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Clinical Microscopy:

CM: CSF Exam

What is a CSF Exam?

- A CSF (cerebrospinal fluid) exam involves analyzing a sample of the clear, colorless fluid that surrounds the brain and spinal cord. It is particularly useful in various acute neurological conditions and helps in rapid diagnosis of the conditions and initiating therapeutic measures.

Procedures for CSF Exam:

1. The patient is positioned either lying on their side or sitting, typically curled forward to widen the spaces in the spine. The lower back area is cleaned and sterilized.
2. A local anesthetic is administered to numb the skin and tissues over the lower spine to reduce discomfort during the procedure.
3. A thin, hollow needle is carefully inserted between the vertebrae in the lower back (lumbar region) into the spinal canal. This is known as a lumbar puncture or spinal tap. Sometimes, the procedure may also be performed at higher levels of the spine or at the base of the skull, depending on the specific medical situation.
4. Once the needle is correctly positioned in the spinal canal, a small amount of cerebrospinal fluid is collected into sterile collection tubes. The pressure of the fluid can also be measured during this process.
5. After the collection, the needle is removed, and a bandage is applied to the puncture site. The patient is usually asked to lie down for a short period to prevent potential complications like headaches.

6. The collected CSF samples are sent to the laboratory for analysis. Microscopic examination, along with chemical and microbiological tests, is performed on the CSF to detect various abnormalities, infections, or other conditions affecting the central nervous system.
7. The laboratory examines the CSF sample, looking for cells, microorganisms, proteins, glucose levels, and other substances. The findings are interpreted by healthcare professionals in conjunction with the patient's symptoms, medical history, and other diagnostic tests to determine the underlying cause of the neurological condition.

Reference:

CSF analysis. (2023, April 29). UCSF Health. Retrieved November 29, 2023, from https://www.ucsfhealth.org/medical-tests/csf-analysis

CM: Fecal Occult Blood Test

What is a Fecal Occult Blood Test?

- A fecal occult blood test (FOBT) is a screening test used to detect hidden blood in the stool. This test helps in identifying potential gastrointestinal problems such as bleeding ulcers, polyps, hemorrhoids, colorectal cancer, or other conditions that might cause bleeding in the digestive tract. There are three types of occult blood test: Guaiac Fecal Occult Blood Test , Fecal Immunochemical Test, FIT-DNA.

Procedures for Fecal Occult Blood Test:

1. The patient must follow a specific diet the healthcare provider requires.
2. Collect the stool samples in a clean dry container. Make sure that the stool is not mixed with urine or toilet water.
3. Follow the same process for the next two bowel movements you have, as long as they’re on different days, unless the patient is doing one sample.
4. Once three bowel movement samples are collected, bring them to your healthcare provider’s laboratory to be analyzed for the presence of blood.
5. The laboratory examines the stool samples,

Reference:

Fecal Occult Blood Test (FOBT): Purpose, Procedure & Results. (2022, September 30). Cleveland Clinic. Retrieved November 29, 2023, from https://my.clevelandclinic.org/health/diagnostics/24227-fecal-occult-blood-test-fobt

CM: Urinalysis (routine)

What is a Urinalysis (routine)?

- A urinalysis test is to detect any irregularities in how your urine looks or what it contains. It's a widely used test to screen, diagnose, and track various health issues like kidney ailments, diabetes, or urinary tract infections. A complete urinalysis usually involves three main components: a visual or physical examination, a microscopic analysis, and a chemical dipstick test. Each part assesses distinct aspects, employing various measurements and evaluations.

Procedures for Urinalysis:

1. A sterile container is provided to collect a midstream urine sample. Before collection, it's essential to clean the genital area to prevent contamination.
2. The urine's color, clarity, and odor are observed. Normal urine is typically yellow or straw-colored and clear. Any unusual color, cloudiness, or strong odor might indicate certain health issues.
3. A dipstick containing various chemical pads is dipped into the urine sample. This assesses:
    - pH Levels: Measures acidity or alkalinity.
    - Protein: Detects abnormal protein levels, indicating potential kidney problems.
    - Glucose: Checks for high glucose levels, associated with diabetes.
    - Ketones: Presence may indicate certain metabolic conditions.
    - Blood: Identifies the presence of blood cells, suggesting bleeding or kidney issues.
    - Other Parameters: Tests for bilirubin, urobilinogen, nitrites, and leukocyte esterase, which provide additional insights into liver function, urinary tract infections, or other conditions.
4. A portion of the urine sample is centrifuged, and the sediment is examined under a microscope. This helps detect:
    - Red Blood Cells (RBCs) and White Blood Cells (WBCs): Elevated levels can indicate infections, kidney issues, or other conditions.
    - Crystals, Bacteria, and Other Elements: Presence of crystals may suggest kidney stones, while bacteria might indicate an infection.
5. The results from the visual, chemical, and microscopic examinations are recorded and analyzed. Healthcare professionals interpret these findings to assess kidney function, detect infections, monitor certain diseases, or identify potential health concerns.

Reference:

Urinalysis. (2023, October 24). Mayo Clinic. Retrieved November 29, 2023, from https://www.mayoclinic.org/tests-procedures/urinalysis/about/pac-20384907

CM: pH (Random Urine)

What is pH (Random Urine)?

- A urine pH test checks the acidity or alkalinity of your urine. High or low levels can indicate various medical problems. Depending on the results, you can make lifestyle changes and get the proper treatment.

Procedures for pH Random Urine:

1. Collect a Sample:
   - Provide the individual with a clean, dry container for urine collection.
   - Instruct them to urinate directly into the container, ensuring a sufficient amount for testing.

