

HANDS-ON EXPERIENCE IN PATHOLOGY, TB DIAGNOSIS AND BLOOD TRANSFUSION SERVICES AT DIVISIONAL HEAD QUATER (DHQ) TEACHING HOSPITAL MIRPUR AZAD KASHMIR

Muhammad Nauman Aziz^{*1}, Maimnat Taiba², Sana Manzoor³, Ali Abbasnezhad⁴, Zill E Huma⁵, Dr. Abdul Jabbar⁶

^{*}1Department of Biotechnology, Mirpur University of Science and Technology, 10250. (AJK) Pakistan

¹mnaumana23@gmail.com, ²maimnetaiba@gmail.com, ³sanimanzoor7@gmail.com, ⁴ali83abs@gmail.com, ⁵zilizareef789@gmail.com, ⁶abdul.jabbar@must.edu.pk

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Corresponding Author: *

Muhammad Nauman Aziz

Abstract

Professional training was conducted at Divisional Headquarters (DHQ) Teaching Hospital, Mirpur, to gain comprehensive practical exposure in diverse diagnostic and laboratory techniques. The training encompassed work in the pathology laboratory, tuberculosis (TB) laboratory, and blood bank. In the Phlebotomy section, blood samples were collected and processed for diagnostic analysis. In the TB lab, diagnostic techniques such as fluorescence microscopy, polymerase chain reaction (PCR) using the GeneXpert system, and culture on Lowenstein-Jensen (LJ) medium were observed and practiced for the detection of *Mycobacterium tuberculosis*. In the pathology laboratory, various sections including clinical pathology, serology, and biochemistry were explored. Procedures included urine and pregnancy testing, serological screening for HIV, HBV, and HCV, and biochemical analyses such as liver and renal function tests, lipid profiling, glucose estimation, and cardiac enzyme assays using a fully automated Selectra analyzer. Work in the blood bank involved performing cross-matching, ABO blood grouping, and observing transfusion protocols. Participation in a workshop on "Data and Information Management in Blood Transfusion Services" further enhanced laboratory data handling and reporting skills. This professional experience provided comprehensive exposure to diagnostic methodologies, laboratory management, and collaborative clinical practice.

INTRODUCTION

1.1 OVERVIEW OF INTERNSHIP ORGANIZATION

The research was conducted at Divisional Headquarters (DHQ) Teaching Hospital, Mirpur, Azad Jammu and Kashmir (AJ&K). It is the largest government hospital in the region, providing comprehensive healthcare and advanced diagnostic facilities. This training provided extensive practical experience and enhanced professional knowledge in various clinical and laboratory procedures.

1.1.1 History

In 1981, this hospital was set up when CMH was moved from Mirpur. An Obstetric and a Gynae ward were added in 1986. For a medical procedure, another ward was added in 1995, which comprised of another neurosurgery unit, operation theaters and surgical Intensive Care Unit (ICU). KIC (Kashmir Institute of Cardiology) was added in 2002. It has private rooms, crisis ward, out entryway and a theater. A private ward was added in 2005 which consisted of 20 beds. ^[1]

1.1.2 Hospital Building

The hospital has various squares built on various occasions. The names of different blocks of hospital buildings are:

- Administration Block
- Outdoor Block
- KIC Block
- Indoor Old Block
- Skin Psychiatry Block
- Stores
- Kitchens
- Private Ward
- Surgical Complex
- Nursing Hostel
- Laundry Block
- Mosque
- Doctors Mess
- Dental Center
- Emergency Center
- Mortuary

1.1.3 Clinical Departments of Hospital

The hospital has different clinical departments. The names of these departments are:

- Medical department
- Surgical Department
- Gynae & Obstetrics department
- Oto-Rhino-Laryngeology (ENT) Department
- Ophthalmology (EYE) Department
- Dermatology Department
- Department of Paediatrics
- KIC (Kashmir Institute of Cardiology)
- Pathology Department
- Department of Radiology
- Psychiatry department
- Department of Dentistry
- Physiotherapy department

1.1.4 Pathology Department and TB Lab

Department of Pathology has different sections. In these sections, one is reception where public dealing occurs. Then comes sampling, where blood samples are taken from patients. Then these samples of patients are given to the main lab of pathology where further testing of these samples occurs. Main lab has further some sections like haematology, clinical pathology, screening, serology, biochemistry, and blood grouping. TB Lab is comprised of Biosafety Level-2.



Figure No. 1.1: Emergency department of DHQ Teaching Hospital, Mirpur



Figure No. 1.2: New building of DHQ Teaching Hospital, Mirpur

1.2 NAMES AND WORKING PRINCIPLE OF INSTRUMENTS AND TECHNIQUES

1.2.1 Syringe and Its Working Principle

A syringe is an easy and simple reciprocating pump that consists of a plunger that is fixed firmly within a cylinder-shaped tube termed a barrel.



Figure No. 1.3: A typical plastic medical syringe

A syringe basically works on the principle of pressure. At the point when the spout of a needle is plunged in a fluid and its cylinder is removed, the pressing factor inside the needle is lower. The more noteworthy environmental pressing factor following up on the outside of the fluid pushes the fluid up into the needle.^[2]

1.2.2 Urine Test Strips and Its Working Principle



Figure No. 1.4: Urine test strips container

The test principles depend on different colors/dyes and reagent responses with segments of the urine that lead to shaded segments, which can be visually recognized as well as estimated by the instruments. The sample responds with strong stage dry reagent regions joined to a plastic holder.^[3]

1.2.3 UPT Strips and Its Working Principle



Figure No. 1.5: UPT strip image

The UPT strip works on the principle of estimating levels of a chemical called human chorionic gonadotropin (HCG). HCG is a chemical created by cells in the placenta. Urine is applied to a sample pad toward the finish of the test stick and is drawn up the strip. The primary region it comes to is the response zone. In case HCG is available in the urine, here it ties to proteins called antibodies. These antibodies have an enzyme joined to them which can take part in responses further along the test strip.^[4]

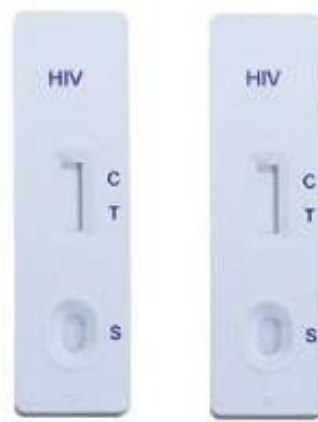
1.2.4 Centrifuge and Its Working Principle

A centrifuge is a part of equipment that is basically used to separate out heavier particles from the lighter ones by using the action of centrifugal force.



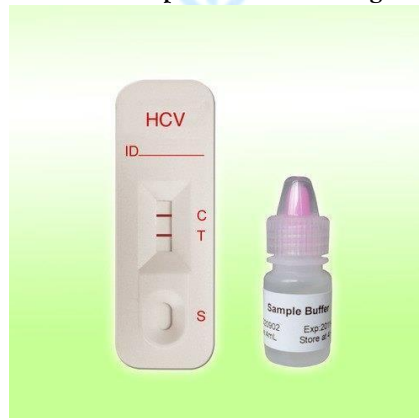
Figure No. 1.6: Centrifuge machine

The centrifuge mainly works on the principle of sedimentation, where the speed increase at centripetal power makes denser substances separate out along the outspread heading at the lower part of the cylinder.^[5]

1.2.5 HIV Rapid Diagnostic Test Strip and Its Working Principle**Figure No. 1.7: HIV rapid diagnostic test strip**

Rapid tests are a worked on variant of immune response ELISA tests. They search for HIV antibodies in the blood. The antigens for HIV are fixed on one specific strip along the quick test stick. Towards the finish of the testing stick are control antigens to show that the test worked. A sample is set toward the finish of the testing stick. A substance, called a support, to work with the testing cycle is added. The compound makes the antibodies in the blood stream along the test stick.

