratory.
5. Do *not* refrigerate the specimen. If there is any delay in transport, maintain the specimen at room temperature.

Fecal Specimens and Cultures

Stool Cultures

Submitted primarily for the detection of *Campylobacter*, *Shigella*, and *Salmonella* species and when specially requested, to detect *Yersinia*, *Vibrio*, and enterotoxigenic *Escherichia coli*.

The specimen of choice is a diarrheal stool. (acute stage of illness). A rectal swab for bacterial culture must show feces. Generally, swabs are recommended only for infants.

For bacterial pathogens, collect and submit three specimens, one each day for three days. A single stool specimen may not exclude bacterial pathogens as a cause of diarrhea.

Keep stool specimens cool; do not incubate them.

Do not use toilet paper to collect stool. Toilet paper may be impregnated with barium salts, which are inhibitory for some fecal pathogens.

Have patient obtain stool specimen by one of the following methods

Pass stool directly into a sterile, wide-mouth, leak proof container with a tight-fitting lid.

Pass stool into a clean, dry bedpan, and transfer stool into a sterile leak proof container with a tight-fitting lid.

Parasitology

Screening for the detection of *Entamoeba histolytica/dispar*, *Giardia lamblia* and *Cryptosporidium parvum*

Only one fresh, un-fixed stool specimen needed for this EIA method.

Stool specimens should be received in an airtight container and stored at 2° - 8°C until tested.

Complete Parasitological Examination

Complete examination of stool specimens will be done on patients with a history of foreign travel and patients with unresolved illness. Contact the laboratory if further testing is required.

For complete examination, three specimens collected every other day or every third day should be adequate. A single stool specimen may not exclude parasitic pathogens as a cause of diarrhea. Specimens for parasitic examination collected too soon after administration of barium oil, magnesium, or crystalline compounds are unsatisfactory. Delay specimen collection a minimum 5 days after administration of these agents.

If transport to the laboratory is delayed, place stool specimen in preservative.

Pin Worm Examination

Using Cellophane tape, obtain a sample from the perianal area when the patient gets up in the morning before patient bathes or defecates.

Send to laboratory as soon as possible.

Clostridium difficile Antigen and Toxin Evaluation

- Only fresh or freshly frozen unfixed stool specimens may be evaluated using this kit.
- Testing for *C.difficile* should not be carried out on formed stools.
- Children less than or equal to 1 year of age should not be tested, as it can be normal flora in this age group.
- Stool specimens should be received in airtight containers and stored at 2°-8°C until tested.
- Undiluted specimens (no preservatives) should be tested as soon as possible. If testing cannot be accomplished within 72 hours after receipt, they may be stored frozen at -20°C until tested.
- Specimens submitted from patients within 7 days of negative test should not be tested. Specimens submitted within 4 weeks of a positive test will not be tested
- A minimum amount of 1 ml of stool is required for the procedure.
- Specimens will be initially be tested for the antigen. Specimens testing positive for the antigen will then be tested for toxin to distinguish between toxogenic and non toxogenic strains.

MRSA

The PCR system for molecular testing for MRSA provides rapid results for the detection of MRSA in nasal samples.

This test can only be used for nasal screening using white swab and should be used to screen for MRSA on admission, ICU screening and those exposed to MRSA who have not been isolated. The white topped swabs should NOT BE USED FOR ANYTHING OTHER THAN NASAL PCR SWABS

Culture swabs with blue tops should be used for all wounds to check MRSA status after decolonisation and to monitor known MRSA positive patients.

Testing times.

Saturday-cultures will be done and results reported on Monday

Sunday-specimen will be processed by PCR on Monday

Monday-Friday-the run will be processed late afternoon. However if urgent please contact the microbiology department to facilitate your needs.

Virology Specimens

Specimens should be collected with 4 days after onset of illness, as virus shedding decreases rapidly after that time.

1. M4 Transport Medium (a liquid medium) is available in the Microbiology laboratory and can be used for either viral or *Chlamydia* isolation. After collection, immerse swab immediately into the M4 transport medium to stabilize the virus and inhibit undesirable fungal overgrowth.
2. After placing swab in transport tube, break off the top so the cap will fit tightly.
3. Fill out Microbiology requisition with specimen source and request specific viral pathogen.
4. Send to laboratory immediately.
5. Do not use calcium alginate swabs or swabs with wooden shafts.

RSV Respiratory Syncytial Virus Antigen Detection

1. Obtain RSV collection kit from the Microbiology lab.
2. Alert Microbiology staff that samples have been taken.

Mycology (Fungal Specimens)

1. Hair – plucked hairs including the root are needed, not cut pieces. Submit to lab in a clean dry sterile container.
2. Skin – scrapings from the active margin of the lesion or a general scrape of the scaly area, if there is no active edge.
3. Nail – nails should be cleansed with 70% alcohol and then scraped deeply enough to obtain recently invaded nail tissue. Collect debris from *under* the nail, and place debris in a clean dry sterile container.
4. Do *not* refrigerate the specimen. Submit at room temperature
5. For systemic infections, consider the need for acute and convalescent-phase sera.
6. Always sample the peripheries of skin lesions.
7. Biopsy material must be kept moist by being placed between pieces of sterile, moistened gauze.
8. Swabs are usually *not* recommended for collecting fungal specimens except when swabbing the vaginal for yeasts or swabbing sporotrichotic chancres.

Cytology Specimen Collection Procedures

The Cytopathology Department processes and analyzes gynecologic and non-gynecologic specimens using microscopic review of cellular elements. The microscopic examination includes review for

- Malignant cells
- Precursors of carcinoma (dysplasia, hyperplasia)
- Benign atypia due to inflammation, drug reactions, radiation reactions, etc.
- Microbiologic elements (parasites, fungi, viral changes, bacteria)
- Other incidental findings (e.g., asbestos bodies, crystals, psammoma bodies, casts, etc)
- Maturation index, when indicated

Requesting and Sending Cytology Specimens to the Laboratory

Completing Laboratory Test Requisition Forms

All specimens must be submitted for testing with a completed requisition form. Please provide any pertinent information legibly. The following information must be included on the request form:

- First and last name of patient
- KEMH chart number (when available)
- Date of birth
- Date and time of specimen collection
- Relevant clinical history
- Source of specimen (e.g. cervix, endocervix, neck)
- LMP for gynecologic specimens
- Collection Method (e.g., voided urine, fine needle aspiration)
- Number of specimens submitted
- Ancillary test request (e.g., HPV, Chlamydia, Gonorrhea, special stains for microorganisms)
- Signature of ordering physician

Specimen Labeling Requirement

Labeling of Slides

- 1) Slides should be clearly labeled to ensure correct identification **before** the sample is applied.

- 2) Labeling must be done with a **lead pencil** on the frosted end of the slide. **DO NOT USE BALL POINT PEN, PERMANENT MARKER, OR WAX PENCILS, AS IT WILL WASH OFF DURING PROCESSING.**

<p>Label</p> <p>name, source</p> <p>Also, fixed on the corner, fixed dried labeled</p>	<table border="1"> <tr> <td style="padding: 5px;">Smith, D Rt. Breast Cyst (WF)</td> </tr> <tr> <td style="height: 100px;"></td> </tr> </table>	Smith, D Rt. Breast Cyst (WF)		<table border="1"> <tr> <td style="padding: 5px;">Smith, D Rt. Breast Cyst (AD)</td> </tr> <tr> <td style="height: 100px;"></td> </tr> </table>	Smith, D Rt. Breast Cyst (AD)		<p>the slide with the patient's last first initial, and of specimen.</p> <p>indicate a spray slide with a 'WF' bottom right denoting a wet preparation. Air slides must be with 'AD'</p>
Smith, D Rt. Breast Cyst (WF)							
Smith, D Rt. Breast Cyst (AD)							

Labeling of Specimens

1. All specimens are to be clearly labeled to ensure correct and complete identification. All specimens should be labeled with
 - Patient's full name
 - Date of birth
 - KEMH chart number
 - Date and time of collection
 - Source of specimen
 - Clinician's initials
2. Specimen containers must be fluid proof and puncture resistant.
3. Material collected from different sites must be submitted in different specimen pots, specifying the sites. (e.g., Right Breast FNA at 12:00 [pot #1], and Rt Breast FNA at 3:00 [pot #2])
4. Place the specimen in a biohazard specimen bag, sealing the zip lock securely for transport.

