B.M.S. College of Engineering, Bangalore – 560019
Department of Medical Electronics Engineering
Organizes
EVENT: INDUSTRIAL VISIT

REF: BMSCE/PG/BIP/2022/IV-1

Topic: "Insight of Biomedical Instruments" Through "BMS HOSPITAL VISIT, BANGALORE"

In collaboration with
IEEE BMSCE chapter
Scheduled on

Date: 07th March 2022
Time: 2.00PM-4.30PM

7/3/2022

Faculty Coordinator

HOD
Medical Electronics Engineering

Administrative officer
BMS Hospital

BMS COLLEGE OF ENGINEERING

DEPARTMENT OF MEDICAL ELECTRONICS ENGINEERING

HOSPITAL VISIT TO BMS HOSPITAL

BN
7/3/2022

VENUE: Opp. BMS Engineering College, Bull Temple Road,
Bangalore – 560019, Karnataka

FACULTY COORDINATOR : Dr. BEENA ULLALA MATA B N (Associate Professor)

Departments visited

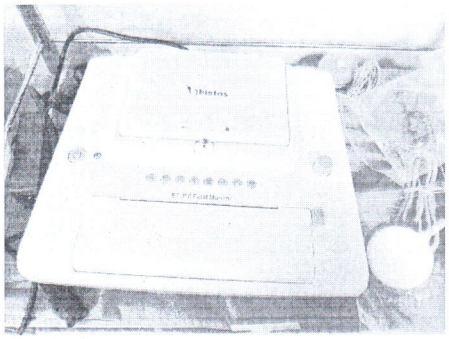
1. Labour ward
2. Dialysis
3. Microbiology department
4. X-Ray
5. Treadmill test
6. Anesthesia machine

LABOUR WARD

The Labour ward is a department in the hospital for the care and admission of women in the process of childbirth. In the labor ward, there are multiple equipments and medical devices required to keep a check on the parameters like heart rate, oxygen saturation, etc of the mother and the fetus (baby inside the womb).
In BMS hospital, the following medical devices were observed.

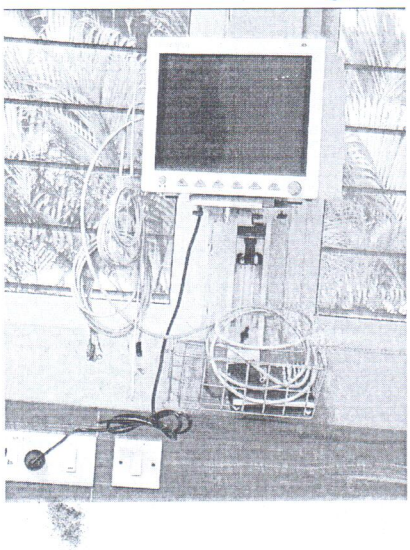
1. Fetal monitor:

BT 350 fetal monitor from bistos was shown. It monitors the rhythm of the fetus and measures heart rate during pregnancy and labor. The average fetal heart rate is 110- 160 beats/ min.



To measure the mother's ECG during labor for continuous monitoring .

- **NST machine -** A nonstress test (NST) for fetal monitoring is a test during pregnancy that measures a baby's heart rate and response to movement.
- There were other devices such as a patient monitor, suction machine, AMBU bag, labor cart, oxygen valves, etc.



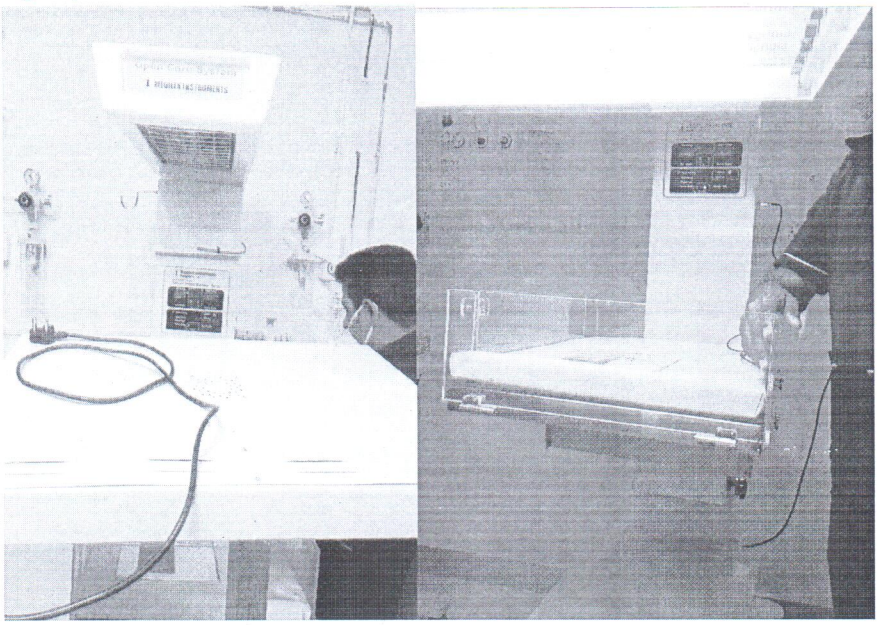
2. Baby Warmer:

Nile-Neo care radiant warmer provides treatment for newborn infants who are suffering from heat loss. It maintains a constant temperature of 36.5 - 37°C. Any infant weighing less than 1000gm should be carried on the radiant warmer.

3. Infant Phototherapy unit and baby warmer:

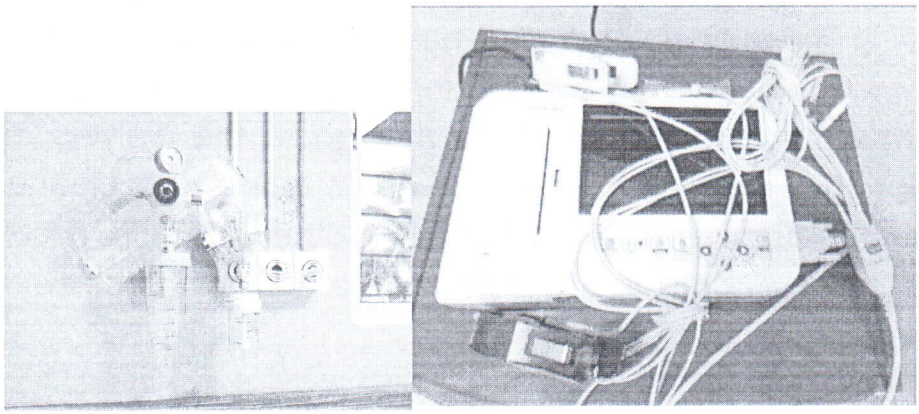
Medilek Instruments microcontroller-based radiant infant warmer was displayed. Operated in Servo mode.

Phototherapy is treatment with a special type of light (blue fluorescent light).



It's sometimes used to treat newborn jaundice by making it easier for the baby's liver to break down and remove the bilirubin from your baby's blood.

4. ECG Device:



To measure the mother's ECG during labor for continuous monitoring during an emergency situation. CONTEC ECG monitor was shown.

- NST machine - A nonstress test (NST) for fetal monitoring is a test during pregnancy that measures a baby's heart rate and response to movement.
- There were other devices such as a patient monitor, suction machine, AMBU bag, labor cart, oxygen valves, etc.

HAEMODIALYSIS

Haemodialysis is a process of purifying the blood of a person whose kidneys are not working normally. Haemodialysis machine pumps the patient blood and the dialysate through the dialyser.A hemodialysis access, or vascular access, is a way to reach the blood for hemodialysis. The access allows blood to travel through soft tubes to the dialysis machine where it is cleaned as it passes through a special filter, called a dialyzer. An access is placed by a minor surgery. As a hemodialysis patient, your access is one of the following:

A fistula, an access made by joining an artery and vein in your arm.

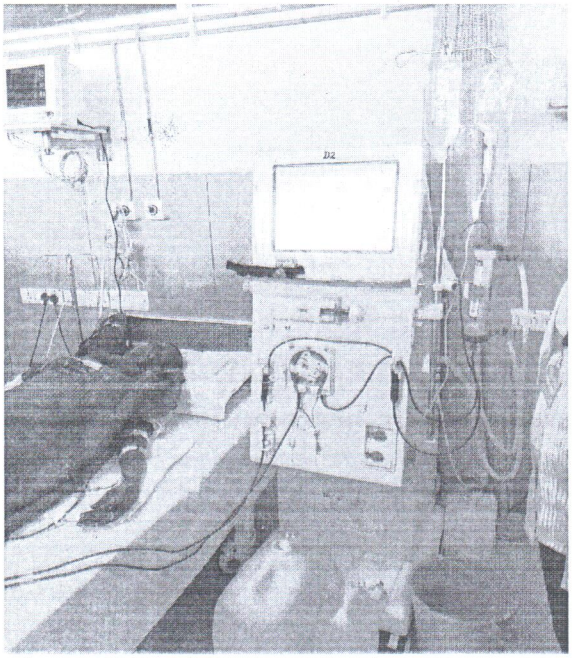
A graft, an access made by using a piece of soft tube to join an artery and vein in arm.