2. Handling the Sample:
   - Cap the container tightly to prevent contamination.
   - Label the container with the individual's name, date, and time of collection.

3. Testing Equipment:
   - Use pH test strips designed for urine analysis. These are readily available in most medical supply stores.

4. Performing the Test:
   - Dip the pH test strip into the urine sample for the specified amount of time, as per the manufacturer's instructions.

5. Reading Results:
   - Compare the color change on the strip to the pH scale provided by the test kit.
   - Record the pH level of the urine sample.

6. Interpretation:
   - Normal urine pH ranges from 4.6 to 8.0. Values outside this range may indicate certain health conditions.

7. Documenting Results:
- Record the pH level along with any relevant information or observations.

Reference:

Young, C., & Nall, R. (2021, August 31). *Urine pH Level Test: Purpose, Procedure, Results & More*. Healthline. Retrieved November 29, 2023, from https://www.healthline.com/health/urine-ph#preparation

CM: Seminal Fluid Analysis

What is Seminal Fluid Analysis?

- A seminal Fluid analysis, also called a sperm count, measures the quantity and quality of semen and sperm.

Procedures for Seminal Fluid Analysis:

1. Abstinence Period:
- Instruct the individual to abstain from ejaculation for 2 to 5 days before the test to ensure an accurate assessment.

2. Sample Collection:
- Provide a sterile container for semen collection.
- The sample is usually collected through masturbation. It's important to avoid any lubricants that could interfere with sperm motility.

3. Handling the Sample:
- The collected sample should be delivered to the laboratory within a specified time frame, often within 30 minutes to an hour.
- Maintain the sample at body temperature during transportation.

4. Macroscopic Examination:
- Laboratory staff visually assess the volume, color, and consistency of the semen sample.
- Normal volume ranges from 1.5 to 5 milliliters.

5. Microscopic Examination:
- A microscope is used to examine various sperm parameters.

6. Sperm Count (Concentration):
- Determine the number of sperm per milliliter of semen.
- A normal sperm count is typically 15 million sperm per milliliter or more.

7. Motility Assessment:
- Evaluate the percentage of sperm that are moving and their forward progression.
- Motility is a crucial factor for fertility.

8. Morphology Examination:
- Assess the shape and structure of sperm cells.
- The morphology is usually reported as the percentage of normal-shaped sperm.

9. Viability Testing:
- Some labs may perform a viability test to assess the percentage of live sperm.

10. White Blood Cell Count:
- Check for the presence of white blood cells, which could indicate infection or inflammation.

11. pH Testing:
- Measure the acidity or alkalinity of the semen.

12. Fructose Test:
- Assess the fructose level, which comes from the seminal vesicles.

13. Additional Tests:
- Depending on the situation, additional tests may include DNA fragmentation analysis or testing for the presence of antisperm antibodies.

14. Report Generation:
- The laboratory compiles the results into a comprehensive report for further analysis by a healthcare professional.

Reference:

Semen Analysis. (2022, September 12). MedlinePlus. Retrieved November 29, 2023, from https://medlineplus.gov/lab-tests/semen-analysis/

MC: pH (Stool)

What is pH (Stool)?

- Fecal pH test measures the amount of acid to determine the pH of stool. This test is used to evaluate disorders where carbohydrates are poorly absorbed, such as diarrhea or suspected lactose intolerance

Procedures for Fecal pH:

1. Collection Container:
   - Provide a clean, dry container designed for stool collection. Some kits may come with a container included.

2. Gathering the Sample:
   - Instruct the individual to pass a bowel movement into the container, ensuring that the sample is not contaminated with urine or toilet water.

3. Handling the Sample:
   - Cap the container tightly to prevent contamination.
   - Label the container with the individual's name, date, and time of collection.

4. Testing Equipment:
   - Use pH test strips designed for stool analysis. These can typically be obtained from medical supply stores or included in a testing kit.

5. Performing the Test:
   - Dip the pH test strip into the stool sample for the specified amount of time, following the instructions provided with the test kit.

6. Reading Results:
   - Compare the color change on the strip to the pH scale provided by the test kit.
   - Record the pH level of the stool sample.

7. Interpretation:
   - Normal stool pH generally ranges from 6.7 to 7.5. Values outside this range may indicate digestive issues or other health conditions.

8. Documenting Results:
   - Record the pH level and any relevant information or observations.

References:

(n.d.). Fecal pH test. Retrieved November 29, 2023, from http://medbox.iiab.me/kiwix/wikipedia_en_medicine_2019-12/A/Fecal_pH_test

Measurement of feces pH | Allina Health. (n.d.). Allina Health account. Retrieved November 29, 2023, from https://account.allinahealth.org/library/content/49/150375

Stool pH - Lab Results explained. (n.d.). HealthMatters.io. Retrieved November 29, 2023, from https://healthmatters.io/understand-blood-test-results/stool-ph

CM: Amoeba Examination

What is an Amoeba Examination?

- Amoeba Examination is performed if the patient is suspected for intestinal amoebiasis. It is a microscopic examination of stool samples to look for trophozoites containing ingested red blood cells. These ingested RBCs is an exhibition of the entamoeba histolytica parasite infection which is the organism that causes amoebiasis. Diagnosis of amoebiasis is known to be complicated, hence, this procedure may ask the patient to submit stool samples on different days as the parasite could not be present in every stool sample.

Procedures for Amoeba Examination:

1. A clean container will be provided for the patient to collect the stool sample. Once filled with the right amount, the container will be labeled and sealed properly.
2. The sample will be immediately sent to the laboratory for analysis.
3. The laboratory personnel will first look into the macroscopic qualities of the sample such as the color, consistency, presence of blood, and the like.
4. Then, the stool sample will be placed on a wet mount and examined through the microscope to look for trophozoites.
5. Trichrome staining will be performed to make the specimen more visible.
6. Determination of the pathogenic and non-pathogenic amoebas will be conducted and specified in the results.