Rejection of Specimens

Specimen rejection criteria for cytologic specimens include:

1. No patient identification on slide or specimen pot/vial
2. Specimen pot/vial has illegible patient name
3. No specimen received with the requisition form
4. Slide broken beyond repair
5. Name on specimen pot/vial and requisition form do not match
6. Specimen pot/vial labeled with last name only

7. Insufficient patient/clinical information
8. Gynecologic specimens collected in less than 12 weeks after a prior pap test
9. Improper preservation/fixation of specimen

Specimen Collection for Gynecologic Specimens

Proper sample collection is the first step in ensuring the best result possible. The preferred method of collection for gynecologic specimens is the ThinPrep Pap Test. The range of clinical benefits of this method include increased disease detection, improved specimen adequacy, reduction of equivocal diagnoses, and the ability to perform additional tests out of the same vial, such as HPV and Chlamydia/Gonorrhea.

Equipment/Materials

ThinPrep® Pap Test Collection Vials (Contains PreservCyt® Solution)
ThinPrep® Pap Test Collection Devices (Plastic Spatula and Endocervical Brush)
Biohazard Specimen Bags
Cytopathology Requisition Forms

**These materials can be obtained from the Cytopathology Department, x1382.

Procedure

- 1) Obtain an adequate sampling from the ectocervix using a plastic spatula.
- 2) Immediately rinse the spatula as quickly as possible into the ThinPrep® vial by swirling the spatula vigorously in the vial 10 times. Discard the spatula.

Obtain an adequate sampling from the endocervix using an endocervical brush. Insert the brush into the cervix until only the bottom most fibers are exposed. Slowly rotate $\frac{1}{4}$ or $\frac{1}{2}$ turn in one direction. DO NO OVER ROTATE.

Rinse the brush as quickly as possible in the ThinPrep® vial by rotating the brush in the solution 10 times while pushing against the vial wall. Swirl the brush vigorously to further release the material. Discard the brush.

Tighten the cap so that the torque line on the cap passes the torque line on the vial.

Record the patient's name and chart number on the vial. When a chart number is not available, record the patient's date of birth.

Complete a K.E.M.H. Cytopathology Requisition form. Ensure the following information has been legibly recorded:

- Patient's first and last name

- Date of Birth
- Date of test request
- K.E.M.H. Chart number
- Source of Specimen.....(e.g. ectocervix, endocervix, etc
- LMP
- Date of specimen collection
- Relevant clinical history or abnormal pap test results.
- Physician's signature (in the space provided)
- Time of Specimen Collection

Submit the specimen to the K.E.M.H. Lab, 1st Floor.

Limitations

Absence of adequate squamous and transformation zone sampling.
Specimens taken less than 12 weeks after a prior pap test.

Specimen Collection for Non-Gynecological Specimens

Purpose

To establish collection methods for maximum cell preservation and recovery for optimal cytologic evaluation. Also, to ensure the safety of health care personnel by requiring careful handling of specimens containing blood or body fluids. Transport of liter bags or bottles of body fluids presents a potential biohazard risk, and is therefore prohibited. All specimens must be submitted in fluid proof, puncture resistant containers with secure fitting lids to prevent leakage during transport.

A) Bronchial, Esophageal, Gastric, Colonic Brushes and Washings

Materials Needed

Specimen Container(s) of Cytolyt Solution

Non-Gynecologic Requisition Forms

Biohazard Specimen Bags (for small amounts, 90mls or less)

*These materials can be obtained from the Cytopathology Department by calling 239-1382

Instructions

Washings

After obtaining the washings, place up to 30mls of washings in each Cytolyt container. DO NOT EXCEED 30mls of specimen per container. Multiple containers (maximum of 3) may be used.

Brushings

After obtaining the brushings, clip the stem of the sampling brush directly into the Cytolyt container.

2) Secure the lid tightly onto the specimen container(s) and label it with the patient's name, K.E.M.H. chart number or date of birth, source of the specimen, and other required information.

3) Complete a Cytopathology Non-Gynecologic Requisition Form, complete with the following:

- Patient's name
- K.E.M.H. Chart Number
- Date of Birth
- Date and time of specimen collection
- Source of Specimen
- Submitting Physician
- Relevant clinical history/details
- Physician's signature (in the space provided)
- Time of Specimen Collection

1) Place the specimen in a biohazard bag, and close the zip-lock seal. Place the completed Non-Gynecologic Requisition Form in the outer pouch.

2) Deliver the specimen to the K.E.M.H. Laboratory.

PLEASE NOTE: Specimens submitted fresh (without Cytolyt) must be submitted to the laboratory immediately. If submissions are made after hours, please ring the lab bell (located to the right of the main door) and give the specimen directly to a medical technologist only! Instruct them to refrigerate the specimen immediately.

B) Body Fluids

- Ascitic/Peritoneal
- Pleural
- Pericardial
- Synovial
- Vitreous
- Cyst (Except Breast)

Materials Needed

Specimen Container(s) of Cytolyt Solution

Non-Gynecologic Requisition Forms

Biohazard Specimen Bags (for small amounts 90mls or less)

*These materials can be obtained from the Cytopathology department by calling 239-1382.

Instructions

After obtaining the specimen, place up to 30mls of specimen in each Cytolyt container. DO NOT EXCEED 30mls OF SPECIMEN PER CONTAINER. Multiple containers (maximum of 3) may be used.

Secure the lid(s) tightly onto the specimen container(s) and label it with the patient's name, K.E.M.H. chart number or date of birth, source of the specimen, and other required information.

Complete a Cytopathology Non-Gynecologic Requisition Form, complete with the following:

- ◆ Patient's name
- ◆ K.E.M.H. Chart Number
- ◆ Date of Birth
- ◆ Source of Specimen
- ◆ Date and time of specimen collection
- ◆ Submitting Physician
- ◆ Relevant clinical history/details
- ◆ Physician's signature (in the space provided)

Place the specimen in a biohazard bag, and close the zip-lock seal. Place the completed Non-Gynecologic Requisition Form in the outer pouch.

Deliver the specimen to the K.E.M.H. Laboratory.

Please note: Specimens submitted fresh (without Cytolyt) must be submitted to the lab immediately. If submissions are made after hours, please ring the lab bell (located to the right of the main door) and give the specimen directly to a medical technologist only! Instruct them to refrigerate the specimen immediately.

C) Fine Needle Aspirations (FNA)

Whenever possible, the Cytopathology Department should be contacted for technical assistance in the FNA procedure, within the K.E.M.H. facility. The Cytotechnologist can confirm that the initial pass is sufficiently cellular to render a diagnosis.

The following procedure is to assist clinicians with the collection procedure in the absence of a Cytotechnologist.

Materials Needed

Leak/ Fluid proof specimen container of Cytolyt Solution

Frosted edge glass slides (with chemical resistant marking surface for labeling.)

A lead pencil

Cytopathology Non-Gynecologic Requisition Form

Biohazard Specimen Bags

Slide holders (cardboard or plastic)

*These materials can be obtained from the Cytopathology Department by calling 239-1382

Instructions

- 1) Using a lead pencil, label 2 glass slides with the patient's last name, first initial, specimen site, and the letters 'AD' for air-dried.
- 2) After obtaining the aspirated material, carefully detach the needle from the syringe, and fill the syringe with air.
- 3) Re-attach the needle and place the needle in the center of one glass slide, with the bevel pointing downward.
- 4) Advance the plunger of the syringe to express a small drop of aspirate, 2-3mm in diameter onto the slide.
- 5) Invert the second labeled glass slide over the drop and as it spreads, gently pull the two slides apart horizontally. (Refer to diagram). DO NOT Immerse the slides in alcohol or spray -fix the slides. AIR DRY ONLY.
- 6) Aspirate the remaining specimen into the Cytolyt container solution, thoroughly rinsing the needle in the Cytolyt.
- 7) Secure the lid tightly and label the specimen container with the patient's name, K.E.M.H. chart number, (or date of birth), the source of specimen, and other required information.
- 8) Complete steps 2-6 for each additional pass.
- 9) Place the air-dried slides into the slides holder for transport.
- 10) Complete a Cytopathology Non-Gynecologic Requisition Form. Including the following:
 - ◆ Patient's name
 - ◆ K.E.M.H. Chart Number
 - ◆ Date of Birth
 - ◆ Source of Specimen
 - ◆ Submitting Physician
 - ◆ Relevant Clinical Details/History
 - ◆ Physician's Signature
 - ◆ Time of Specimen Collection

- 11) Place the Cytolyt specimen container and the slide holder in a biohazard bag, and close the ziplock seal. Place the completed requisition form in the outer pouch.
- 12) Deliver the specimen to the K.E.M.H. Laboratory.

PLEASE NOTE:

Specimens submitted fresh (without Cytolyt) must be submitted to the lab immediately. If submissions are made after hours, please ring the Laboratory bell (located to the right of the main door) and give the specimen directly to a medical technologist. Instruct them to refrigerate the specimen immediately.