At the point when they disregard the part with the antigens, assuming there are any antibodies for HIV present, they will adhere to these antigens and change tone. ^[6]

1.2.6 HCV Rapid Diagnostic Test Strip and Its Working Principle**Figure No. 1.8: HCV rapid diagnostic test kit**

HCV rapid test device is used for qualitative detection of antibodies to hepatitis C virus in human plasma, serum, and whole blood samples. It is used as an aid in the analysis of Hepatitis C infection. HCV test utilizes chromatographic horizontal stream gadget in a strip design. Colloidal gold formed recombinant antigens (Au-Ag) comparing to HCV center. HCV antigens are bond at the Test Zone (T) and hare hostile to HCV monoclonal antibodies are bond at the Control Zone (C). Upon test expansion, it moves by hair like dissemination rehydrating the gold form. In the event that present in sample, HCV antibodies will tie with the gold formed antigens shaping particles. These particles will keep on moving along the strip until the Test Zone (T) zone where they are caught by the HCV antigens producing an apparent red line. In case there are no HCV antibodies in sample, no red line is framed in the Test Zone

(T). The gold form will keep on relocating alone until it is caught in the Control Zone(C) by the hare against HCV antibodies totaling in a red line, which shows the legitimacy of the test. ^[7]

1.2.7 HBsAg Rapid Diagnostic Test Strip and Its Working Principle



Figure No. 1.9: HBsAg rapid diagnostic test kit

The One Step HBsAg Rapid Test depends on the guideline of chromatographic immunoassay for subjective recognition of the surface antigen of hepatitis B infection (HBsAg) in human entire blood, serum, and plasma tests. Monoclonal and polyclonal antibodies are utilized to distinguish HBsAg explicitly. HBsAg Rapid Test is extremely delicate and results can be perused outwardly with no instrumentation. This HBsAg Rapid Test utilizes chromatographic horizontal stream gadget. Colloidal gold formed monoclonal antibodies receptive to HBsAg (sAb-Au) are dry immobilized onto a nitrocellulose film strip. At the point when the sample is added, it moves by slender dissemination box the strip rehydrating the gold form. In the event that present, HBsAg will tie with the gold formed antibodies shaping particles. These particles will keep on relocating along the strip until the Test Zone (T) where they are caught by enemies of HBs antibodies immobilized there and an apparent red line shows up. ^[8]

1.2.8 Blood Collection Tubes and Its Working Principle



Figure No. 1.10: Blood collection tubes

Most blood assortment tubes contain an added substance that either speeds up thickening of the blood (coagulation activator) or keeps the blood from thickening (anticoagulant). A cylinder that contains a coagulation activator will create a serum test when the blood is isolated by centrifugation while a cylinder that contains an anticoagulant will deliver a plasma test. The phlebotomy methodology should be performed to protect venous trustworthiness. At the point when a cylinder is embedded into the holder, its elastic cap is penetrated by this internal needle and the vacuum in the cylinder gets blood through the needle and into the cylinder. The filled cylinder is then taken out and another can be embedded and filled the same way.^[9]

1.2.9 Electrolytes Analyzer and Its Working Principle



Figure No. 1.11: Electrolyte analyzer

Significant segments of an electrolyte analyzer are - reagents, cathode module, peristaltic siphon, and test. Electrolytes are estimated by a cycle known as potentiometer. This technique estimates the voltage that creates between the inward and external surfaces of a particle specific anode. The cathode (film) is made of a material that is specifically porous to the particle being estimated. All calcium and magnesium are generally estimated by colorimetric methodology called dye binding assays.^[10]

1.2.10 Selectra Machine and Its Working Principle

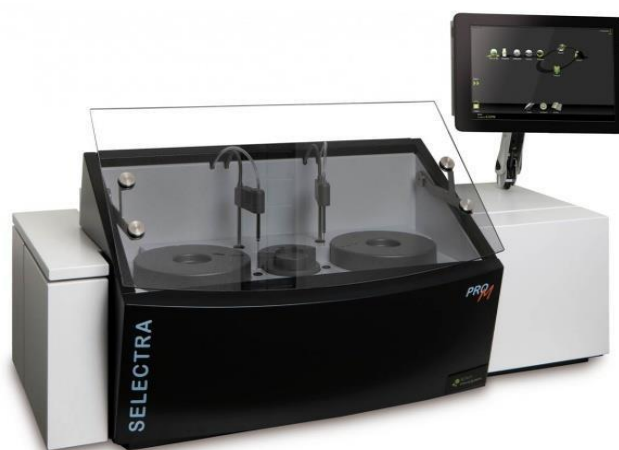


Figure No. 1.12: Selectra Pro M machine

The ELI Tech Selectra Pro M depends on the colorimetric principle and Lambert Beer's law which relates the ingestion of light to the properties of the material through which light is voyaging. Test that contains the analyte being estimated is precisely administered into an optical clear cuvette and blended in with precisely apportioned reagent. The analyte in the sample will respond with the reagent and an

adjustment of shading will happen. The adjustment of shading is straightforwardly relative to the concentration of the analyte in the example.

1.2.11 Fluorescence Microscopy and Its Working Principle



Figure No. 1.13: Fluorescence microscope

The essential reason of fluorescence microscopy is to stain the segments with colors. Fluorescent colors, otherwise called fluorophores or fluorochromes, are atoms that retain excitation light at a given frequency (for the most part UV), and after a brief pause emit light at a more extended frequency. The discharge light would then be able to be shifted from the excitation light to uncover the area of the fluorophores. Light of the excitation frequency is centered on the sample through the goal focal point. The fluorescence produced by the sample is centered on the indicator by the goal. Since a large portion of the excitation light is sent through the sample, just mirrored excitatory light arrives at the target along with the radiated light. ^[11]

1.2.12 GeneXpert and Its Working Principle



Figure No. 1.14: GeneXpert system

The GeneXpert analyze TB by identifying the presence of TB microorganisms. The test is a sub-atomic TB test which distinguishes the DNA in TB microorganisms. The GeneXpert can likewise distinguish the hereditary transformations related with protection from the medication Rifampicin. ^[12] GeneXpert MTB/RIF test is a quick analytic trial of tuberculosis (TB) and medication opposition. It is changing TB control with helps in brief analysis and treatment. GeneXpert MTB/RIF examine is a

nucleic acid amplification (NAA) test which at the same time distinguishes DNA of *M. tuberculosis* complex (MTBC) and protection from rifampin (RIF) in under 2 hours. This framework incorporates and robotizes test preparing, nucleic acid amplification, and recognition of the objective arrangements.^[13]

1.2.13 Water Bath and Its Working Principle

A water bath is basically lab equipment that is made from a container filled with water which is warm. It is utilized to incubate tests in water over a long period of time at a constant.^[14]



Figure No. 1.15: Water bath

The sensor move water temperature to resistance value amplified and compared by integrated amplifier, then, at that point yield the control signal, productively control the normal warming force of electric warming cylinder and preserve with water in steady temperature.^[15]

1.2.14 Plasma Thawer and Its Working Principle



Figure No. 1.16: Plasma thawer

The work done by plasma thawer is to liquefy plasma at 37° C. Plasma thawer, which is a water bath, intended to give fast and safe thawing out of frozen plasma. Before a frozen pack of plasma can be utilized for a transfusion, the frozen plasma needs to be warmed to an ideal transfusable temperature. A plasma thawer accomplishes a uniform and quality norm of thawed out plasma for its ensuing use.^{[16][17]}

1.2.15 Serofuge and Its Working Principle

A Serofuge is a piece of laboratory equipment that is used in blood banking by spinning the serum from whole blood red cells.^[18]



Figure No. 1.17: Serofuge equipment

Working principle of serofuge is to isolate blood parts at 3500 rpm, 11° C temperature for 12 minutes. A rotator works by utilizing the rule of sedimentation: Under the impact of gravitational power (g-power), substances separate as indicated by their thickness. Various kinds of partition are known, including isopycnic, ultrafiltration, thickness angle, stage division, and pelleting.^[19]