References:

\/. (2023, June 16). YouTube. Retrieved November 29, 2023, from https://emedicine.medscape.com/article/212029-workup?form=fpf

General Information | Amebiasis | Parasites. (n.d.). CDC. Retrieved November 29, 2023, from https://www.cdc.gov/parasites/amebiasis/general-info.html

CM: Synovial Fluid Analysis (Body Fluid Examination)

What is a Synovial Fluid Analysis?

- Synovial fluid is a substance present in joints. If there are suspected complications in the joints, this test is done to determine the causes of pain, swelling, and/or numbness in the joints of the patient. There are cases when the right intervention to ease the pain is by removing the synovial fluid. Prior to the examination, the patient will be asked if they have taken any anticoagulation medications as these highly affect the sample examination.

Procedures for Synovial Fluid Analysis:

1. The sample is obtained by drawing the synovial fluid through the needle of a sterile syringe. The specimen is then stored in a 6 mL red-top tube.
2. The sample is immediately transferred to the laboratory for examination. Delaying the transfer affects the quality of the sample.
3. In the laboratory, the laboratory personnel will then assess the visible qualities of the sample such as the color and thickness.
4. The sample will then be placed under the microscope and the laboratory personnel will determine the number of white blood cells, red blood cells, and crystals. They may also measure protein, uric acid, glucose, and lactate dehydrogenase (LDH) levels. And, tests for viruses and bacteria might also be done. This depends on what is requested by the physician.
5. Once analysis is accomplished, the results of the tests will be provided to the attending physician.

References:

Synovial fluid analysis Information. (n.d.). Mount Sinai. Retrieved November 29, 2023, from https://www.mountsinai.org/health-library/tests/synovial-fluid-analysis

Watson, S. (2021, December 15). *Synovial (Joint) Fluid Analysis: Purpose, Procedure, Results*. WebMD. Retrieved November 29, 2023, from https://www.webmd.com/arthritis/synovial-joint-fluid-analysis

CM: Fecalysis

What is Fecal Analysis?

- Fecal analysis, also known as stool examination or stool analysis, is a procedure

performed in cases where complications in the digestive system are suspected. The feces of the patient is the sample collected in this laboratory test. Diagnosis based on this test could range from infection to cancer cases. Patients that are advised to have stool analysis might be ordered not to consume certain beverages, food, or medication, especially laxatives, as they could affect the quality of the stool sample.

Procedures for Fecalysis:

1. The stool sample stored in a sterile container will be collected from the patient. The container will then be labeled (with appropriate information).
2. The sample will be transferred to the laboratory with no delay.
3. The laboratory professional will examine the observable characteristics of the stool sample.
4. The sample will then be placed on a wet mount slide where a small amount of the stool will be smeared on the slide and mixed with saline solution and covered by cover slip. Trichrome staining procedure will also be performed.
5. The laboratory professional will look for bacteria, viruses, and parasites present in the specimen. The organisms that are commonly looked for are the protozoa, helminths, and fecal leukocytes.
6. Based on the examination, it will be analyzed by the laboratory professionals. The analysis will be presented in the results which are provided after the procedure.

References:

DPDx - Diagnostic Procedures - Stool Specimens. (n.d.). CDC - DPDx - Diagnostic Procedures - Stool Specimens. Retrieved November 29, 2023, from https://www.cdc.gov/dpdx/diagnosticprocedures/stool/microexam.html

Guide, S., Abrina, J. P., & Bunag, L. (2021, August 2). *Stool Specimen Collection Procedure: A Step-by-Step Guide*. Hello Doctor Philippines. Retrieved November 29, 2023, from https://hellodoctor.com.ph/health/diagnosis-tests/stool-specimen-collection-procedure/

CM: Schistosoma Examination

What is Schistosoma Examination?

- Examination of stool and/or urine for ova is the primary method of diagnosis for suspected schistosome infections. The choice of sample to diagnose schistosomiasis depends on the species of parasite likely causing the infection.

Reference:

Resources for Health Professionals. (2020). Centers for Disease and Control Prevention. Retrieved from https://www.cdc.gov/parasites/schistosomiasis/health_professionals

Laboratory Investigations:

1. Stool/ Urine examination for schistosome eggs
2. Full Blood Count: eosinophilia (>80% of patients) with acute infections; anaemia and thrombocytopenia may be present in chronic and advanced schistosomiasis.
3. Serology: may be diagnostic in patients in whom no eggs are present, such as those with Katayama syndrome.
4. Rectal or bladder biopsy for the identification of eggs may be performed if stool or urine are egg-negative but schistosomiasis is still suspected.
5. Urea, electrolytes, and liver function: raised urea and creatinine may be evident; and hyperglobulinemia and hypoalbuminemia may be present in chronic and advanced schistosomiasis.

Reference:

BMJ. (2011). Diagnosis and management of schistosomiasis. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3230106/

CM: Scotch Tape Swab

What is Scotch Tape Swab (anal swab)?

- A transparent adhesive (cellophane) tape test (sometimes called a "Scotch tape" test) refers to the collection and examination of a sample from the skin around the anus. This test is used to identify pinworms and pinworm eggs.