D) Urine Specimens

VOIDED URINE

This is a physician referral test. Patients are sent to the laboratory reception to collect specimen pots and receive instructions. Ensure that each patient has received 3 completed Non-Gynecologic Requisition Forms (one for each early morning urine specimen).

The following information must be submitted on the requisition form:

- ◆ Patient's name
- ◆ K.E.M.H. Chart Number
- ◆ Date of Birth
- ◆ Source of Specimen
- ◆ Submitting Physician
- ◆ Relevant Clinical Details/History
- ◆ Physician's Signature
- ◆ Time of Specimen Collection

The patient receives the Cytopathology Department instructions which appear on the following page.

Catheterized Urines

Catheterized urines received from wards must be sent immediately to the lab, in a fluid/leak proof container. If the specimen is collected after hours, deliver the specimen to the lab immediately. Ring the laboratory door bell located to the right of the door, and give the specimen to a medical technologist. Instruct them to refrigerate the specimen immediately.

A Non-Gynecologic Requisition Form must accompany the specimen, with the information noted in the section above, under 'Voided Urine'. Additionally, the date and time of specimen collection must be recorded on this form.

PLEASE INDICATE THAT THE SPECIMEN IS A CATHETERIZED URINE ON THE REQUISITION FORM!!!

E) Sputum Specimens

Materials Needed

Leak/Fluid Proof containers of Cytolyt Solution
Biohazard Specimen Bags
Non-Gynecologic Requisition Forms

These materials can be obtained from the Cytopathology Department by calling 239-1382

Instructions

*Three consecutive early morning deep cough sputums must be collected before the patient eats or drinks.

*Specimen collection must begin no later than Wednesday of each week.

- a. The patient should rinse the mouth with water before producing the sputum sample, and encouraged to produce a deep cough specimen.
- b. Collect the sputum sample directly into the Cytolyt Solution container. In cases where little or no sputum can be produced, induced sputum may be obtained.
- c. Secure the lid tightly on the container and label the container with the patient's name, K.E.M.H. chart number (or date of birth) and source of specimen, and other required information.
- d. Complete a Cytopathology Non-Gynecologic Requisition Form and include the following:
 - Patient's name
 - K.E.M.H. Chart Number
 - Date of Birth
 - Source of Specimen
 - Submitting Physician
 - Relevant Clinical Details/History
 - Physician's Signature
 - Time of Specimen Collection
- e. Identify the specimen as collected as #1, #2, or #3 on the requisition form.
- f. Place the specimen in the biohazard bag, and close the ziplock seal. Place the completed Non-Gynecologic requisition form in the outer pouch.

PLEASE NOTE: Specimens submitted fresh (without Cytolyt) must be submitted to the lab immediately. If submissions are made after hours, please ring the laboratory bell (located to the right of the main door) and give the specimen directly to a medical technologist.

F) Ureter, Kidney, Bladder Washings

Materials Needed

- a. Specimen container(s) of Cytolyt Solution
- b. Non-Gynecologic Requisition Forms
- c. Biohazard specimen bags

These materials can be obtained from the Cytopathology Department by calling 239-1382.

Instructions

- a. After obtaining the washings, place up to 30mls of washings in each Cytolyt containers. DO NOT EXCEED 30mls OF SPECIMEN PER CONTAINER.
- b. Secure the lid tightly onto the specimen container(s) and label it with the patient's name, K.E.M.H. chart number (or date of birth) and source of specimen.
- c. Complete a Cytopathology Non-Gynecologic Requisition Form, including the following:
 - Patient's name
 - K.E.M.H. Chart Number
 - Date of Birth
 - Source of Specimen
 - Submitting Physician
 - Relevant Clinical Details/History
 - Physician's Signature
 - Time of Specimen Collection

Place the specimen in a biohazard bag and close the ziplock seal.

Place the completed Non-Gynecologic Requisition Form in the outer pouch.

Deliver the specimen to the K.E.M.H. laboratory.

PLEASE NOTE: Specimens submitted fresh (without Cytolyt) must be submitted to the lab immediately. If submissions are made after hours, Please deliver to the main laboratory and ring the laboratory door bell (located to the right of the main door) and request immediate refrigeration for the specimen.

G) Cerebral Spinal Fluids

Materials Needed

- a. Sterile, leak/fluid proof container or collection tube
- b. Cytopathology Non-Gynecologic Requisition Form

Cytopathology Non-Gynecologic Requisition Forms can be obtained from the Cytopathology Department, by calling 239-1382

After collecting the fresh specimen in the sterile collection tube or leak proof container the specimen must be transported directly to the Cytopathology Laboratory, and given to a Cytotechnologist or a Cytology Laboratory Assistant.

** An absolutely fresh specimen is required and should be collected only when the laboratory can process it immediately. Delays can result in specimen deterioration.

The Cytopathology Non-Gynecologic Requisition Form must accompany the specimen, and include the following:

- ◆ Patient's name
- ◆ K.E.M.H. Chart Number
- ◆ Date of Birth
- ◆ Source of Specimen
- ◆ Submitting Physician
- ◆ Relevant Clinical Details/History
- ◆ Physician's Signature
- ◆ Time of Specimen Collection

If a CSF is taken after the departmental hours, please ring the laboratory doorbell (located to the right of the main door) and give the specimen directly to a medical technologist. Instruct them to refrigerate the specimen immediately.

H) Breast/Nipple Secretions

There are two (2) methods of collection:

1. Smear Preparations
2. Thin Prep Preparations

1. Nipple Breast Secretion For Smear Preparations

Materials Needed

- a. Frosted End Glass Slides
- b. Cytology spray-fixative in a bottle (pump or aerosol)
- c. Cardboard or plastic slide holder
- d. Cytopathology Non-Gynecologic Requisition Form

These materials can be obtained from the Cytopathology Department by calling 239-1382

Instructions

- a. Label the frosted end of the glass slide using a lead pencil.
- b. (Patient's last name, first initial, source of specimen, and the letters 'WF' for the spray/wet fixed preparation.
- c. Refer to Section 3, 'Labeling Information')

NOTE: The number of smears will depend on the amount of secretion available for examination.

- d. Using the thumb and forefinger, gently express the nipple and subareolar area. Allow only a drop ('pea-size' or smaller) to collect on the nipple.
- e. Immobilize the breast and use the nipple to smear the material in a thin, even layer over the length of the glass slide.
- f. IMMEDIATELY SPRAY FIX THE SLIDE by applying Cytology spray-fixative evenly over the smear. Ensure that the spray bottle is held at least 12 inches away from the glass slide during the spraying action.
- g. Allow the fixed smear to dry completely before packing for transport.
- h. Place the dry, spray fixed smear(s) into a plastic/cardboard holder for transport. Secure the slide holder with scotch tape or rubber bands to prevent opening during transport.
- i. Complete a Cytopathology Non-Gynecologic Requisition Form, and include the following:
 - Patient's Name
 - K.E.M.H. Chart Number
 - Date of Birth
 - Date and Time of Specimen Collection
 - Source of Specimen
 - Submitting Physician
 - Relevant Clinical History/Details
 - Physician's Signature (in space provided)
- j. Place the specimen in a biohazard bag and close the ziplock seal. Place the requisition form in the outer pouch.
- k. Deliver the specimen to the KE.M.H. Laboratory.

2. Nipple Breast Secretions - Method for Thin Prep Preparations

Materials Needed

- a. PreservCyt® Vials
- b. Cytopathology Non-Gynecologic Requisition Forms
- c. Biohazard Specimen Bags

These materials can be obtained from the Cytopathology Department by calling 239-1382.

Instructions

- a. Collect the specimen directly into a PreservCyt® Solution Vial.
- b. Gently shake the PreservCyt Sample vial to mix the contents.
- c. Complete a Non-Gynecological Requisition Form and include the following :
 - d. following :
 - Patient's Name
 - K.E.M.H. Chart Number
 - Date of Birth
 - Date and Time of Specimen Collection
 - Source of Specimen
 - Submitting Physician
 - Relevant Clinical History/Details
 - Physician's Signature

Place the specimen vial in the biohazard bag and close the ziplock seal. Place the requisition form in the outer pouch.

- 5) Submit the specimen to the K.E.M.H. Laboratory.

I) Touch Preparations/Imprints

Materials Needed

2 Frosted End Glass Slides
Cytology Spray-fixative in a bottle (pump or aerosol)
Cardboard/Plastic Slide Holder
Cytopathology Non-Gynaecologic Request Form

*These materials can be obtained From the Cytopathology Laboratory by calling 239-1382.

Instructions

- Label the frosted end of the glass slides using a lead pencil.