1.2.16 Platelet Agitator and Its Working Principle

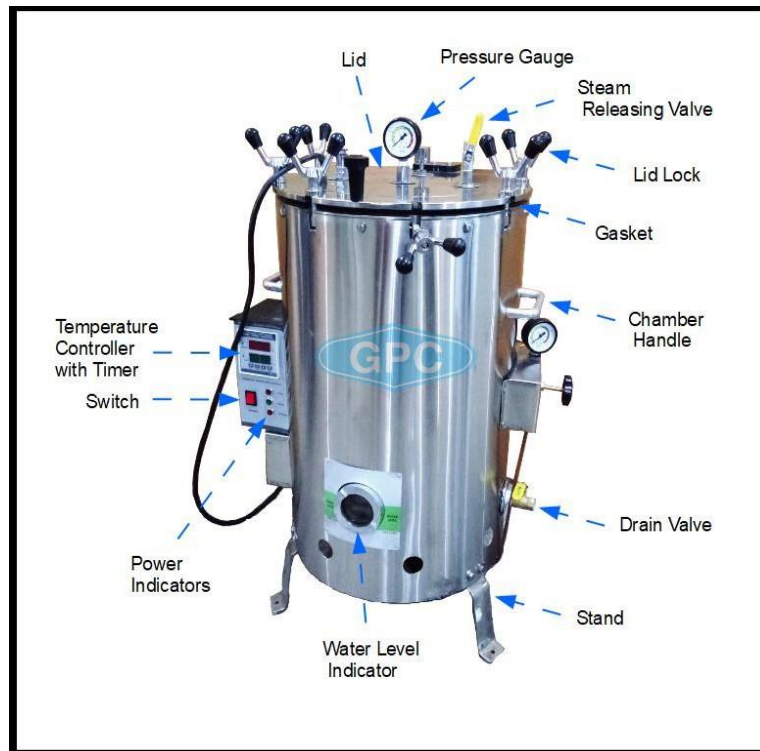
Figure No. 1.18: Platelet agitator

Platelet agitators are intended for capacity of platelet focuses and are intended to give nonstop delicate flat movement to the packs, commonly at a fixed speed and at a temperature of 20–24 °C. Platelet concentrates are harvested from entire blood by centrifugation or during platelet apheresis.^[20]

1.2.17 Autoclave and Its Working Principle

The autoclave deals with the standard of sodden warmth sanitization where steam under tension is utilized to disinfect the material present inside the chamber. The high pressing factor builds the limit of water and accordingly accomplishes a higher temperature for disinfection. At the point when this steam comes in touch on a superficial level, it kills the organisms by emitting idle warmth. The condensed fluid guarantees the damp killing of the microorganisms. When the disinfection stage is finished, the pressing factor is delivered from within the chamber through the whistle. The pressing factor inside the chamber is then reestablished back to the surrounding pressure while the segments inside stay hot for quite a while.^[21]

Figure No. 1.19: Vertical autoclave



1.2.18 Biosafety Cabinet and Its Working Principle



Figure No. 1.20: Biosafety cabinet, Class-II

A BSC is a ventilated fenced in area offering security to the client, the item and the climate from mist concentrates emerging from the treatment of possibly unsafe miniature life forms (micro-organisms). The constant wind current is released to the air through a HEPA channel/filter. ^[22]

1.2.19 Incubator and Its Working Principle**Figure No. 1.21: Incubator**

Incubator relies upon the guideline of thermo-power. The incubator has an indoor regulator which keeps a consistent temperature by making a warm angle. All incubators depend on the idea that when living beings are furnished with the ideal state of temperature, oxygen, and carbon dioxide levels, they develop and gap to frame more creatures. ^[23]

1.2.20 Laminar Flow Cabinet and Its Working Principle**Figure no. 1.22: Laminar flow cabinet**

The device works by the utilization of inwards stream of air through at least one HEPA channels to establish a without particulate climate. The air is taken through a filtration framework and afterward depleted across the work surface as a piece of the laminar progression of the air. ^[24]

1.2.21 CBC Analyzer and Its Working Principle

The entire blood is passed between two electrodes through an opening so thin that only each cell can go through in turn. The instrument uses stream cells, photometers and gaps to break down various components in the blood. Locally available the analyzer, the example is weakened and suctioned into no

less than two distinct stations, one of which is utilized to check red platelets and platelets, the other to tally white platelets. ^[25]



Figure No. 1.23: Hematology/CBC analyzer

1.3 DESCRIPTION OF TASKS

I started my practical training on 20th October, 2020 and ended on 30th November, 2020. The attendance was taken by Lab Manager Mr. Irfan Shahid daily. As an interne, I was expected to work according to the duty hours of 8 am until 2 pm, six days in a week. I was assigned to work in pathology lab, TB lab and blood bank. The detailed description of tasks assigned to me during this internship is given below:

1.3.1 Blood Sampling/Phlebotomy

In 1st week, I was assigned to work in blood sampling. Blood sampling was one of the sections of Department of Pathology. For the sampling, a lot of syringes or needles, different blood collection tubes, butterfly needles, tornigates, needle cutter, and cotton were present in a sufficient amount. I take blood samples from patients through syringes. For babies, old and those people who have narrow veins or not prominent veins, blood samples were taken through butterfly needles. After taking blood samples from patients, these samples were transferred to their respective tubes according to the tests required.

1.3.1.1 Blood collection cubes

Most blood assortment tubes contain an added substance that either speeds up coagulating of the blood (coagulation activator) or keeps the blood from thickening (anticoagulant). A cylinder that contains a coagulation activator will deliver a serum test when the blood is isolated by centrifugation and a cylinder that contains an anticoagulant will create a plasma test after centrifugation. A few tests require the utilization of serum, some require plasma, and different tests require anticoagulated entire blood. ^{[26][27]}

Table No. 1.1: Blood collection tubes used in our lab

Tube color	Additive	Additive's function	Sample specimen production	Laboratory tests
Purple	EDTA	Prevents blood clotting by removing calcium	Extract plasma after centrifugation	Haematology tests (CBC, ESR and HgBA1c) and Blood Bank
Red (plain tube)	None or contains silica particles which act as clot	Promotes blood clotting with silica particles	Extract serum after centrifugation	Biochemistry tests, Blood Bank and serology

	activators			
Light blue	Sodium citrate (3.2%)	Prevent blood clotting by binding calcium	Extract plasma after centrifugation	Coagulation (used for the testing of PT and APTT/PPT)

All of these are the information about blood collection tubes which we used in pathology lab.

1.3.2 TB Lab

I was assigned to work in TB Lab for a week. The lab comprised of BSL-2. In lab, they perform three methods to test MTB. These three methods are PCR, culture and microscopy. I observed all these three methods to test MTB. As we know that TB is an infectious disease which affects lungs. It is caused by MTB.

1.3.2.1 Symptoms

The symptoms are weight loss, fever, cough with blood and night sweats.

1.3.2.2 Risk factors

The risk factors include smoking and HIV/AIDS.

1.3.2.3 Treatment

For the treatment, the antibiotics were given to the patients of TB.

1.3.2.4 GeneXpert PCR method

I have observed this method in TB lab for detection of MTB through GeneXpert system. GeneXpert MTB/RIF examine is a quick demonstrative trial of TB and medication opposition. It is upsetting TB control with helps in brief conclusion and treatment (determination of proper TB routine).

GeneXpert MTB/RIF measure is a nucleic acid amplification test which at the same time identifies DNA of MTB complex and protection from rifampin in less than 2 hours. ^[28]

1.3.2.5 Fluorescence microscopy

Fluorescence microscopy is an exceptionally incredible insightful device that consolidates the amplifying properties of light microscopy with perception of fluorescence. For this fluorescence microscopy, first of all make smear of about 2.5 cm length and 2 cm width. And also for this we need to make auramine stain for the procedure. Then after following all the procedure to dye the slides, observe the slides under fluorescence microscope to see the colonies of MTB. ^[29]

1.3.2.6 Culture

For the culturing, LJ Media (Lowenstein Jensen) as a selective media was used for the cultivation and isolation of Mycobacterium specifically "M. tuberculosis".

Table No. 1.2: Advantages and disadvantages of GeneXpert, Fluorescence Microscopy and culture methods

Methods	Advantages	Disadvantages
GeneXpert PCR method	Quick (1-2 hours) Time efficient technique Fully mechanized framework	No drawbacks

Fluorescence Microscopy	Less time consumption Less space required Easy to replace Take 30 min to 1 hour for test result Less cost	Less sensitive Long exposure to fluorescent light result in loss of intensity and bleaching
Culture	Gold standard Antibiotics susceptibility Require more labor Check drug resistance	Time consumption (2 months) Sometimes result comes negative, so its time wastage

Clinical Pathology

For one week, I was assigned to work in clinical pathology section. In this clinical pathology, tests were performed from urine sample. First, for 1-2 days I observed urine tests which are performed by urine tests strips. Then I also performed these tests and then my instructor interprets these strips results by comparing the color of strip with the color chart printed in the bottle of container. I also performed pregnancy tests from urine samples and interpret these test results.