Procedure for Scotch Tape Swab:

This test should be done first thing in the morning before the person suspected of the infection has gotten out of bed, used the bathroom, or taken a bath. To carry out the test:

1. The parent applies the sticky side of a piece of clear tape (such as Scotch tape) briefly to the skin around the child's anus. Any pinworms and/or eggs that are on the skin will stick to the tape.
2. The medical technology presses the sticky side of the tape to a microscope slide and uses a microscope to look for pinworms and/or pinworm eggs.

- This is the best test for diagnosing pinworms. Pinworm eggs (when present) can be easily

identified under the microscope by a trained professional. More than one transparent tape test may be needed to detect pinworm infection.

- The transparent tape test is a quick, cost-effective, and painless test. Samples may be collected at home early in the morning before bathing and taken to your doctor's office. Samples can also be taken at the doctor's office.

Reference:

Healthwise Staff. (2017). Transparent Tape Test for Pinworms. Retrieved from https://www.myactivehealth.com/hwcontent/content/special

CM: Micral II Test

What is the Micral II Test?

- The MICRAL test is an immunospecific dipstick for detection of low concentrations of albumin in urine (microalbuminuria). The test is intended to be used for screening in an ambulatory setting. The utility of the test depends on its ability to accurately predict which patients will be classified as either microalbuminuric or normoalbuminuric by means of a standard laboratory method for determination of albumin in urine.

Reference:

J E Jensen, S H Nielsen, L Foged, S N Holmegaard, E Magid. (n.d). The MICRAL test for diabetic microalbuminuria: predictive values as a function of Prevalence. Retrieved from https://pubmed.ncbi.nlm.nih.gov/

Procedure for Micral II Test:

1. Dip the test strip into the urine for 5 seconds.
2. Place the strip on a nonabsorbent surface or across the top of the collection cup to allow excess urine to drain, wait for 1 minute.
3. Compare the color of the detection pad on the strip with the color scale on the test strip vial.

The expected value for normal urine samples:

- The albumin concentration of an average urine specimen should not exceed 15 – 20 mg/L.
- Clinical diabetic nephropathy is indicated when microalbuminuria (> 20 mg/L) is present in at least two of the three morning urine samples.

- A normal microalbuminuria value does not necessarily rule out renal disease.

Reference:

F. Hoffmann-La Roche Ltd. (2023). Micral-Test strip. Retrieved from https://diagnostics.roche.com/

CM: Bence Jones Protein

What is Bence Jones Protein?

- The Bence Jones protein test is a laboratory test used to detect the presence of Bence Jones proteins in the urine. Bence Jones proteins are abnormal monoclonal immunoglobulin light chains, either kappa or lambda, that are produced by abnormal plasma cells. These proteins are associated with certain types of blood cancers, particularly multiple myeloma.
- The primary purpose of the test is to identify and quantify the presence of abnormal monoclonal immunoglobulin light chains in the urine. The Bence Jones protein test is often ordered for patients suspected of having multiple myeloma or other conditions associated with abnormal plasma cells.

(Test may be done with a 24-hour urine sample)

Procedure for Bence Jones Protein:

1. Patient must empty the bladder completely first thing in the morning.
2. Note the time.
3. Patient must collect the urine every urination over the next 24 hours.
4. Urine sample must be stored in a container given by the laboratory or healthcare provider.
5. The collected urine sample is properly mixed and prepared for laboratory analysis.
6. The volume of the 24-hour urine collection is measured accurately.
7. The urine sample is centrifuged to separate cells and debris from the liquid portion (supernatant).
8. Immunoelectrophoresis or immunofixation, are used to separate and identify proteins in the urine.
9. The medical technician visually examines the result.

Reference:

University of Rochester Medical Center. Bence-Jones Protein (Urine).

https://www.urmc.rochester.edu/encyclopedia/content.aspx?contenttypeid=167&contentid=bence_jones_protein_urine

CM: Scolex Exam

What is the Scolex Exam?

- A scolex exam is part of a stool test, also known as a fecal or bowel movement analysis, is a diagnostic test that examines a sample of your stool to gather information about your digestive health. It can help detect various conditions such as infections, parasites, digestive disorders, and bleeding in the digestive tract. In this exam scolex are identified. The scolex contains organs which facilitate attachment to the host tissue. Examples of this include suckers or hooks (sciencedirect.com).

Procedure for Scolex Exam:

Macroscopic Examination

1. Note the color of the specimen.
2. Note the consistency of the specimen. Mushy or liquid stools suggest the possible presence of trophozoites or intestinal protozoa. Protozoan cysts are found most frequently in formed stools. Helminth eggs and larvae may be found in either liquid or formed stools.
3. Examine the surface of the specimen for parasites (e.g., tapeworm proglottids or, less commonly, adult pinworms).
4. Examine the stool for blood and/or mucous.
    a. Fresh blood (bright red) indicates acute lower intestinal tract bleeding
    b. Bloody mucus suggests ulceration, and some of this material should be examined microscopically for trophozoites.
    c. Black, tarry stools are indicative of occult (hidden) blood from higher up in the intestinal tract.
5. Break up the stool with applicator sticks to check for the presence of adult helminths (e.g., Ascaris).
6. Feces should be sieved after drug treatment for tapeworm infections to assure recovery of the scolex.

Microscopic Examination:

1. Direct saline wet mount
    a. Place a drop of saline on the slide.
    b. Pick up a small amount of fecal material on the end of an applicator stick. NOTE: Take small amounts of material from several different areas, especially from bloody

and/or mucoid areas.
c. Emulsify in the saline and cover with a coverslip. Examine low and high power. NOTE: A smear should be thin enough so that a printed page can be read through it.
d. The entire preparation must be examined for the presence of eggs, larvae and protozoa. Low power is used to scan for large helminth eggs or larvae. High power is used to detect and identify smaller parasites and larger helminth eggs and larvae.
e. Any parasites detected are reported out by their scientific name and quantity observed. The following chart describes the method used by the Texas State Health Department for quantitation of parasites found.