- Write the patient's last name, first initial, and source of specimen.
- Complete a Cytopathology Non-Gynecologic Requisition Form.
- Include the following:
 - Patient's name
 - K.E.M.H. Chart Number
 - Date of Birth
 - Source of Specimen
 - Submitting Physician
 - Relevant Clinical Details/History
 - Physician's Signature
 - Time of Collection

Obtain wet tissue sample for touch preparation/imprint.

Gently touch the wet tissue sample with the 1st labeled glass slide.
Place the slide aside and allow to air dry.

Gently touch the wet tissue sample with the 2nd labeled glass slide.
FIX IMMEDIATELY by applying spray- fixative evenly over the smear.
Ensure that the spray bottle is held at least 12 inches away from the glass slide during the spraying action.

Label the air-dried slide with 'AD' on the frosted end. Label the 2nd fixed Slide with 'WF' on the frosted end.

Let smears dry completely before packing for transport.

Place dry smear(s) into a plastic/cardboard slide holder for transport.
Secure the slide holder with scotch tape or rubber bands to prevent opening during transport.

Place the holders/container(s) into a biohazard specimen bag and close the zip lock seal. Place the requisition form in the outer pouch.

Deliver the specimen to the K.E.M.H. Laboratory.

J) Tzanck Cells

There are two (2) methods for collection:

- a. Smear Preparations
- b. Thin Prep Preparations

1. Smear Preparations

Materials Needed

Cytopathology Non-Gynecologic Requisition Form
Frosted End Glass Slides
Cytology Spray Fixative in a bottle (pump or aerosol)
Plastic/Cardboard Slide Holder

These materials can be obtained by calling the Cytopathology laboratory by calling 239-1382.

Instructions

- Complete a Cytopathology Non-Gynecologic Request Form
- Include the following information:
- Patient's name
- K.E.M.H. Chart Number
- Date of Birth
- Source of Specimen
- Submitting Physician
- Relevant Clinical Details/History
- Physician's Signature
- Time of Specimen Collection

Label the specimen container with the patient's name, K.E.M.H. chart number or date of birth and source of specimen.

Pre- moisten the suspected lesion with saline. If possible, select a fresh vesicle that has not ruptured and crusted.

Using a disposable needle carefully expose a fresh vesicle or crusted lesion.

Using the edge of a spatula, scalpel blade, or glass slide, carefully scrape the lesion along its margin (the edges will yield the best morphologically recognizable inclusions)

DO NOT use a cotton swab or similar material to sample because diagnostic cells may become trapped in the fiber matrix.

Carefully, but quickly spread the material in a thin, even layer over the length of the slide.

FIX IMMEDIATELY by applying Cytology fixative over the length of the glass slide. Ensure the spray bottle is held at least 12 inches away from the glass slide during the spraying action.

Allow the spray fixed slide to dry completely before packing for transport. Secure the cardboard/plastic slide holder(s) with scotch tape or rubber bands to prevent opening during transport.

Place the specimen bag in the biohazard zip lock bag, and close the seal. Place the requisition form in the outer pouch of the bag.

10) Transport the specimen to the K.E.M.H. laboratory

2. Thin Prep Preparations

Materials Needed

PreservCyt® Vials
Cytopathology Non-Gynecological Requisition Forms
Biohazard Bags

*These materials can be obtained from the Cytopathology Department by calling 239-1382

Instructions

- Collect the Specimen directly into the PreservCyt Vial.
- Gently shake the PreservCyt Vial to mix the contents.
- Complete a Cytopathology Non-Gynecological Requisition Form, and include the following:
- Patient's Name
- K.E.M.H. Chart Number
- Date of Birth
- Source of Specimen
- Submitting Physician
- Relevant Clinical Details/History
- Physician's Signature
- Time of Specimen Collection

Place the specimen vial in a biohazard bag and close the ziplock seal. Place the requisition form in the outer pouch. Transport the specimen to the K.E.M.H. laboratory.

References

Laboratory Accessioning, Anatomic Pathology, J.H.Publications
Cytoc Corporation, Thin Prep® 2000 System Operators Manual
The Manual of Cytotechnology, 7th Edition, pg 242
K.E.M.H. Anatomic Pathology Laboratory
The Mayo Foundation for Medical Education and Research

Attachments/Related Documents

K.E.M.H Cytopathology Gynecologic Requisition Form
K.E.M.H. Cytopathology Non-Gynecologic Requisition Form
K.E.M.H. Cytopathology Department Urine Collection Instruction

Appendix 1 - Guidelines for the Ordering of Erythrocyte Sedimentation Rate (ESR)

Background

The Erythrocyte Sedimentation Rate (ESR) is a laboratory test, which should be ordered in only a few clinical situations.

Limitations

There is no evidence to support the use of ESR as a screening test in asymptomatic individuals. The test should not be ordered in this situation.

Indications

Evaluation of the ESR is accepted as a diagnostic adjunct in Temporal Arteritis and Polymyalgia Rheumatica and may be used to monitor the activity of these conditions.

The ESR is a component of some clinical indices of Rheumatoid Arthritis and may be used to follow the activity of this condition or other connective tissue disorders.

The ESR may be used to monitor patients with treated Hodgkin's Disease and to monitor certain infections such as Tuberculosis and Osteomyelitis.

Interpretations

Slightly elevated ESR results must be interpreted with caution, particularly in patients with negative physical examinations. Extensive diagnostic work-ups are not indicated. A markedly elevated ESR is often present in patients with significant infectious, inflammatory and malignant disease but is rarely the sole indicator of the presence of such diseases.

Recommendations

It is recommended that the ESR not be used as a screening test in asymptomatic patients. In specific clinical situations, ESR is a relevant test for diagnosis and disease monitoring. Test results must be interpreted with caution.

References

- Constantino, B.T., Erythrocyte Sedimentation Rate: What Technologists Need to Know, CJMT, Vol. 56, P. 161-169 (1994)
- Green C.J., Friesen, K.D., et al. The Erythrocyte Sedimentation Rate – An Examination of the Evidence. B.C. Medical Journal, Vol. 36, No. 2, P 108 – 112, February 1994.
- Saade, H.C., The Erythrocyte Sedimentation Rate, Southern Medical Journal, Vol. 91, No. 3, P 220 – 225 (1998).

Appendix 2 - Tests to Detect Iron Deficiency

Serum Ferritin	< Normal range	Iron deficiency, high degree of confidence
	< 40 µg / L	Possible iron deficiency, lesser degree of confidence.
	< 70 µg / L	Iron deficiency in patients with inflammation, moderate degree of confidence.
Serum Iron	Decreased >	Iron deficiency, moderate degree of confidence.
TIBC	Elevated	
TIBC	Normal	Results are inconclusive

Appendix 3 - Tests to Detect Iron Overload

Serum Ferritin	Increased levels	Reflect increased body stores.
Serum Iron	Increased >	Increased stores but changes are not proportional to the degree of overload >60% in males, >50% in females.
TIBC	Decreased or Normal	
<u>% Saturation</u>	Increased	