1.3.2.7 Urine test strips

A urine test strip is a fundamental indicative instrument used to decide pathological changes in a patient's urine in standard urinalysis. A standard urine test strip may include up to 10 diverse substance reagents which respond (change tone) when drenched in, and afterward eliminated from, a urine test. The test can regularly be perused in just 60 to 120 seconds subsequent to plunging, albeit certain tests require longer. Routine testing of the urine with multiparameter strips is the initial phase in the analysis of a wide scope of illnesses. The examination incorporates testing for the presence of proteins, glucose, ketones, hemoglobin, bilirubin, urobilinogen, nitrite and leucocytes just as testing of pH and explicit gravity or to test for contamination by various microbes.^{[30] [31]}

1.3.2.8 Expected values

- Glucose: Groupings of just 0.1g/dl glucose, read either at 10 or 30 seconds, might be fundamentally unusual whenever found reliably.
- Ketone: Normally no ketones are available in urine. Discernible degrees of ketone might happen in urine during physiological

pressure conditions like fasting, pregnancy, and successive exercise.

- pH: infant: 5-7, from there on: 4.5-8, normal: 6
- Blood: Any green spots or green shading that shows up on the reagent region inside 60 seconds demonstrates blood has been recognized and the requirement for additional examination.
- Nitrite: Any level of pink tone following 30 seconds demonstrates a positive test for nitrite proposing a clinically huge contamination by microbes.
- Urobilinogen: In this test the ordinary reach is 0.2-1.0 mg/dl.
- Bilirubin: Normally no bilirubin is recognizable in urine by even the most delicate strategies. Abnormal tones might demonstrate that bilirubin inferred bile shades are available in the urine test and are conceivably covering the bilirubin response.
- Protein: Normally urine samples contain some protein, (0-4 mg/dl) in this manner, just tireless degrees of urine protein show kidney or urinary plot sickness.
- Explicit gravity: In typical grown-up irregular urine explicit gravity might be from 1.003 to 1.040.
- Leukocytes: Normal urine samples for the most part yield adverse outcomes; positive outcomes (little or enormous) are clinically huge.

1.3.2.9 UPT Strips

The UPT strip works on the principle of estimating levels of a chemical called human chorionic gonadotropin (HCG). HCG is a chemical created by cells in the placenta. Urine is applied to a sample pad toward the finish of the test stick and is drawn up the strip. The

primary region it comes to is the response zone. In case HCG is available in the urine, here it ties to proteins called antibodies. These antibodies have an enzyme joined to them which can take part in responses further along the test strip.^[32]

1.3.2.10 Limitations of Test

The test works just if the directions are followed correctly. Though the test is profoundly precise in recognizing pregnancy, a low rate of bogus outcomes can happen. Certain ailments can likewise cause a bogus or unpredictable test outcome. The accompanying elements ought not to influence the test outcomes: liquor, analgesics (pain relievers), anti-toxins, and anti-conception medication pills. The test ought not to be utilized after the lapse date displayed on the bundle.^[33]

1.3.3 Biochemistry

I was assigned to work in biochemistry section for one week. In our lab, the biochemistry tests were performed through Selectra machine which is fully-automated. We just need to give command through the computer system which was attached with machine, and then it gives us the results according to the command. The biochemistry tests include LFTs, RFTs, lipid profile, glucose, uric acid, calcium, sodium, potassium, urea and cardiac enzyme. We just need to put reagents in the machine according to given instructions. Then we get the results. I observed all this process. I also performed electrolyte tests with semi-auto machine called electrolyte analyzer. Electrolytes tests include sodium, calcium and potassium.

1.3.3.1 Selectra

The Selectra Pro M framework approaches 180 photometric tests each hour to serve research facilities with essential, STAT or back-up testing needs. The framework offers insignificant upkeep and viable utilization of consumables to genuinely decrease functional expense.^[34]

- Completely mechanized clinical science analyzer
- Up to 180 photometric tests/hour, in addition to discretionary dry ISE
- Wide test menu
- Top tier administrator interface
- Efficiency and blunder decreasing

abilities

- Mechanized reagent the board
- Yearly Pro Active Maintenance Kit

1.3.3.2 Electrolyte Analyzer

An electrolyte analyzer is a piece of research facility hardware that checks electrolyte levels. The electrolyte analyzer is a gadget for estimating the electrolytes in the human body. They are fundamentally utilized in the quantitative estimation of sodium, potassium, and chloride in entire blood, serum, or plasma. Some electrolyte analyzers utilize scaled down ISE, which are created in planar kind.^[35]

1.3.3.3 Role in Maintenance of Body Function

Electrolytes assume numerous parts in the support of body capacities, for example, supporting legitimate body Ph, controlling capacity of the heart and different muscles, and taking an interest in enzymatic capacities.

1.3.3.4 Imbalance electrolytes

Electrolytic uneven characteristics can bring about congestive cardiovascular breakdown, diabetes insipidus, and kidney sicknesses. Hence electrolytic investigation is a critical factor in quiet determination and treatment.

1.3.4 Blood Bank

For one and half week, I was assigned to work in Blood Bank. The staff of Blood Bank was very kind and generous. Blood Bank plays a very important role for Thalassemia patients. Blood Bank gives these patients blood whenever they need blood. It gives whole blood and also components of blood that required according to need like white blood cells, red blood cells and platelets. In Blood Bank, I observed all the instruments and equipment's present in Blood Bank like platelet agitator, serofuge, plasma thawer, and the process of cross-match tests. In which they check that if the donor blood is compatible for patient or not by both minor cross-match and major cross-match. I also performed screening of HIV, HCV and HBsAg with the rapid diagnostic kits. And I also performed blood grouping in Blood Bank. I also learned one important thing that the fresh blood is not the blood which is taken from

donor at that time but the fresh blood is that which was about 7-8 days old.

1.3.4.1 Cross-match Test

There are two types of cross-match tests. One is minor cross-match and another is major cross-match:

- **Major cross-match:** For this we need donor's cell and patient's serum, after performing all procedure if agglutination occurs it

shows incompatibility. If agglutination not occurs, it shows that donor blood is compatible for patient.

- **Minor cross-match:** For this we need donor serum and patient's red blood cells.

1.3.5 Reception

I was also assigned to work in reception for 2-3 days. In reception, I performed the sorting of result reports. I observed billing procedure by using computer system. I learned from this how to communicate with people, how to understand them and how to answer them and to relax them.

All of these are the tasks that are assigned to me during this internship of six weeks. I performed all these tasks that are given to me during this internship. I also participated in a training workshop on "Data and Information Management in Blood Transfusion Services" during my internship.

Chapter 02 METHODOLOGY

2.1 PHLEBOTOMY OR BLOOD COLLECTION FOR TESTS

2.1.1 Materials

- Syringes, safety needles and butterfly needles
- Blood Collection Tubes (red, purple and blue)
- Vacutainer tube holder
- Needle Cutter or Sharps Disposal Container
- Tornigates
- Antiseptic cotton

2.1.2 Procedure

- First, I asked some questions

from the patient related to him to confirm his/her information mentioned in recipient given by patient.

- Then in order to relax patient, I told him that for your tests only a small amount of blood required.

- I gathered all necessary equipment's according to the need.

- Then I asked patient to put his/her arm in a straight way from shoulder to wrist and to close his/her fist tightly for the purpose of getting prominent veins.

- Then I applied tornigate 3-4 inches above the collection site.

- Then I uncovered syringe needle, and hold it in line with the vein, then put the needle in vein smoothly.

- Release the tornigate when blood starts to flow and asked patient to open his/her hand.

- Then after getting the desired amount of blood, placed a piece of cotton on puncture site and release the needle and asked patient to apply cotton for at least 2 minutes.