If no parasites are observed, report out as "No parasites seen."

2. Iodine Wet mount
    a. Place a drop of Lugol's iodine solution on a slide.
    b. Pick up a small amount of fecal material on an applicator stick using the same criteria in the saline procedure for selection of the proper areas.
    c. Emulsify in the iodine solution and cover with a coverslip.
    d. Examine low and high power as described in the previous procedure.

NOTES: The film may be made directly with iodine or the iodine may be added to a saline mount by adding a drop to the edge of the coverslip so that it gradually diffuses into the saline mount.

Reference:

Austin Community College District. Medical Laboratory Technology. Laboratory Manual. https://www.austincc.edu/ddingley/MLAB1331/LabManual/LabManual.htm

CM: Urobilinogen

What is Urobilinogen?

- A urobilinogen test in laboratories measures the presence of urobilinogen in urine. Urobilinogen is a substance formed during the breakdown of bilirubin, a yellow pigment derived from the breakdown of hemoglobin in red blood cells. Bilirubin is processed by the liver and excreted in bile.
- The urobilinogen test is often part of a routine urine analysis and can provide information about liver function and the breakdown of red blood cells. Abnormal levels of urobilinogen in urine may indicate liver disease, hemolysis (destruction of red blood cells), or other conditions affecting the bilirubin metabolism.

Procedure for Urobilinogen:

For patients:

1. Wash your hands with soap and water and dry them.
2. Open the container without touching the inside.
3. Clean your genital area with the cleansing wipe:

(a) For a penis, wipe the entire head (end) of the penis. If you have a foreskin, pull it back first.
(b) For a vagina, separate the labia (the folds of skin around the vagina) and wipe the inner sides from front to back.

4. Urinate into the toilet for a few seconds and then stop the flow. Start urinating again, this time into the container. Don't let the container touch your body.
5. Collect at least an ounce or two of urine into the container. The container should have markings to show how much urine is needed.
6. Finish urinating into the toilet.
7. Put the cap on the container and return it as instructed.

In laboratory:

1. A urine sample is collected from the patient in a clean, sterile container.
2. A small portion of the test strip, which contains chemical reagents, is dipped into the urine sample (Test Strip Method).
3. The color change on the strip is compared to a color chart provided by the manufacturer. The intensity of the color corresponds to the concentration of urobilinogen in the urine.
4. The laboratory may perform a quantitative measurement using more advanced equipment to provide a precise urobilinogen concentration in the urine.
5. The results are reported to the healthcare provider.

Reference:

MedelinePlus. National Library of Medicine.
https://medlineplus.gov/lab-tests/urobilinogen-in-urine/

Hematology:

Hema: CBC

What is CBC?

- A blood test known as a complete blood count (CBC) is utilized to assess composition of blood, including red and white blood cells, platelets, hemoglobin, and other factors. It provides valuable information about overall health, helps diagnose various conditions like anemia, infection, leukemia and monitors treatment effectiveness. Abnormalities in CBC results may indicate various health issues.

Reference:

Complete blood count (CBC). (2023, January 14). Mayo Clinic. Retrieved November 29, 2023, from https://www.mayoclinic.org/tests-procedures/complete-blood-count/about/pac-20384919

Procedure for CBC test:

A laboratory technician will extract blood from a vein located in your arm. The procedure lasts only a few minutes and involves the following steps:

1. Cleanse your skin using an antiseptic wipe.
2. Apply an elastic band (tourniquet) around your upper arm to facilitate blood flow and vein visibility.
3. Insert a needle into your vein and collect a blood sample into a vial.
4. Remove the elastic band.
5. Cover the puncture site with a bandage to prevent bleeding.
6. Label your blood sample and send it to a laboratory for analysis.

Reference:

Sullivan, D. (2017, June 26). *Complete Blood Count (CBC): Types, Preparation & Procedure*. Healthline. Retrieved November 29, 2023, from https://www.healthline.com/health/cbc#procedure

Hema: ESR

What is ESR?

- The erythrocyte sedimentation rate (abbreviated as sedimentation rate, sed rate, or ESR) is a frequently conducted hematology test that can signal and track heightened inflammatory activity in the body resulting from various conditions like autoimmune diseases, infections, or tumors.

Reference:

Erythrocyte Sedimentation Rate - StatPearls. (2023, April 23). NCBI. Retrieved November 29, 2023, from https://www.ncbi.nlm.nih.gov/books/NBK557485/

Procedure for ESR test:

1. A doctor draws a small blood sample from the individual's vein.
2. The blood sample is sent to a laboratory for analysis.
3. Lab technicians transfer the blood to a vertical test tube.
4. Overtime, as red blood cells settle, a clear, yellowish fluid (blood plasma) forms at the top.
5. The amount of plasma at the top of the tube after 1 hour is measured in millimeters.
6. Results and interpretation.

Reference:

Murrell, D. (2018, September 13). *ESR test: Procedure, results, and risks*. Medical News Today. Retrieved November 29, 2023, from https://www.medicalnewstoday.com/articles/323057#procedure

Hema: Le Prep

What is Le Prep Test?

- The Lupus Erythematosus (LE) cell test, also known as LE prep or LE phenomenon (CPT No. 85544, LE Cell Prep), is a diagnostic tool for systemic lupus erythematosus (SLE). It relies on an in vitro immunologic reaction between the patient's autoantibodies targeting nuclear antigens and compromised nuclei present in the test medium.