Appendix 4 - Investigation for Evidence of Acute Infection

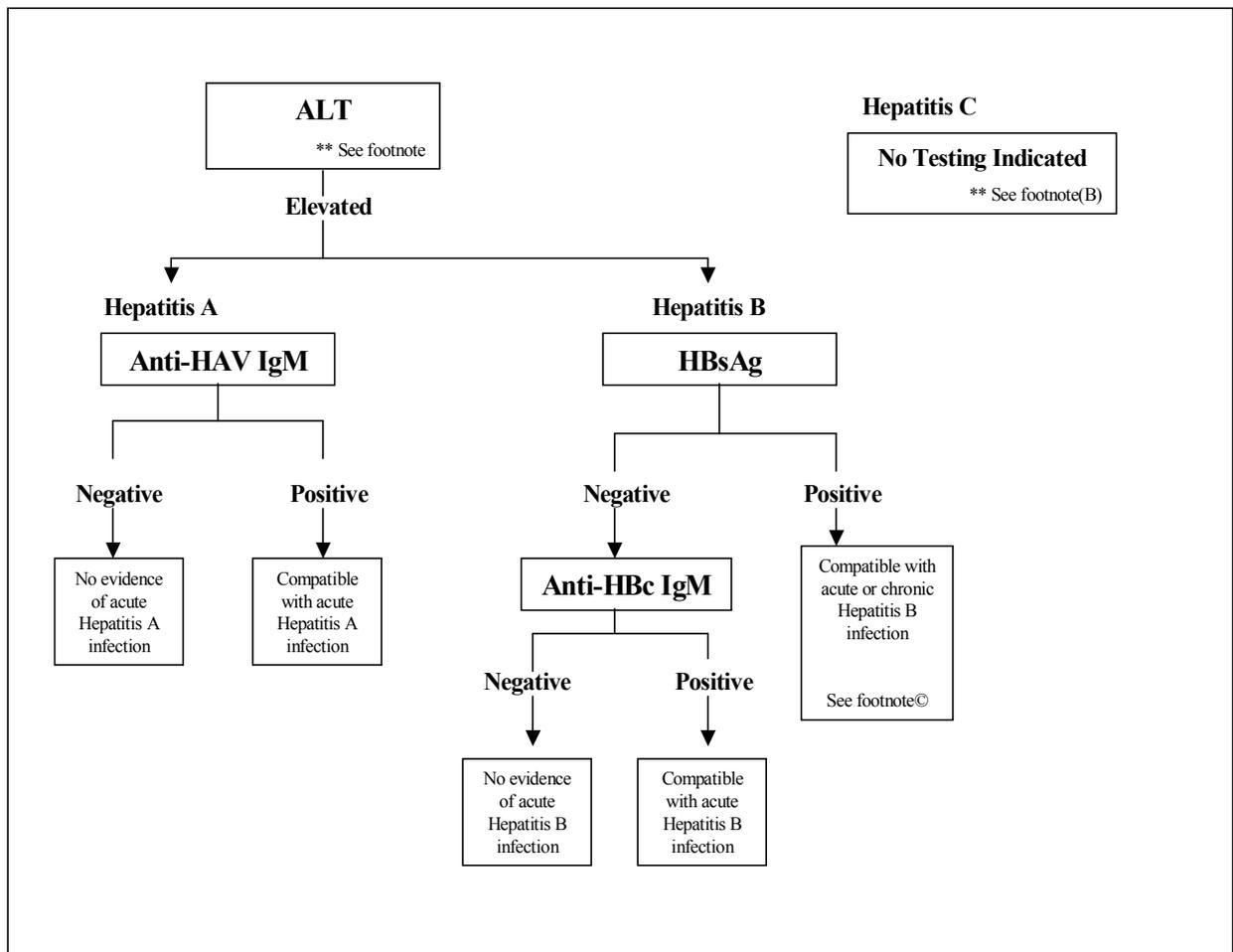
Recommendations

The algorithms accompanying these guidelines are designed to simplify the ordering of hepatitis testing and reporting of results. The recommendations that follow are reflected in the algorithms.

Notes:

If the ALT is elevated (1.5 x upper limit of normal) proceed with hepatitis testing. If ALT is not elevated, hepatitis markers will not routinely be done and the report will read, "ALT not elevated, no viral hepatitis marker testing done."

Because of the prolonged period of sero-conversion, hepatitis C cannot reliably be diagnosed in the acute phase: testing should not be done for acute hepatitis C. Since antibodies to HCV may not be detectable when symptoms are present in patients for whom HAV and HBV have been ruled out, a second sample should be specifically tested for HCV one to three months later.



If HBsAg is positive for a period of greater than six months, it is consistent with chronic Hepatitis B infection.

Interpretations: Acute Viral Hepatitis

The following statements are provided to assist the physician in the interpretation of test reports. As is the case with any diagnostic assay, false negative and positive results may occur.

Guidelines are appropriate at the time of writing and are applicable in most situations. However, if in doubt referral to a specialist should be considered.

Positive Anti-HAV IgM, Negative HBsAg, Negative Anti-HBc IgM

Positive anti-HAV IgM indicates acute hepatitis A infection. This will resolve spontaneously. No further serological testing is required.

Positive HBsAg, Positive Anti-HAV IgM

HAV infection in a chronic carrier of HBV can occur rarely.

Positive HBsAg, Negative Anti-HAV IgM

This pattern of markers can indicate acute hepatitis B. Testing for clearance of the infection should be performed after 6 months, using either HBsAg or anti-HBs. If HBsAg persists for more than six months, this indicates chronic infection.

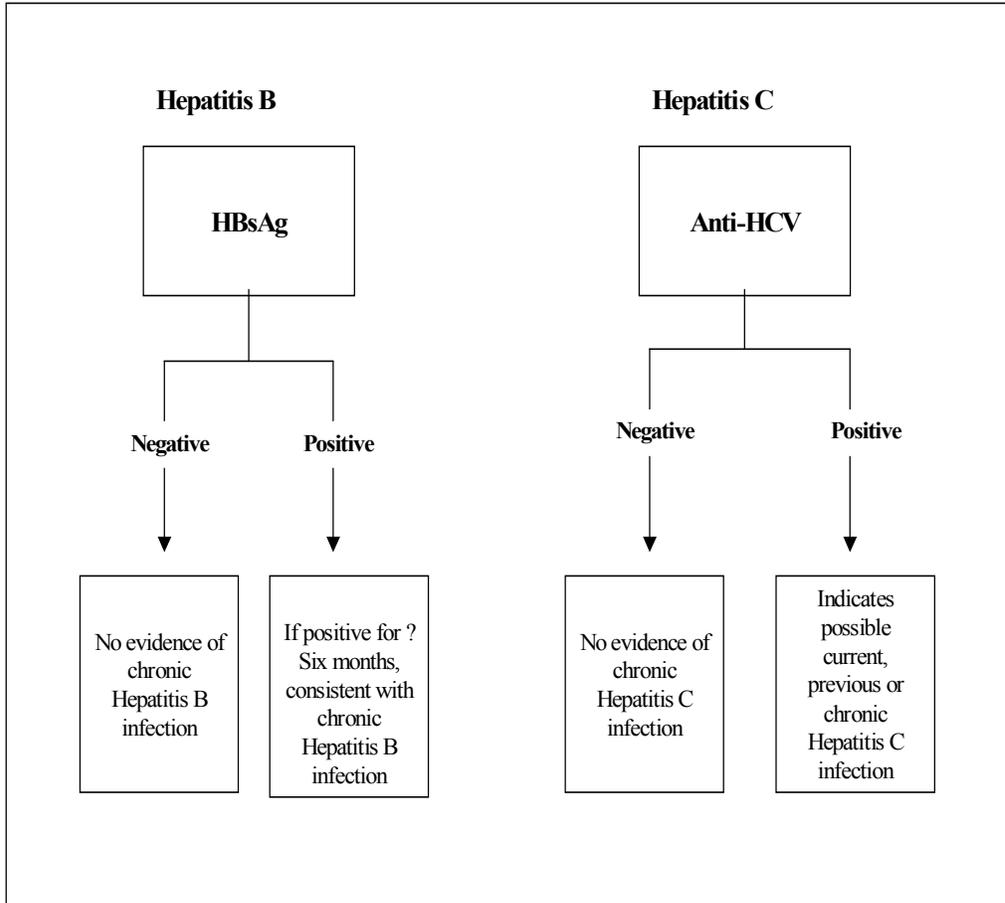
Negative Anti-HAV IgM, Negative HBsAg, Positive Anti-HBc IgM

This pattern of markers indicates acute hepatitis B. Testing for clearance of the infection should be performed after six months, using either HBsAg or anti-HBs.

Negative Anti-HAV, Negative HBsAg, Negative Anti-HBc IgM

Standard testing for acute viral hepatitis is negative. Consider acute hepatitis C. Anti HCV usually becomes positive six weeks to three months after onset of the acute illness. Consider less common viral or non-viral illnesses.

Appendix 5 - Investigation for Evidence of Chronic Infection



Interpretations: Chronic Viral Hepatitis

The following statements are provided to assist the physician in the interpretation of test reports. As is the case with any diagnostic assay, false negative and positive results may occur. It is preferred laboratory practice that a positive HBsAg or a positive anti-HCV be confirmed prior to the reporting of a positive result.

Guidelines are appropriate at the time of writing and are applicable in most situations. However, if in doubt referral to a specialist should be considered.

HbsAg Positive, Anti-HCV Negative

Indicates acute or chronic Hepatitis B. Persistence of HBsAg for greater than 6 months is evidence of chronic HBV. If ALT is elevated in a chronic carrier, the patient may be a candidate for antiviral treatment.

Anti-HVC Positive, HBsAg Negative

A positive anti-HCV indicates exposure to the Hepatitis C virus but does not distinguish current from previous infection. This requires referral to a specialist.