- After this, transfer the blood drawn from patient to their respective tubes according to their test needs gently and immediately before clotting of blood.

- After converting the blood to the tubes, gently invert tubes 4-5 times in order to mix additive present in tube.

- After this, the used needle of syringe must be disposed by Needle Cutter or Syringe Disposal Container.

2.2 URINE STRIP TEST

2.2.1 Materials

- Urine sample
- Urine collection container
- Urine test strips

2.2.2 Procedure

- First, I need to check the urine sample that it must be fresh, not kept for a long time.

- Then gently shake the container of sample before using.

- Remove the lid of container of sample for testing.

- Take a strip from the bottle of urine test strips, then hold it from the opposite end of testing area and then dip the stick into the sample in such a way that all test areas must be dipped into the sample. After 10 seconds, remove the strip immediately because if I dip strip for too long it may affect the test reagents present in strip.

- Then put the strip horizontally to prevent mixing of reagents.

- After taking one strip from the bottle, immediately close the urine test strips bottle from contamination.

- By keeping the strip horizontal, read the results by comparing the color of strip with the color chart printed in the bottle of container.

2.3 URINE PREGNANCY TEST

2.3.1 Materials

- Urine sample
- Pregnancy test strip

2.3.2 Procedure

- First, we need to wait for the temperature of urine sample and the test strip become equal to the room temperature.
- After taking the strip out of the foil use it as soon as possible.
- We must need to keep the arrow head on the test strip towards the sample of urine.
- We must need to make sure that the strip is only dipped in the sample to the given maximum mark.
- Then record time and after 10 seconds take the test strip out of the urine sample.
- After taking it out, we need to wait for 5 minutes before result reading.
- After 10 minutes, we don't need to rely on the result.

2.4 BIOCHEMISTRY TESTS

2.4.1 Materials

- Serum samples
- Selectra machine
- Printer
- Tubes for sample

- Reagents for Selectra machine

2.4.2 Procedure

- First of all, we need to centrifuge the blood to get serum for processing.
- We used Selectra for biochemistry tests in our lab.

- Then we need to check reagents of machine and also need to put control and calibrator in proper place mentioned in machine.

- Then after putting the serum samples in the tubes with the labeling of samples with numbers of all the patients, we need to put these in the Selectra machine in their place properly.

- Then we need to enter the details of the patients given in computer system which was attached with machine.

- Then after this we need to enter the names of tests of the patients according to patient requirement.

- After doing all of this, we give command to system to run the tests.

- Then after completing the process of every test, it gives us the results of the patients, which appears on the screen of computer and then we print out these results through printer.

-

2.5 ELECTROLYTES TEST

2.5.1 Materials

- Sample
- Electrolyte analyzer

2.5.2 Procedure

- In our lab, we used electrolyte analyzer to test electrolytes.

- First we need to centrifuge the blood to get serum sample.

- Then put this sample in a tube and then take it to the near of machine.

- Then open the probe of the electrolyte analyzer.

- Put the probe in the sample tube in such a way that the probe must not touch the sides and bottom of tube.

- Then press the button 'YES' then the probe sucks the sample.

- Then close the probe for the further processing.
- After doing all testing, the analyzer gives us the results in a small recipient.

2.6 HIV RAPID DIAGNOSTIC TEST

2.6.1 Materials

- HIV rapid diagnostic test kit
- Plastic dropper
- Sample diluent
- Centrifuge

2.6.2 Procedure

- First, we need to collect serum or plasma specimens from the patient's blood samples.
- Take a test kit and remove it from sealed pouch.
- Label the kits for the patient identification.
- Then add 1 drop of 10 µl of specimen to the "S" well of the test kit with the help of dropper.
- Then in "D" well as mentioned in test kit, add 2 drops of Sample Diluent.
- Then at 15 minutes, we can be able to interpret results.

2.7 HCV RAPID DIAGNOSTIC TEST

2.7.1 Materials

- HCV rapid diagnostic test devices
- Droppers
- Buffer
- Disposable pipettes
- Centrifuge

2.7.2 Procedure

- HCV Test Device only needs human serum or plasma specimens for use.
- Before starting the test, we need to bring tests, specimens (serum or plasma), and controls to the temperature.
- First remove the test device from the sealed pouch.
- Place the test device on a hygienic and flat surface.
- Then label the device for patient identification.
- Transfer 1 drop of serum/plasma specimen which is approximately 25 µl to the

"S" specimen well of the device with the help of disposable pipette.

- Add 2 drops of buffer in it and note the time.
- Color will migrate to the membrane as the test begins to work.
- Then we need to wait for colored bands to appear.
- Then at 10 minutes, we should need to read results.
- After 20 minutes, do not interpret the results.

2.8 HBsAg RAPID DIAGNOSTIC TEST

2.8.1 Materials

- HBsAg rapid diagnostic test device
- Buffer
- Droppers
- Centrifuge
- Timer

2.8.2 Procedure

- HBsAg Rapid Test Device needs only human serum or plasma specimen for use.
- According to safe phlebotomy to collect specimens.
- Before use, bring the buffer, specimen and test device to room temperature.
- First, remove the test device from sealed pouch.
- Place the device on a hygienic and flat surface.
- Label the device with the patient ID.
- Transmission 3 drops of serum or plasma which is approximately 75 µl to the "S" well of the test device with the support of dropper.
- In this device, no buffer is added.
- Start the timer and wait for dyed bands to seem.
- Then at 15 minutes, recite the results and read them.

2.9 ABO BLOOD GROUPING

2.9.1 Materials

- Blood sample
- Cotton

- Plastic tray for procedure
- Anti A sera (Blue in color)
- Anti B sera (Yellow in color)
- Anti RhD sera (Clear)

2.9.2 Procedure

- First take the blood sample.
- Put the 1 drop of blood on 3 separate spots with some distance on a plastic tray.
- In 1 spot, add 1 drop of anti A sera.
- In 2 spot, add 1 drop of anti B sera.
- In 3 spot, add 1 drop of anti RhD sera.
- Then mix the blood and antiserum thoroughly by using clean stick.
- Then slightly tilt the tray in a circular motion to mix cells and antiserum.
- Then after 1-2 minutes, look for agglutination and record results.

2.10 CROSS-MATCH TESTS

2.10.1 Materials

- Donor blood sample
- Patient blood sample
- Donor serum
- Patient serum
- Test tubes
- Incubator
- Centrifuge
- Microscope

2.10.2 Procedure

- There are two types of cross matches present, one is major cross match and other is minor cross match.
- First we need to prepare donor and patient blood samples.
- For major cross match, we require donor's red cell and patient serum.
- For minor cross match, we require patient's red cells and donor's serum.
- For major cross match, take 10 μ l of donor's cell in a test tube.
- Wash the donor's cell 3 times with normal saline.
- Then add 10 μ l of patient serum.

- Mix the tube.
- Then put in water bath for almost 15 minutes.
- Add 2 drop of antihuman globulin in it and then mix well.
- Then centrifuge it at 1500rpm.
- Then after this, read the results through microscope and record them.

2.11 FLUORESCENCE MICROSCOPY METHOD TO DETECT MTB

2.11.1 Materials

- Slides
- Patient sputum
- Fluorescence Microscope
- Auramine dye
- Acid alcohol
- Methylene blue
- Slide stand

2.11.2 Procedure

- First, we need to make a smear of thicker part of sputum on a slide about 2.5 cm length and approximately 2 cm width and spread it in circular motion and then let it down to dry.
- Put the slides in a stand to paint them for the Fluorescence Microscopy.
- Put the slides in a stand in such a way that the material of one slide does not go to another slide.
- Then put auramine on the surface of slides and keep it for 20 minutes.
- After this wash out the slides with water and do assure that the drops of water do not spread on other slides.
- Then put acid alcohol on all slides for 1-2 minutes and then wash it out with water.
- Then remove the extra water from the slides.
- Then put methylene blue on slides and keep it for 1 minute and then wash out it water and remove extra water from the slides.
- Then put these slides on the stand to dry properly.
- To see colonies, put these slides onto the AFB microscope.