Reference:

Conn, R. (n.d.). *Practice parameter--the lupus erythematosus cell test. An obsolete test now superseded by definitive immunologic tests*. PubMed. Retrieved November 29, 2023, from https://pubmed.ncbi.nlm.nih.gov/7661893/

Procedure for Lupus Erythematosus (LE prep):

1. A technician draws a blood sample from the patient's vein.
2. The blood is processed to separate serum, the liquid part with antibodies.
3. The serum is mixed with a testing medium containing damaged nuclei.
4. The mixture is left to react, then examined under a microscope for LE cells.
5. Presence of LE cells suggests a positive result, possibly indicating systemic lupus erythematosus (SLE).

Reference:

Lupus - Diagnosis & treatment. (n.d.). Mayo Clinic. Retrieved November 29, 2023, from https://www.mayoclinic.org/diseases-conditions/lupus/diagnosis-treatment/drc-20365790

Hema: Blood Typing ABO and RH

What is Blood Typing ABO and RH?

- A set of genetically inherited antigens present in the outer membrane of every red blood cell are categorized by the Rh type and ABO group. There are four options in the ABO group: A, B, AB, and O. There are two types of Rh: positive and negative. To perform an ABO/Rh test, a sample of the cell suspension is combined with different reagents, centrifuged at a certain speed for a certain period of time, and the tube is gently shaken. The outcome for that reagent is positive if there is any agglutination, or clumping, of blood cells.

Procedure for Blood Typing:

1. The patient’s skin will be cleaned before the test with an antiseptic to help prevent infection.
2. A medical technician will wrap a band around the patient’s arm to make the veins more visible. They’ll use a needle to draw several samples of blood from the arm or hand. After the draw, gauze and a bandage will be placed over the puncture site.
3. In order to determine the blood type, a lab technician will mix the patient’s blood sample with antibodies that attack types A and B blood to see how it reacts.
4. If the patient’s blood cells clump together when mixed with antibodies against type A blood, for example, the patient has type A blood. The patient’s blood sample will then be mixed with an anti-Rh serum. If the blood cells clump together in response to the anti-Rh serum, it means that the patient has Rh-positive blood.

References:

COLA LabFacts. (n.d.). ABO and Rh Typing.
http://www.labflorida.com/internal/COLA/guides/elf27.pdf
ABO Group and RH blood Type | Star Wellness. (n.d.).
https://starwellnessusa.com/access/abo-group-rh-blood-type/

Blood typing ABO only

What is Blood Typing ABO only?

- ABO testing should include both forward and reverse typing. Forward typing is cross-checked with reverse typing. However, since newborns and infants under the age of four months have not generated the appropriate antibodies required for the test to be reliable, reverse typing is not advised when typing them.

Procedure for Blood Typing:

1. One end of a slide is labeled Anti-A, and the other Anti-B.
2. A drop of Anti-A test serum is added to the end marked Anti-A, and a drop of Anti-B serum is added to the end marked Anti-B.
3. One drop of blood is added to each end of the slide, and mixed well, using separate wooden sticks.
4. The results are read directly from the slide. The subject is blood group A if agglutination occurred with the Anti-A test serum; group B if agglutination occurred with the Anti-B test serum; group AB if agglutination occurred with both test serums, and O if there was no agglutination in either case.

References

Blood cell indices - Blood typing - the ABO system. (n.d.).
https://www.medicine.mcgill.ca/physio/vlab/bloodlab/ABO_n.htm#:~:text=Testing%20for%20ABO%20Group%20%2D%20Procedure&text=A%20drop%20of%20Anti%2DA,read%20directly%20from%20the%20slide.

Blood Typing RH only

What is Blood Typing RH only?

- All patients are either Rh D positive or Rh D negative. Red blood cells from the patient and the reagent Anti-D are used to test for the Rh D factor. When tested with Antibody D (Anti-D), there will be agglutination if the patient's red blood cells carry the D antigen

(Rh D factor). In this case, the patient is deemed Rh D positive. The patient is often Rh D negative if there is no cell agglutination.

Procedure for Blood Typing:

1. A small sample of the patient's blood is mixed with anti-Rh antibodies to determine if the Rh factor is present.
2. If the blood agglutinates, the patient is Rh-positive; if there's no clumping, the patient is Rh-negative

References:

Krans, B. (2022, April 5). Blood typing. Healthline. https://www.healthline.com/health/blood-typing#how-its-done

Hema: Fibrinogen Assay

What is a Fibrinogen Assay?

- A fibrinogen assay is a laboratory test that quantifies the amount of fibrinogen in a blood sample. The assay is crucial for assessing blood clotting function and is often utilized in various medical situations, including diagnosing coagulation disorders, monitoring patients undergoing surgery, or evaluating liver function.

Procedure for Fibrinogen Assay:

During a fibrinogen test, your healthcare provider will:

1. Cleans a small area of your arm with rubbing alcohol.
2. Inserts a needle into your arm vein.
3. Attaches the needle to a small tube to collect a blood sample.
4. Removes the needle and covers the area with a gauze pad.
5. The blood sample is then centrifuged to separate the liquid portion of the blood (plasma) from the cellular components.
6. The time it takes for the clot to form is measured, and this is known as the thrombin clotting time (TCT).
7. The clotting time is compared to a standard curve or control, allowing the determination of fibrinogen concentration in the sample.
8. The results are reported in terms of fibrinogen concentration, often measured in milligrams per deciliter (mg/dL) or grams per liter (g/L) of plasma.

Reference:

Underwood, C. (2017, March 31). *Ham test*. Healthline. Retrieved from https://www.healthline.com/health/ham-test

Hema: Ham's Test

What is Ham's Test?