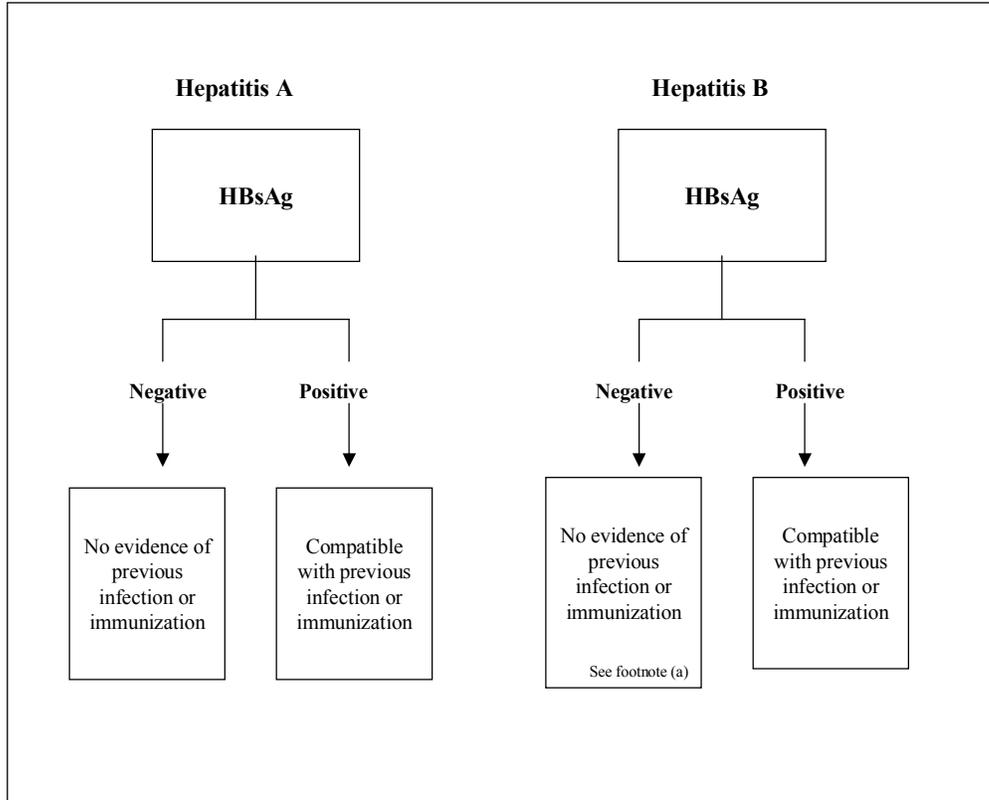
HBsAg Negative, Anti-HCV Negative

Indicates that the patient is not infected with either virus. If the liver enzymes are elevated, consider other viral or non-viral etiology. Note that anti-HCV can be falsely negative in patients infected with Hepatitis C when the patient is immunocompromised, as for instance, patients on chemotherapy, corticosteroids or in renal failure.

HBsAg Positive, Anti-HCV Positive

Dual infection with both viruses. Evaluation of these patients is complex; such patients should be referred to specialists, if clinically indicated.

Investigation for Evidence of Previous Infection or Immunization in Immunocompetent Individuals:



Notes:

A small number of patients may be positive for anti-HBc from a previous infection in the absence of anti-HBs. If there is a strong suspicion of previous infection, then order an anti-HBc.

Interpretations: Previous Exposure or Immunization

The following statements are provided to assist the physicians in the interpretation of test reports. As is the case with any diagnostic assay, false negative and positive results may occur.

Guidelines are appropriate at the time of writing and are applicable in most situations. However, if in doubt referral to a specialist should be considered.

Anti-HAV (total or IgG) Positive

This test becomes positive within 2 months after vaccination against hepatitis A and six to twelve months after acute Hepatitis A infection. A positive test indicates immunity to Hepatitis A. After a naturally acquired infection the test generally remains positive for life.

Anti-HAV IgG Negative

A negative test indicates no exposure to either Hepatitis A or to Hepatitis A vaccine.

Anti-HBs Positive

A positive test is seen after naturally acquired acute Hepatitis B infection or after vaccination against Hepatitis B. Titres may decline below arbitrarily determined levels of antibody immunity or even become undetectable but immunity may persist for life.

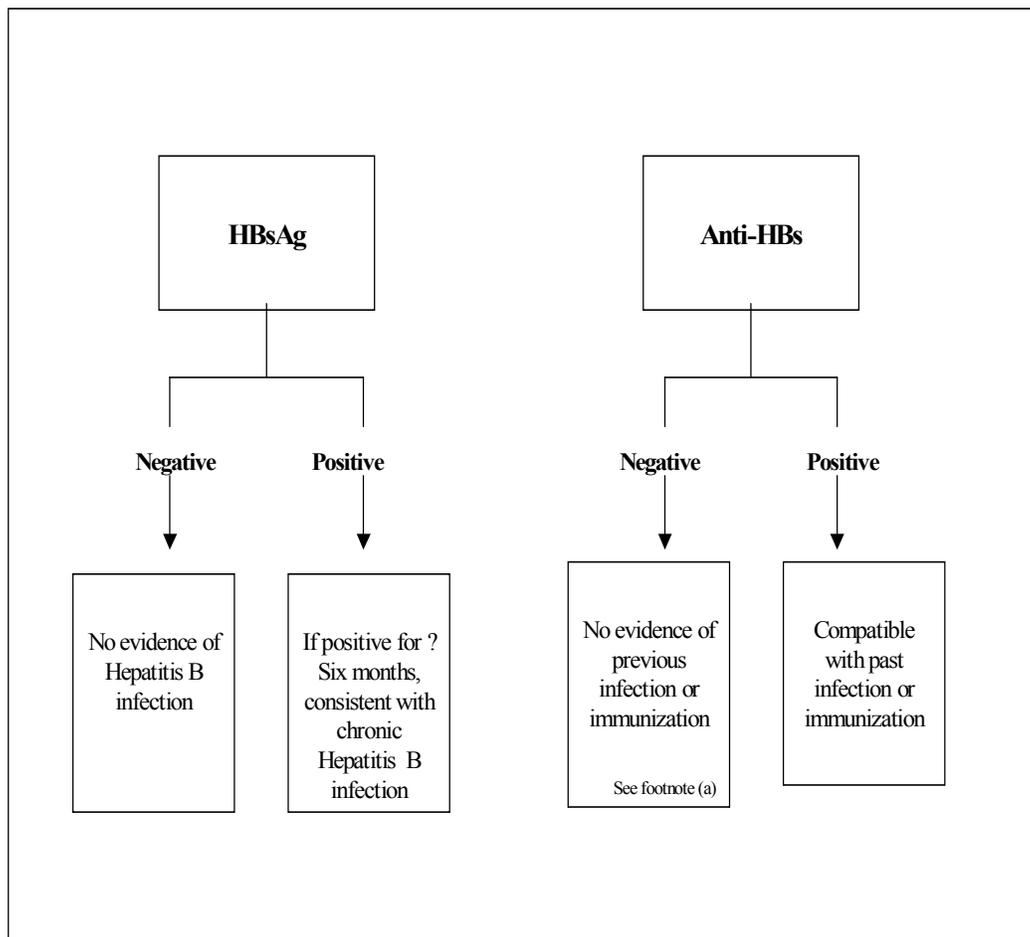
Anti HBs Negative

This result most often indicates no previous exposure to Hepatitis B and no immunity. However, in subjects who have been vaccinated or who have previously had acute Hepatitis B, the titre of anti-HBs can decline and become undetectable and yet immunity persists. A small number of patients may be positive for anti-HBc from a previous HBV infection in the absence of anti-HBs. If there is a strong suspicion of previous infection, then order an anti-HBc.

Appendix 6 - Investigation for Hepatitis B Contacts

Notes:

A small number of patients may be positive for anti-HBc from a previous HBV contact in the absence of anti-HBs. If there is a strong suspicion of previous infection, then order and anti-HBc.



Interpretations: Hepatitis B Contacts

The following statements are provided to assist the physician in the interpretation of test reports. As is the case with any diagnostic assay, false negative and positive results may occur.

Guidelines are appropriate at the time of writing and are applicable in most situations. However, if in doubt referral to a specialist should be considered.

HBsAg Negative, Anti-HBs Negative

The result suggests there is presently no evidence of exposure to Hepatitis B. Submit a follow up specimen in 3 – 6 months. If still negative immunization may be appropriate.

HBsAg Negative, Anti-HBs Positive

This result indicates previous infection or immunization.

HBsAg Positive, Anti-HBs Negative

This result indicates currently infected with Hepatitis B and may become a chronic carrier. Submit a follow-up serum at 6 months; if HBsAg remains positive, patient is a chronic carrier.

HBsAg, Anti-HBs Positive

This result also indicates currently infected with Hepatitis B and may become a chronic carrier. Submit a follow-up serum at 6 months; if HBsAg remains positive, patient is a chronic carrier.

Selected References

Chernesky, M *et al.*, Diagnostic Significance of Anti-HbcIgM Prevalence Related to Symptoms in Canadian Patients Acutely or Chronically Infected With Hepatitis B Virus, *Journal of Medical Virology* 20:269-277 (1986)

Gretch, DR *et al.*, Assessment of Hepatitis C Viremia Using Molecular Amplification Technologies: Correlations and Clinical Implications, *Ann Intern Med.* 1995; 123:321-329.