2.12 CULTURE METHOD TO DETECT MTB

2.12.1 Materials

- Patient sample sputum
- Ingredients of LJ Medium
- Autoclave
- Incubator
- Universal container
- Inspicator
- Measuring scale

2.12.2 Procedure

- For the culture process, we need to make LJ Medium.
- Take 600 ml of distilled water which contains 12 ml of glycerol and dissolve 37.3 g of the medium in it.
- To dissolve the medium completely, heat it if necessary.
- Then for 15 minutes, autoclave it at 121° C.
- Under aseptic condition, make uniform suspension of fresh eggs of about 1000 ml.
- During the mixing and collection, avoid whipping air into suspension.
- Mix 1000 ml of egg suspension with 600 ml of the sterile LJ Medium.
- Then cool it down to 50-60° C by avoiding air bubbles.
- Then convert this finished medium into sterile universal container.
- Then place universal containers into the inspicator in a tilt form to make slope to increase surface area for about 2 hours at 80-88° C.
- Then solidify it.
- After this, do the process of inoculation with given sample.
- Then put these universal containers on the incubator at 35-37° C.
- Then monitor the growth and observation of colonies.

2.13 RT-PCR METHOD TO DETECT MTB

2.13.1 Materials

- GeneXpert System
- GeneXpert Cartridge
- Patient's sputum

- Class II biosafety cabinet (BSC)
- Individually packed disposable transfer pipettes
- Permanent marker pens
- Sterile screw-capped containers for specimen collection
- Discard containers

2.13.2 Procedure

- First take 1 part of sample and 2 parts of reagents then vortex it.
- Then sputum liquefaction and inactivation with 2:1 sample reagent occurs.
- Then transfer of 2 ml material into test cartridge.
- Then this cartridge inserted into MTB-RIF test platform.
- From this point on all the processing is fully automated.
- Then after all processing, it gives us printed results.

2.14 HEMATOLOGY TEST

2.14.1 Materials

- Blood sample in a purple tube
- CBC Analyzer
- Printer

2.14.2 Procedure

- First, sample of blood is collected in a purple tube which contains an anticoagulant.
- Invert the blood collection tube to mix the sample thoroughly.
- Enter the sample ID.
- Then open the seal of tube and take it to the aperture to suck in the sample for following analysis.
- It gives us result in a printed form, after the analysis.

Chapter 03

RESULTS & DISCUSSION

3.1 BLOOD COLLECTION OR SAMPLING FOR TESTS

After blood collection in different tubes mentioned in above procedure of blood sampling, we get different samples after the centrifugation of blood. Like, a red tube has no factor present for blood clotting, and then it

extracts a serum sample after the process of centrifugation and a purple tube has blood

clotting factor, it extracts a plasma sample after centrifugation for further laboratory tests.

Table No. 3.1: Sample production after centrifugation

Tube Color	Additive	Sample Produced After Blood Centrifugation	Used For Laboratory Tests
Red Tube	No blood clotting factor present	Serum Sample	Biochemistry tests Serology tests Blood Bank
Purple Tube	EDTA present	Plasma Sample	Haematology Blood Bank
Blue Tube	Sodium Citrate (3.2%) present	Plasma Sample	Coagulation PT APTT/PPT

In results, from these blood collection tubes we get serum and plasma samples after the centrifugation of blood for different laboratory tests.

3.2 URINE TEST STRIP

The results of urine test strips were obtained after the procedure by comparing the color of

strip with the color printed on the bottle of urine test strips we used.



Figure No. 3.1: Color chart of urine test strips

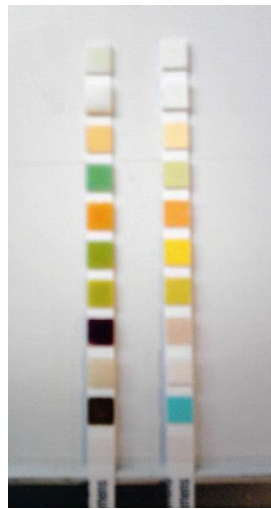


Figure No. 3.2: Comparison between two strips, pathological and unreacted strip

Figure (3.2) shows the comparison between a pathological urine test strip on the left side in figure and a strip without reaction on the right side in figure. From top (leucocytes) to bottom (glucose) in the figure, the interpretation of results is mentioned in the given below table (3.2) with normal reference value from top to bottom.

Table No. 3.2: Interpretation of urine test strip results with normal reference value

Test name	Normal Reference Value	Test report result
Leucocytes	Negative	Negative
Nitrite	Negative	Negative
Urobilinogen	0.2 ~ 1 mg/dl	Negative
Protein	Negative	Positive
Ph	newborn: 5-7, average: 6	5.0
Blood	Negative	Positive
Specific gravity	Normal adult random urine specific gravity may be from 1.003 to 1.040	1.025
Ketones	Negative	(++++)
Bilirubin	Negative	(+)
Glucose	Negative	(+++)

These results showed that the pathological urine test strip has positive protein (+), blood (+), ketones (++++), bilirubin (+) and glucose (+++) rather than negative normal reference value.

3.3 URINE PREGNANCY TEST

After performing the urine pregnancy test with strip, we get results.

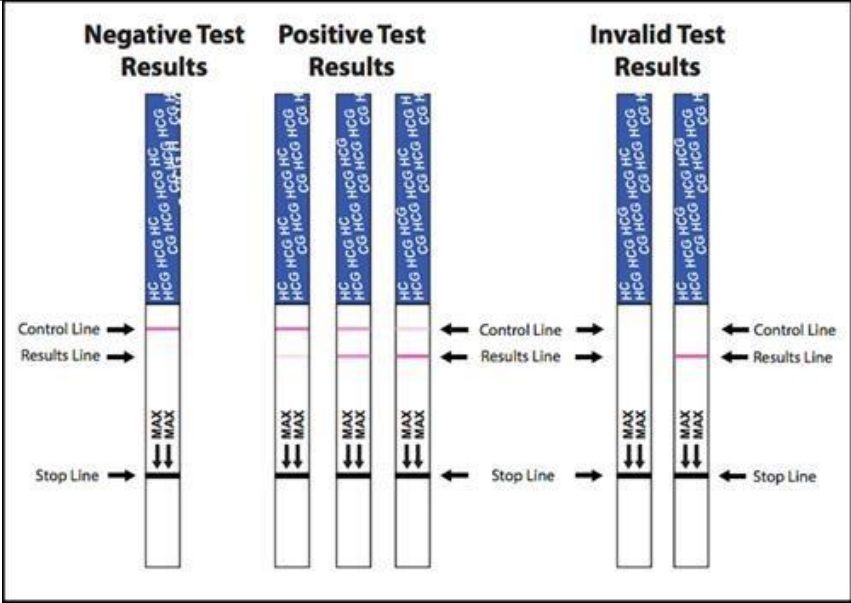


Figure No. 3.3: Urine pregnancy test results

In this figure, positive, negative and invalid results of urine pregnancy tests are mentioned. The interpretation of these results is:

Negative Test Result: If only one line appeared on the test strip as a control line, it means that the result is negative.

Positive Test Result: If two lines appeared on the test strip, one as a control line and another as a test line, it means that the result is positive which also means that she is pregnant. The results are also positive if the lines are light in color.

Invalid Results: If no line appeared on the test strip, then it means that the test is invalid or not worked properly. Even if the line appeared on the test strip, as the test line, it also means that the test is invalid. And this result is usually because of that when strip is not dipped for almost ten seconds or without being wet enough.

3.4 BIOCHEMISTRY TEST RESULTS

After performing the biochemistry tests from Selectra machine, we get the results.

Patient Name	M/o Faisal	Gender	Female
Age	60.0Years	Phone No	0
Email	faisal health dp	Refer by Doctor	OPD
Selected F/Y :2020-21			

TestName	Result	Units	Normal Range	Remarks
Total Bilirubin	0.6	mg/dl	Upto 1.0	
ALT (SGPT)	37	U/l	Upto 43	
Alk-Phosphate ALP	357	U/l	Adults: 65-360Chil...	
Urea	47	mg/dl	Upto 50	
Creatinine	1.3	mg/dl	Male: Upto 1.3Fem...	
Cholesterol	155	mg/dl	<200	
Triglycerides TG	191	mg/dl	150	
CK-NAC	61	U/l	Upto 190	
CK-MB	24	U/l	Upto 25	
LDH	175	U/l	Adults: 225-455Inf...	
AST (SGOT)	49	U/l	Upto 38	
Calcium	10.1	mg/dl	8.1-10.4	
Uric Acid UA	11.2	mg/dl	Male: 3.5-7.2Femal...	