- The Ham's test, or Ham's acid hemolysis test, is employed to diagnose paroxysmal nocturnal hemoglobinuria (PNH), a rare blood disorder characterized by the destruction of red blood cells and hemoglobin in urine.

Procedure for Ham's Test:

1. A healthcare provider will clean the site.
2. They'll insert the needle into your vein and draw your blood into an attached tube.
3. When they've drawn enough blood for a sample, they'll remove the needle and bandage the site.
4. Red blood cells (RBCs) are isolated from the patient's blood sample. This is typically done through centrifugation to separate plasma and cellular components.
5. The patient's serum, which contains complement proteins, is added to the isolated RBCs.
6. The mixture of RBCs and serum is incubated at 37°C for a specific period. This incubation allows for the activation of complement proteins.
7. The sample is then acidified, creating an acidic environment. This step triggers the complement-mediated hemolysis of RBCs.
8. The sample is centrifuged again to separate the lysed (broken) RBCs from any intact cells.
9. The supernatant (liquid portion) is examined for hemolysis. If complement-mediated hemolysis has occurred, it indicates the presence of PNH. The degree of hemolysis is assessed visually or through measurements.

Reference:

HAM's (Acid hemolysin) test. (2020, October 6). ucsfhealth.org. Retrieved from https://www.ucsfhealth.org/medical-tests/ham-test

Hema: Hematocrit

What is a Hematocrit test?

- A hematocrit test measures the proportion of red blood cells in the total volume of blood. It is expressed as a percentage and is an important component of a complete blood count (CBC). It is sometimes referred to as a packed-cell volume test.

Procedure for Hematocrit:

1. A healthcare professional will collect a blood sample, usually from a vein in the arm. The area is typically cleaned with an antiseptic, and a tourniquet may be applied to make the veins more visible.
2. The blood is drawn into a special tube known as a hematocrit tube or capillary tube. The tube is narrow and has graduation marks to measure the volume of red blood cells.
3. The hematocrit tube is then placed in a centrifuge, a machine that spins at high speeds to separate the components of blood. Centrifugation causes the heavier red blood cells to settle at the bottom of the tube.
4. After centrifugation, the volume of red blood cells is measured as a percentage of the total blood volume in the tube. This percentage is the hematocrit value.
5. The hematocrit value is interpreted in the context of the individual's age, sex, and overall health.

Reference:

Vallie, S. (2022, December 1). *What is the hematocrit test?* WebMD. Retrieved from https://www.webmd.com/a-to-z-guides/what-is-the-hematocrit-test

Hema: APT's Test

What is APT's Test?

- The APT test uses alkali denaturation of hemoglobin to determine if the blood present in a stool or Emesis sample from a newborn is maternal in origin or if it is due to GI hemorrhage in the patient.

Procedure for APT's Test:

1. Collect bloody fluid
2. Add a small amount of tap water (Hemolyzes blood)
3. Centrifuge sample
4. Add 5 cc pink supernatant to 1 cc Sodium Hydroxide 1%
5. Read in 2 minutes (may be difficult)

1. Pink sample indicates fetal Hemoglobin
2. Yellow-Brown sample indicates adult Hemoglobin

References:

APT Test - Seattle Children's Hospital. (n.d.). https://seattlechildrenslab.testcatalog.org/show/LAB2810-1
Modified APt test. (n.d.). https://mobile.fpnotebook.com/OB/Lab/MdfdAptTst.htm

Hema: APTT (Plasma)

What is APTT (Plasma)?

- Activated Partial Thromboplastin Time (PTT) is commonly used for pre-surgical screening for intrinsic factor deficiency, monitoring heparin therapy, in the detection of Lupus Anticoagulants, and quantitative determination of the Factor VIII, IX, XI, and XII relevant with the intrinsic coagulation system.

Procedure for APTT (Plasma):

Specimen collection
1. Plasma obtained from whole blood samples that had been collected in a tube with 0.109M sodium citrate as an anticoagulant, nine parts of freshly collected whole blood should be immediately added to one part of anticoagulant. Centrifuge the whole blood specimen at 2500 xg for 15 minutes. Separate the plasma using a plastic pipette and place it in a plastic test tube. Perform the activated partial thromboplastin time assay within 4 hours.
2. Add 1 ml distilled water to the vail mix well and allow it to stand for 15 minutes at ambient temperature to ensure it is dissolved completely.
3. Allow the PTT reagent to reach room temperature before use.

Manual method
1. Bring all reagents, controls and samples to room temperature 15 minutes prior to testing.
2. Pipette 50 µl of PTT reagent to each tube.
3. Pipette 50 µl of sample controls to the tubes prepared in step 2.
4. Incubate for 3 minutes at 37°C.
5. Add 25µl of CaCl2 solution to each tube, start the stopwatch, mix in a water bath (37°C) for 20 seconds, then record the time required for clot formation.