Health Protection Branch, Laboratory Centre for Disease Control, *Canadian Immunization Guide*; 46-57, Fourth Edition, 1993

Hoofnagle, JH and di Bisceglie, AM, Serologic Diagnosis of Acute and Chronic Hepatitis. *Seminars in Liver Disease*, II 2:73-83, 1991.

Poynard T *et al.*, A comparison of three interferon alpha 2B regimens for the long term treatment of non A non B Hepatitis, *NEJM*, 332:1457-62, 1995.

Sherman, M ed., *Hepatitis Update Clinical News & Views on Hepatitis B and C*, 3rd February, 1996.

Appendix 7 - Serologic Antibody Patterns in EBV Infection

	Susceptible (No past Infection)	Primary EBV (Acute Infection)	Convalescent (3 months)	Prior (Past Infection)	Reactivated (Chronic Infection)
VCA-IgM	-	+	+/-	-	-
VCA-IgG	-	+	+	+	+
EA-D	-	+*	+*	-	+*
EA-R					
EBNA	-	-	+	+	+

EBV = Epstein-Barr virus;

VCA = Viral capsid antigen;

EA-D = Early antigen complex, diffuse component;

EA-R = Early antigen complex, restricted component;

EBNA = EB- associated nuclear antigen.

+ is titer > 1:5

*Titer < 1:5 in 80% of patients.

Appendix 8 - Conversion Factors Between Conventional and Système International Units

This list is included to assist in converting values between conventional units and the newer SI units (Système International d'Unites) that have been mandated by many journals. Only common analytes are included.

ANALYTE	CONVENTIONAL UNITS	SI UNITS	CONVENTIONAL TO SI UNITS	SI TO CONVENTIONAL UNITS
WBC count (leukocytes) (B) (CSF) (SF)	/ μ L or/cu mm or mm ³ /cu mm or /cu μ L #/ μ L	Cells x 10 ⁹ /L 10 ⁶ /L 10 ⁶ /L #/L	0.001 1 10 ⁶ 10 ⁶	1000 1 10 ⁻⁶ 10 ⁻⁶
Platelet count	10 ³ /cu mm	10 ⁹ /L	1	1
Reticulocytes	/cu mm	10 ⁹ /L	0.001	1000
RBC count (erythrocytes) (B) (CSF)	10 ⁶ / μ l or/cu mm or/mm ³ /cu mm	10 ¹² /L 10 ⁶ /L	1 1	1 1
Hematocrit (packed cell volume [[PCV]])	%	Volume fraction	0.01	100
Mean corpuscular volume (MCV) (volume index)	μ ³ (cubic microns)	fL	1	1
Mean corpuscular hemoglobin (MCH) (Colour index)	pg (or μ g) pg	pg fmol	1 0.06206	1 16.11
Mean corpuscular hemoglobin concentration (MCHC) (Saturation index)	gm/dl gm/dL	g/l mmol/L	10 0.6206	0.1 1.611
Hemoglobin (Whole blood) (Plasma)	gm/dL gm/dL mg/dL	g/l mmol/L μ mol/L	10 0.155 0.155	0.1 6.45 6.45

ANALYTE	CONVENTIONAL UNITS	SI UNITS	CONVENTIONAL TO SI UNITS	SI TO CONVENTIONAL UNITS
Fibrinogen	mg/dL	g/l	0.01	100
Albumin (S)	g/dl	g/l	10	0.1
Base excess	mEq/L	mmol/L	1	1
Bicarbonate	mEq/L	mmol/L	1	1
Bilirubin	mg/dL	µmol/L	17.1	0.0584
Calcium (S)	mg/dL mEq/L	mmol/L mmol/L	0.25 0.5	4.0 2.0
(U)	mg/24 hr	mmol/L	0.025	40
CO ₂ partial pressure, tension (PCO ₂)	mm Hg	kPa	0.133	7.52
Standard bicarbonate (hydrogen carbonate)	mEq/L	mmol/L	1	1
Chloride	mEq/L or mg/dL	mmol/L	1	1
Carcinoembryonic antigen (CEA)	ng/mL µg/mL	µg/L mg/L	1 1	1 1
Cholesterol	mg/dL	mmol/L	0.0259	38.61
HDL-Cholesterol	mg/dL	mmol/L	0.0259	38.61
LDL-Cholesterol	mg/dL	mmol/L	0.0259	38.61
Creatinine (S,AF)	mg/dL	µmol/L	88.4	0.0113
Glucose	mg/dL	mmol/L	0.0555	18.02

Ferritin	ng/mL	µg/L	1	1
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ANALYTE	CONVENTIONAL UNITS	SI UNITS	CONVENTIONAL TO SI UNITS	SI TO CONVENTIONAL UNITS
Iron	µg/dL	µmol/L	0.179	5.587
Iron-binding capacity	µg/dL	µmol/L	0.179	5.587
Iron saturation	%	Fraction saturation	0.01	100
Magnesium (U)	mg/24 hr	mmol/d	0.411	2.433
O ₂ partial pressure (Pa O ₂)	mm Hg	kPa	0.133	7.5
pH	nEq/L	nmol/L	1	1
Phosphate (inorganic phosphorous) (S) (U)	mg/dL gm/24 hr	mmol/L mmol/d	0.323 32.3	3.10 0.031
Potassium (S)	mEq/L	mmol/L	1	1
Protein, total (S) (U) (CSF)	gm/dl mg/dl mg/dl	g/l g/dl mg/L	10 0.001 10.	0.1 1000 0.1
Sodium (S)	mEq/L	mmol/L	1	1
Triglycerides	mg/dL	mmol/L	0.0113	88.5
Urea Nitrogen (S) (U)	mg/L gm/24 hr	mmol/L mol/d	0.357 0.0357	2.8 28
Uric Acid (S)	mg/dL	mmol/L	0.05948	16.9

ANALYTE	CONVENTIONAL UNITS	SI UNITS	CONVENTIONAL TO SI UNITS	SI TO CONVENTIONAL UNITS
Folate	ng/mL	nmol/L	2.266	
Vitamin B12 (cyanocobalamin)	pg/mL	pmol/L	0.738	1.355

ANALYTE / UNIT ABBREVIATIONS

μ = micron

μmol = micromole

mmol = millimole

nmol = nanomole

fmol = femtomole

mOsm = milliosmole

mg = milligram

gm = gram

kg = kilogram

pg = pictogram

ng = nanogram

L = liter

mL = milliliter

mEq = milliequivalent

mL/s/m² = milliliter/second/square meter

mL/min/m² = milliliter/minute/square meter

U = unit

mU = milliunit

IU = international unit

d = day

hr = hour

S = serum

U = urine

CSF = cerebrospinal fluid

P = plasma

C = clearance

F = feces

AF = amniotic fluid

SF = synovial fluid

B = blood

T = tissue

All reference to serum unless otherwise stated.

References

MJ McQueen, *SI Unit Pocket Guide*: ASCP Press 1990.

Nichols Institute, *Endocrine Interpretive Guide* 1995.

Système International Conversion Factors for Frequently Used Laboratory Components JAMA 260:74, 1988.

NW Tietz et al (Eds), *Clinical Guide to Laboratory Tests* (3rd ed.) Philadelphia: Saunders 1995.

NW Tietz *Textbook of Clinical Chemistry*. Philadelphia: Saunders 1986.

DS Young, Implementation of SI Units for clinical laboratory data: Style specification and conversion tables. *Ann Intern Med* 106:114, 1987.

Appendix 9 - Therapeutic Drugs and Toxic Drugs

ANALYTE	CONVENTIONAL UNITS	SI UNITS	CONVENTIONAL TO SI UNITS	SI TO CONVENTIONAL UNITS
Acetaminophen	µg/mL	µmol/L	6.62	0.151
Digoxin	ng/mL	nmol/L	1.28	0.781
Ethanol	mg/dL	mmol/L	0.217	4.61
Gentamicin	µg/mL	µmol/L	2.09	0.478
Phenobarbital (Luminal)	µg/mL	µmol/L	4.31	0.232
Phenytoin (Dilantin)	µg/mL	µmol/L	3.96	0.253
Valproic acid	µg/mL	µmol/L	6.93	0.144
Vancomycin	µg/mL	mg/L	1	1

Appendix 10 - International Normalized Ratio (INR)

The accuracy of the Prothrombin Time (PT) is known to be very system-dependent. The World Health Organisation has addressed the system variability problem by (1) the establishment of primary and secondary international reference preparations of thromboplastin and (2) the development of a statistical model for the calibration of thromboplastins to derive the International Sensitivity Index (ISI) and the INR.