Comments/Opinion : Update

Figure No. 3.4: Biochemistry tests result report

This figure (3.4) shows the results of biochemistry tests of mother of Faisal, in which her total bilirubin result is 0.6 mg/dl and total bilirubin normal range is up to 1.0 mg/dl. Her results for ALT, ALP, urea, creatinine, cholesterol, CK-NAC, CK-MB, and calcium are in the normal range as mentioned in figure. Her results of triglycerides are 191 mg/dl, greater than the normal range i.e. 150 mg/dl. It may cause due to obesity and poorly controlled diabetes. LDH results are low in case of normal range and this usually become cause of muscle pain and cramps during exercise. And AST value is also higher than normal value and it can become cause of liver disease and hepatitis.

3.5 ELECTROLYTES TEST RESULTS

After performing the electrolytes tests from electrolyte analyzer, we get the results.

LAB NO. LAB/2020-21/038048		Print Date: 06-Jul-2021		11:17:40AM		Page 1 of 1	
Patient's Name	NIMRA	Female	Age:	23	Years		
Refer by Resp:	Emergency Center	Date In :	11-Mar-2021	11:03 pm			
Electrolyts							
Bio-Chemistry							
SodiumNa	140	mmol/L	135-145				
PotassiumK	3.7	mmol/L	3.5-5.5				

Figure No. 3.5: Electrolytes test results

This figure 3.5 shows the electrolytes results of patient Nimra, her results of sodium (Na) and potassium (K) ions are 140mmol/L and 3.7mmol/L, respectively. Her results are under the normal range as shown in figure. If these values of electrolytes are high or low, it may cause the illness of high blood pressure and inflammation and also cause dehydration and fluid retention.

3.6 HIV RAPID DIAGNOSTIC TEST RESULTS

After performing the HIV screening of blood sample from rapid diagnostic test kit, then we get the results.

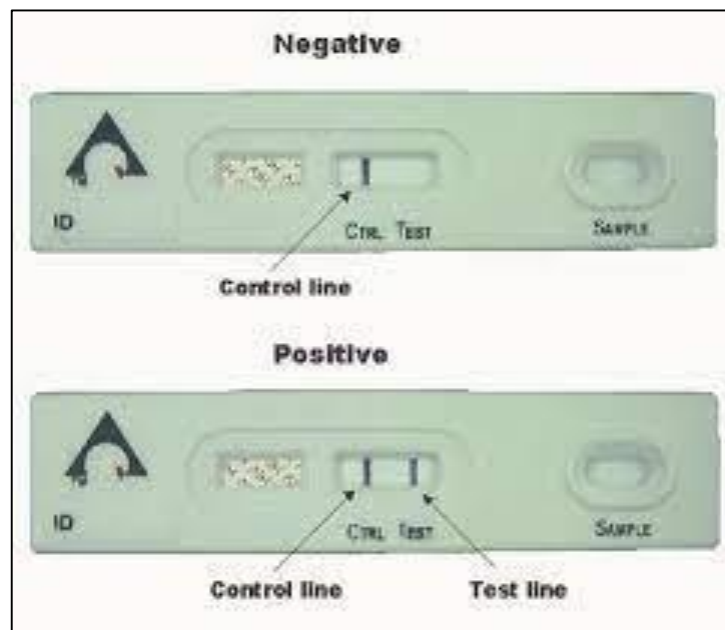


Figure No. 3.6: HIV rapid diagnostic test kit result

Interpretation of result:

Positive HIV result: If two bands/lines appear, one is control band and another is test band, then result is read as positive and the patient has HIV.

Negative HIV result: If only one band/line of control appears on the kit, it means that the result of HIV is negative and patient has no HIV.

Invalid HIV result: If a band appear as a test band not control band then this result is read as invalid. If no band is appear, it also means that the result is invalid. If result is invalid then repeat test by using another new kit.

3.7 HCV RAPID DIAGNOSTIC TEST RESULTS

After performing the HCV screening of blood sample from rapid diagnostic test kit, we get the results.

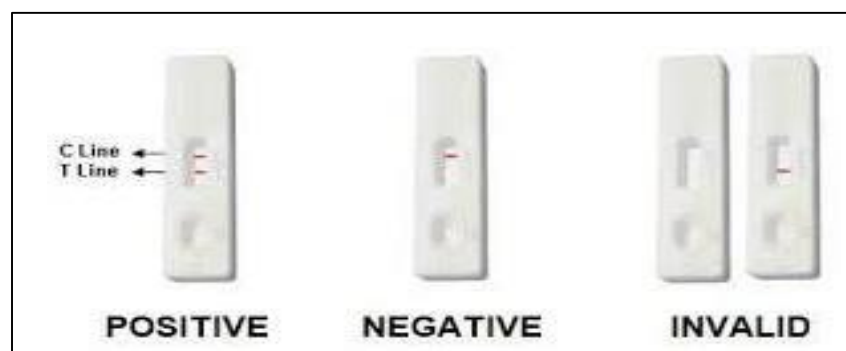


Figure No. 3.7: HCV rapid diagnostic test kit results

Interpretation of results:
Positive HCV result: If two bands/lines appear as control line and test line, then the result of HCV is positive. The patient has HCV.

Negative HCV result: If only one band/line appears as the control line then the result of HCV is negative.

Invalid HCV result: If one band is appears as test band and also no band appear, and then the result is invalid for HCV.

3.8 HBsAg RAPID DIAGNOSTIC TEST RESULTS

After performing the HBsAg screening of blood sample from rapid diagnostic kit, we get the results.

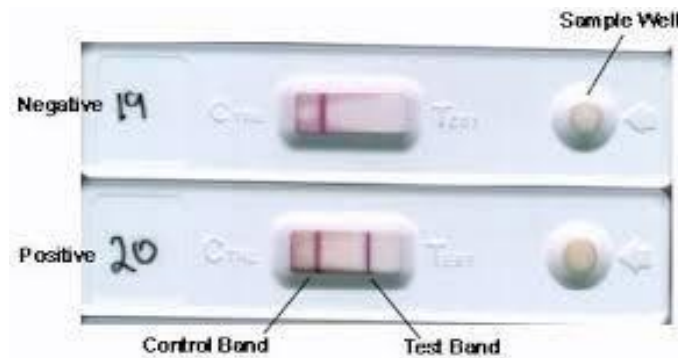


Figure No. 3.8: HBsAg rapid diagnostic test kit results Interpretation of results:

Positive HBsAg result: If two bands/lines appear on the kit as control band and test band then the result for HBsAg is positive. The patient has HBV.

Negative HBsAg result: If only one band is appears as a control band then the result for HBsAg is negative.

Invalid HBsAg result: If no band appears or only one band appears as test band then the result for HBsAg is invalid.

3.9 ABO BLOOD GROUPING TEST RESULTS

After performing the ABO blood grouping tests of different samples, we get the results.

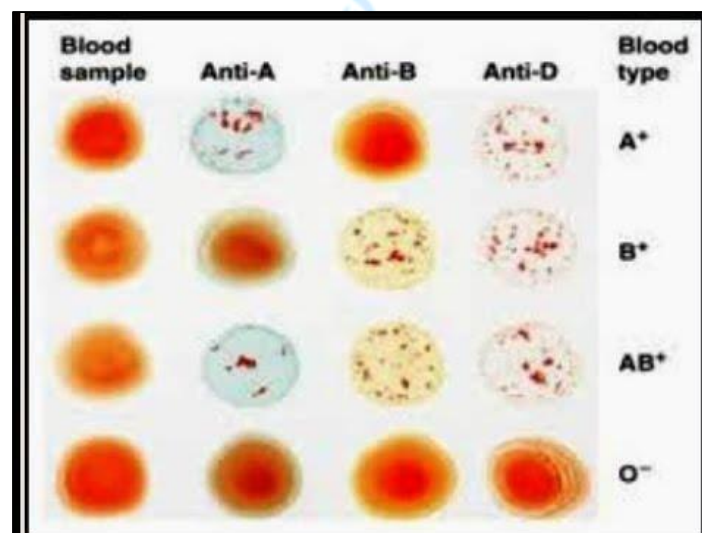


Figure No. 3.9: ABO blood group test results The interpretation of figure 3.9 result is:

- First row sample blood type is A⁺; in this agglutination is observed when we add anti-A sera to blood sample and no agglutination is observed with anti-B sera so the blood type is A. And agglutination is also observed at anti-D so the type of blood is positive.
- Second row sample, in this agglutination observed on anti-B sera and anti-D sera, and no

agglutination observe on anti-A sera so the blood type of this is B⁺.