Reference:

ACTIVATED PARTIAL THROMBOPLASTIN TIME (PTT) (LIQUID REAGENT). (n.d.). Atlas Medical. Retrieved November 29, 2023, from https://atlas-medical.com/upload/productFiles/205004/APTT%20(PTT)%20Kit%20with%20Normal%20Control%20Package%20Insert.pdf

Hema: Hemoglobin

Drabkin's Solution for Hemoglobin Estimation

- This reagent is used to quantitatively measure the concentration of hemoglobin in whole blood

Procedure for Manual Preparation of Drabkin's Solution

1. Hemoglobin (Drabkin's) solution can be prepared in the laboratory.
2. Drabkin's solution reagents needed are:
    1. Potassium ferricyanide = 200 mg
    2. Potassium cyanide = 50 mg
    3. Potassium dihydrogen phosphate = 140 mg
    4. Non-ionic detergent = 1 ml
    5. Distal water = Make up to 1000 ml (1 L)

Procedure for Hemoglobin Estimation by Drabkin's Solution

1. Take 20 microliter of blood + Drabkin 4 mL = 1: 200 dilution.
2. OR take 20 microliter of blood + Drabkin 5 mL = 1: 250 dilution.
3. Now mix well.
4. Read within 6 hours of mixing the blood with Drabkin's solution.
5. Read on a spectrophotometer at filter 540.
6. Read against the blank of Drabkin's solution (Drabkin solution can be used as blank).
7. Also, read the standard solution (12 G/dL) with the same dilution as the test sample.
8. Read by the spectrophotometer; the reading is called optical density (OD).

$$\text{Calculation} = \frac{\text{OD of test}}{\text{OD of standard}} \times \text{Conc. of standard} = \text{Hemoglobin of test in} \frac{\text{g}}{\text{dl}}$$

Reference:

Ahmad, F. (n.d.). *Drabkin's solution for hemoglobin estimation-formula and...* Labpedia.net. Retrieved November 29, 2023, from https://labpedia.net/drabkins-solution-for-hemoglobin-preparation-of-drabkins-solution/

HEMA: Platelet Count

What is Platelet count?

- A quick and widely used test to find out how many platelets are in your blood is called a **platelet count**. Small blood cells called platelets, also known as thrombocytes, develop from bone marrow cells called megakaryocytes. When a blood vessel is damaged, platelets clump together. For instance, when you cut your finger, the blood's proteins called clotting factors combine with platelets. They combine to create a "glue" that stops the bleeding. A single drop of blood contains hundreds of thousands of platelets. Typically, a complete blood count includes a platelet count. Red blood cells, white blood cells, and platelets are counted in this test.
- It just takes a few minutes to draw blood for a platelet count. The test may be administered in a lab, hospital, or the office of your healthcare provider. Typically, a healthcare professional known as a lab technician draws blood samples.

Procedure for Platelet Count:

The laboratory technician:
• Chooses a vein close to your elbow on the inside of your arm.
• Wraps your upper arm in a tourniquet, which is a tight band or cord. The tourniquet helps easier blood drawing by forcing blood into your veins.
• Makes your veins surrounding your skin clean.
• Penetrates your vein with a needle. You may experience some discomfort and a light stick.
• Transfers blood into a collection tube.
• Takes out the tourniquet and needle.
• Dresses your arm with a tiny bandage.

A medical professional inserts the blood into a tiny device. In roughly sixty seconds, the device counts the other blood cells and platelets.

It is possible that your provider will perform a blood smear. This is an extra test to look under a microscope at a tiny sample of blood. The size and shape of blood cells are evaluated using a blood smear.

Reference:

Professional, C. C. M. (n.d.). *Platelet Count*. Cleveland Clinic.

https://my.clevelandclinic.org/health/diagnostics/21782-platelet-count

HEMA: RBC Count

What is RBC Count?

- The quantity of red blood cells, or erythrocytes, in your blood is determined by a red blood cell (RBC) count. Every cell in your body receives oxygen from your lungs through red blood cells. For cell growth, reproduction, and overall health, oxygen is necessary. A higher or lower-than-normal RBC count is frequently the initial indicator of a disease. Thus, even before you experience symptoms, the test might enable you to start treatment.
- The complete blood count, a collection of tests that examine different components and characteristics of your blood, usually includes a **red blood cell (RBC) count**. Anemia, a condition in which your body produces insufficient amounts of healthy red blood cells, is one red blood cell disorder that the RBC measurement is used to help diagnose.

Procedure for RBC Count:

- A tiny needle will be used by a medical professional to draw blood from a vein in your arm. A tiny amount of blood will be collected into a test tube or vial following the insertion of the needle. The needle may sting a little as it enters or exits your body. Usually, this takes under five minutes.

Reference:

Red Blood Cell (RBC) Count. (n.d.). https://medlineplus.gov/lab-tests/red-blood-cell-rbc-count/#:~:text=What%20happens%20during%20a%20red,needle%20goes%20in%20or%20out.

HEMA: Reticulocyte Count

What is Reticulocyte Count?

- Red blood cells in the process of developing are called reticulocytes. They go by the name of immature red blood cells as well. The bone marrow produces and distributes reticulocytes into the blood.
- The quantity of reticulocytes in the blood is gauged by a **reticulocyte count**, also known as a *retic count*. Anemia and problems with the kidneys, liver, and bone marrow are among the major health issues that could be indicated by a count that is either too high or

too low.

Most frequently, a reticulocyte count is used to:

• Make specific anemia diagnosis. Anemia is a disorder where the concentration of red blood cells in your blood is below normal. Anemia can have a variety of forms and causes.
• Check the effectiveness of the anemia treatment.
• Check if the bone marrow is generating the appropriate number of red blood cells.
• After chemotherapy or a bone marrow transplant, evaluate bone marrow function.

Procedure for Reticulocyte Count:

- Using a tiny needle, a medical professional will draw blood from a vein in your arm. A tiny amount of blood will be collected into a test tube or vial following the insertion of the needle. The needle may sting a little as it enters or exits your body. Usually, this takes under five minutes.
- An infant is tested by having their heel cleaned with alcohol and punctured with a tiny needle by a medical professional. After taking a few blood droplets, the medical professional will bandage the injured area.

Reference:

Reticulocyte Count. (n.d.). https://medlineplus.gov/lab-tests/reticulocyte-count/#:~:text=What%20happens%20during%20a%20reticulocyte,needle%20goes%20in%20or%20out