The INR uses the ISI to equate all thromboplastins to the reference thromboplastin through the following equation:-

$$\text{INR} = (\text{patient PT} / \text{mean normal PT})^{\text{ISI}}$$

Thus, the INR can be calculated using the working prothrombin time ratio once the ISI of the thromboplastin is known.

Documented differences in PT results in several interlaboratory trials led the International Committee on Thrombosis and Hemostasis to make a joint recommendation in 1983 to express all PTs as INRs and that manufacturers indicate the ISI of their thromboplastin reagents.

Recommendations for extent of anticoagulation based on INR can be found in “The Sixth American College of Chest Physicians (ACCP) Consensus Conference on Antithrombotic Therapy” published in the January 2001 (supplement) issue of *Chest*. This contains recommendations of many specialists’ conditions and other related topics. In brief, the recommendation of an INR of 2.0 to 3.0 is made for most indications. For further monitoring recommendations refer to the Consensus Conference Publication.

Patients are widely variable in response to oral anticoagulation. In addition, early efforts to use the INR among laboratories have had some problems. The guidelines can be helpful in monitoring patients but they should not replace sound clinical judgment.

Studies have shown that low ISI (high sensitivity) reagents are optimal. The laboratory will choose reagents with ISI <1.5. For further information about the current lot of reagents, please contact the Hematology Senior on extension 1732.

References

Hirsh, J. et al, Oral Anticoagulants, *Chest* 2001; 119:85 – 215.

Appendix 11 - Serologic Profiles for EBV Infections

Clinical Status	Antibodies to					
	VCA-IgM	VCA-IgG	EA-D	EA-R	EBNA	Hallmark Antibodies
Susceptible	- ^a	-	-	-	-	
Current Primary	+	+	+ or -	-	-	IgM-VCA
Recent Primary	+ or -	+	+ or -	+	± or -	
Past Infection	-	+	-	-	+	
Reactivated	-	+	+ or -	+ or -	+	IgG EA-D or EA-R
Burkett's Lymphoma	-	++	-	++	+	IgG-EA-R
NPC	-	++ ^b	++ ^b	-	+	IgG-EA-D & IgA-EA-D IgA-VCA

a Negative (-): <1:5. Positive (+): ≥ 1:5.

b IgA as well as IgG.

Appendix 12 - Collecting Blood Cultures Cleanly

Contaminated blood cultures cause unnecessary treatment, extended stays and consume valuable laboratory, pharmacy and nursing resources. To reduce contaminated cultures, collectors should be mindful of these important practices:-

1. Cleanse the intended puncture site thoroughly with a 30-60 second scrub with an appropriate antiseptic. Cutting down the time in this step invites contamination.
2. Allow the antiseptic time to dry. Complete asepsis is only accomplished when iodine compounds are in a dried state.
3. Do not touch a site after cleansing. The temptation is great, especially for hard to find veins, but rely on skin markers (freckles, hair, creases in the skin, etc.) to remind you where the vein is after cleansing.
4. Follow the Order of Draw. When collecting blood for other tests, fill the culture vials first. To reverse the order is to contaminate the blood culture.

A contaminated blood culture could mean 4 more days of needles, bed pans, drafty gowns and hospital food.

Pretend you're the patient!!

Appendix 13 - Hemolysis, a Pre-Analytical Quandary

Hemolysis results from the destruction of RBC's and the liberation of hemoglobin in to the fluid portion of the specimen. When the red blood cell is ruptured and hemoglobin is released, it causes the pinkish to red coloration of serum or plasma.

Hemolysis can be caused by a variety of events. Some diseases will cause hemolysis but it is most likely hemolysis is caused by poor venipunctures or specimen handling during the pre-analytical phase of testing.

Let's break down the causes of hemolysis during the pre-analytical phase into three parts; venipunctures, skin punctures and specimen handling.

Causes of hemolysis:

Venipunctures

Drawing blood from a vein that has a hematoma.

Pulling back the plunger on a syringe too quickly.

Using a needle with too small of a bore for venipuncture.

Using too large a tube when using a small-diameter butterfly needle.

Frothing of the blood caused by improper fit of the needle on a syringe (bubbles in the tube).

Forcing the blood from a syringe into an evacuated tube.

Allowing alcohol into the sample from the site.

Partially filled tubes.

Excessive trauma to the vein (probing)

An excessive amount of time withdrawing the blood (coming in too slow, or sitting in the syringe too long before being put into a tube).

Skin Punctures

There is residual alcohol at the skin-puncture site.

The collection device may have mechanically pressured the tissue adjacent to the puncture site to obtain greater volume of blood.

Patients have increased red blood cell fragility and high packed cell volume.

Excessive and aggressive milking of the site.

Scooping the blood off the skin instead of allowing drops to flow freely into the micro-tube.

Not wiping away the first drop of blood (may have residual alcohol).

Puncturing over a hematoma.

Puncturing through previously punctured sites (trauma)

Specimen Handling and processing

Vigorous mixing of additive tubes.

Extremes in temperature.

Rough handling during transport.

Improper centrifugation.

Rimming a specimen.

The way that hemolysis can affect lab results vary but is often significant to many analytes. NCCLS lists the following tests that are seriously affected (all increased) as follows: LD, AST, potassium, and plasma hemoglobin.

Tests noticeably affected include: Iron (increased), ALT (increased), and T4 (decreased).

Obviously red blood cell counts can be affected.

It is important to note that the increased use of whole blood samples for testing makes hemolysis a real challenge since it is not clearly evident that hemolysis has occurred when using a whole blood sample. It is recommended that if values are consistent with normal values that the sample be checked for hemolysis. This can be done by aliquotting a small portion of the sample and spinning it down for visual inspection.

We can minimize the possibility of hemolysis by first being able to identify the causes. Avoiding many of the causes of hemolysis can primarily boil down to following the proper procedures and taking the time necessary to care for the patient and the sample.

References

NCCLS procedures for the Handling and Processing of Blood Specimens; Approved guideline – Second edition H18-A2 Vol. 19 No. 21

NCCLS Procedures and Devices for the Collection of Diagnostic Blood Specimens by Skin Puncture: Approved Standard – Fourth edition HA-A4 Vol 19. No. 16

Phlebotomy Essentials Second Edition McCall and Tankersley Published by Lippincott Williams & Wilkins 1998.

Phlebotomy for Nurses and Nursing Personnel by Dennis J Ernst and Catherine Ernst Published by Healthstar Press 2001.

The complete Textbook of Phlebotomy 2nd Edition by Lynn B. Hoeltke published by Delmar 2000.

Phlebotomy Handbook Blood Collection Essentials by D. Garza and K. Becan-McBride 6th edition published by Prentice Hall 2002.

Clinical Laboratory Science. The Basic and Routine Techniques by J.J. Linne and K.M. Ringsrud Fourth edition published by Mosby 1999.

Appendix 14 - Of All the Nerve!!

Injuries to nerves during a routine venipuncture is a reality and a liability. Correct phlebotomy requires education in proper venipuncture techniques that can reduce the possibility of a nerve injury.

In some cases the phlebotomist will know that a nerve injury has occurred from observation of the patient. The patient may relay useful information indicating a possible nerve injury by indicating verbally or non-verbally any or all of the following symptoms:

Sharp acute pain at the venipuncture site.

Sensations of pain that can fluctuate in severity according to needle position.

Description of “pins and needles” sensations or “an electric shock” in the arm and venipuncture was performed.

Pain that moves up or down the arm during or immediately after the venipuncture.

Pain or tingling discomfort in the hand or fingertips.

A scream, or non-verbal pain communication during needle entry.

Once the phlebotomist suspects a nerve injury may have occurred they should take the following steps:-

Immediately withdraw the needle.

Apply pressure to the site to prevent hematoma.

According to the severity of the situation you should contact your supervisor.

Review the policy at your facility.

Document the incident.

When attempting a second collection you should collect from an alternate site, preferably the opposite arm.

There are two types of nerve injuries that phlebotomists must be aware of. The first type is a nicked or severed nerve caused by the needle. The second is an injury caused by compression to the nerve. A compression injury occurs when the nerve is pinched or compressed to the point of injury. Sometimes a hematoma forms and causes a compression injury by putting pressure on an underlying nerve. It can also happen when a tourniquet is put on too tight and for too long. Unfortunately a compression nerve injury can take 24 – 36 hours before symptoms begin to manifest themselves. By that time, the phlebotomist may have forgotten the details of the draw.

The best defense against these types of injuries is preventative measures. Although the phlebotomist cannot see or feel a nerve there are preferred sites that may alleviate some of the risk of nerve injury.

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**Approval Workgroup: Laboratory Admin Approvals K.
Stephens**