- Third row sample, in this agglutination is observed on anti-A, anti-B, and anti-D sera so the blood type is AB⁺.
- Fourth row sample, no agglutination is observed on both anti-A and anti-B sera so the blood type is O and also no agglutination is observed on anti-D sera so the blood type is negative (O).

3.10 CROSS-MATCH TEST RESULTS

After performing the both major and minor cross-match tests to see if the blood is compatible or not for patient, we get results.

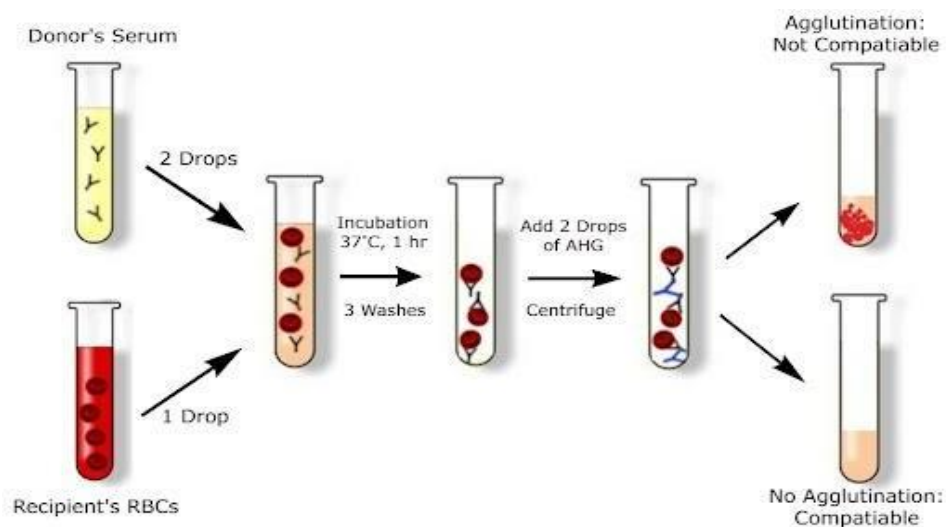


Figure No. 3.10: Minor cross-match test results Interpretation of result:

If agglutination observed at the end of cross-match test, then the blood is not compatible for the patient. Then donor does not give the blood to the patient.

If agglutination is not observed at the end of cross-match test, then the blood is compatible for the patient. Then the donor gives the blood to patient.

3.11 FLUORESCENCE MICROSCOPY TEST RESULTS

After observing the results of fluorescence microscopy, we need to interpret results and give patient report.

MINISTRY OF NATIONAL HEALTH SERVICES REGULATION & COORDINATION GOVERNMENT OF PAKISTAN STATE TB REFERENCE LABORATORY-AJK Divisional Headquarters Teaching Hospital, Mirpur, Azad Jammu Kashmir				
Final Laboratory Report				
Name:	Karamat Bibi	Sex/Age	77/F	Rep. Date: 09-07-2021
Ref By:	DHQ Mirpur	Lab No:	844	Xpert No: 751
 1. Microscopic Result:				
Specimen			AFB Smear Result	
Type	Appearance	Volume	Result	Grading(if Positive)
Sputum	MP	5ml	Positive	1+
Technique Used: Fluorescence Staining.				

Figure No. 3.11: Laboratory report of AFB Smear Microscopy

This report shows the positive results of patient which means that the patient has TB. And grading 1+ means 3-24 AFB in one field observed from FM 200x (1 length = 30 fields and 1-6 AFB in one field observed from FM 400x (1 length = 40-50 fields).

3.12 CULTURE RESULTS

After performing the culture method, after inoculation, we should need to observe the cultures within 5-7 days and then for further 8 weeks we need to observe culture once a week. Then record readings.



Figure No. 3.12 Colonies of MTB on LJ Medium

Figure (3.12) shows the MTB colonies growth on LJ Medium. In these test tubes a huge number of colonies present on media which are non-pigmented, rough, dry colonies. And the green color of the medium is basically because of the presence of malachite green that is used to prevent growth of most other impurities.

3.13 GENEXPERT TEST RESULTS

Final Laboratory Report																				
Name:	Jaweria	Sex/Age	15/F	Rep. Date:	12-07-2021															
Ref By:	DHQ Mirpur	Lab No:	756	Xpert No:	764															
1. Microscopic Result: <table border="1"> <thead> <tr> <th colspan="3">Specimen</th> <th colspan="2">AFB Smear Result</th> </tr> <tr> <th>Type</th> <th>Appearance</th> <th>Volume</th> <th>Result</th> <th>Grading(if Positive)</th> </tr> </thead> <tbody> <tr> <td>Sputum</td> <td>MP</td> <td>5ml</td> <td>Negative</td> <td>-</td> </tr> </tbody> </table> Technique Used: Fluorescence Staining.						Specimen			AFB Smear Result		Type	Appearance	Volume	Result	Grading(if Positive)	Sputum	MP	5ml	Negative	-
Specimen			AFB Smear Result																	
Type	Appearance	Volume	Result	Grading(if Positive)																
Sputum	MP	5ml	Negative	-																
2. GeneXpert MTB/RIF Ultra Assay Result: MTB Result: Detected, Low Rif Resistance: : Not Detected																				

Figure No. 3.13: Laboratory report of GeneXpert MTB/RIF ultra assay result

This lab report shows that the detection of MTB is low and no RIF's resistance detected. The results from the GeneXpert MTB/RIF assay show only the detection of MTB whether or not MTB was detected in the sample.

3.14 HEMATOLOGY TEST RESULTS

After performing the hematology test by CBC analyzer, we get the results.

Routine Hematology				
Test	Result	Unit	Reference value	Diff Result
CBC				
W.B.C	6.5	$\times 1000/\text{mm}^3$	4.0 - 10	
R.B.C	5.01	Mill/mm^3	M: 4.5 - 6.3; F: 4.2 - 5.4	
Hb	15.4	gm/dl	M: 14 - 18; F: 12 - 16	
Hct	45.2	%	M: 39 - 52; F: 36 - 46	
M.C.V	90.2	fL	77 - 97	
M.C.H	31	Pgm	26 - 32	
M.C.H.C	34	%	32 - 36	
Platelet	209	$\times 1000/\text{mm}^3$	140 - 440	
PBS				

Figure No. 3.14: Hematology test result with reference value

This figure (3.14) shows that the results of all complete blood count of blood cells are under the reference values.

CONCLUSION

The professional training conducted in the Pathology Department of DHQ Teaching Hospital, Mirpur, AJ&K, provided valuable insight into various disciplines of medical laboratory science and helped identify potential areas for future work. This experience offered an excellent opportunity to explore modern technologies and practical applications in medical analysis. Working in pathology and tuberculosis (TB) laboratories allowed exposure to advanced diagnostic instruments and procedures, enhancing both technical understanding and analytical skills.

Engaging directly with instruments and automated machines transformed theoretical knowledge from university lectures into real-world applications. Initially, the equipment and techniques were unfamiliar, but with time and practice, their operation, purpose, and efficiency became clearer. Observing how these machines deliver rapid and accurate diagnostic results was both fascinating and inspiring.

The training also fostered teamwork, communication, and professional collaboration. Working alongside supportive colleagues encouraged a positive learning environment and reinforced essential laboratory values such as precision, discipline, and cooperation. Overall, this six-week experience significantly broadened professional horizons, deepened practical understanding, and strengthened motivation to pursue further

research and specialization in medical diagnostics.

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