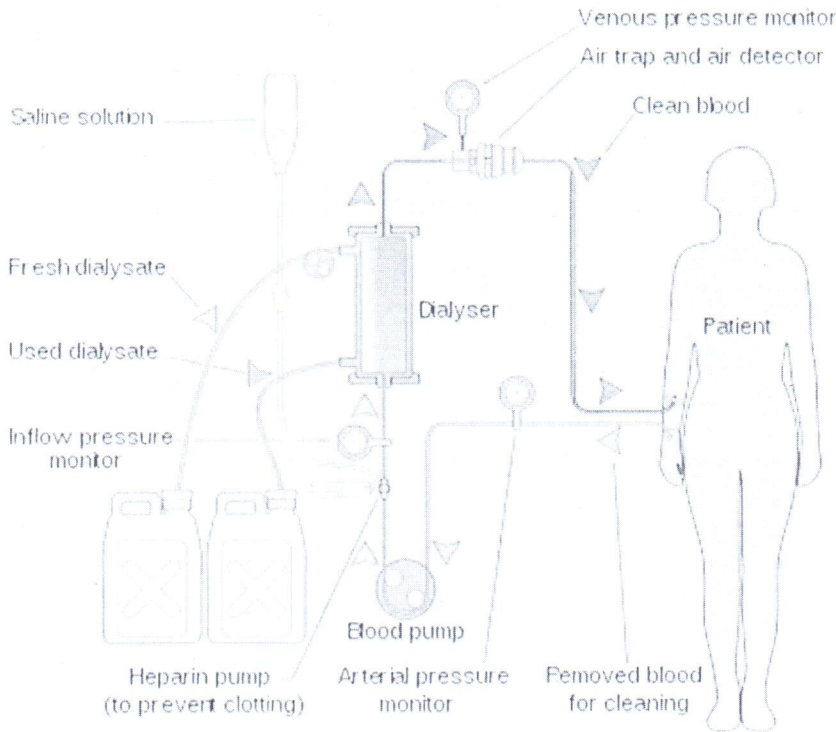
A catheter, a soft tube that is placed in a large vein, usually near neck.

If access is a fistula or graft, the nurse or technician will place two needles into the access at the beginning of each treatment. These needles are connected to soft tubes that go to the dialysis machine. Blood goes to the machine through one of the tubes, gets cleaned in the dialyzer, and returns to you through the other tube. If access is a catheter, it can be connected directly to the dialysis tubes without the use of needles.

A fistula should be considered the first choice for access because it generally lasts longer and has fewer problems such as infections and clotting. However, some patients may not be able to receive a fistula because their blood vessels are not strong enough. A graft is considered the second choice for an access. Catheters are generally used as a temporary access, but sometimes they are permanent. Sometimes, it may be possible to switch to a fistula from another type of access.

Haemodialysis machine and Schematic of a haemodialysis circuit





Microbiology department

Introduction:

Microbiology is the study of all living organisms that are too small to be visible with the naked eye. This includes bacteria, archaea, viruses, fungi, prions, protozoa and algae, collectively known as 'microbes'. These microbes play key roles in nutrient cycling, biodegradation or biodeterioration, climate change, food spoilage, the cause and control of

disease, and biotechnology. Thanks to their versatility, microbes can be put to work in many ways: making life-saving drugs, the manufacture of biofuels, cleaning up pollution, and producing/processing food and drink.

Blood tests:

Blood tests are used to measure or examine cells, chemicals, proteins, or other substances in the blood. Blood testing, also known as blood work, is one of the most common types of lab tests. Blood work is often included as part of a regular check-up. Blood tests are also used to:

- Help diagnose certain diseases and conditions
- Monitor a chronic disease or condition, such as diabetes or high cholesterol
- Find out if treatment for a disease is working
- Check how well your organs are working. Your organs include your liver, kidneys, heart, and thyroid.
- Help diagnose bleeding or clotting disorders
- Find out if your immune system is having trouble fighting infections

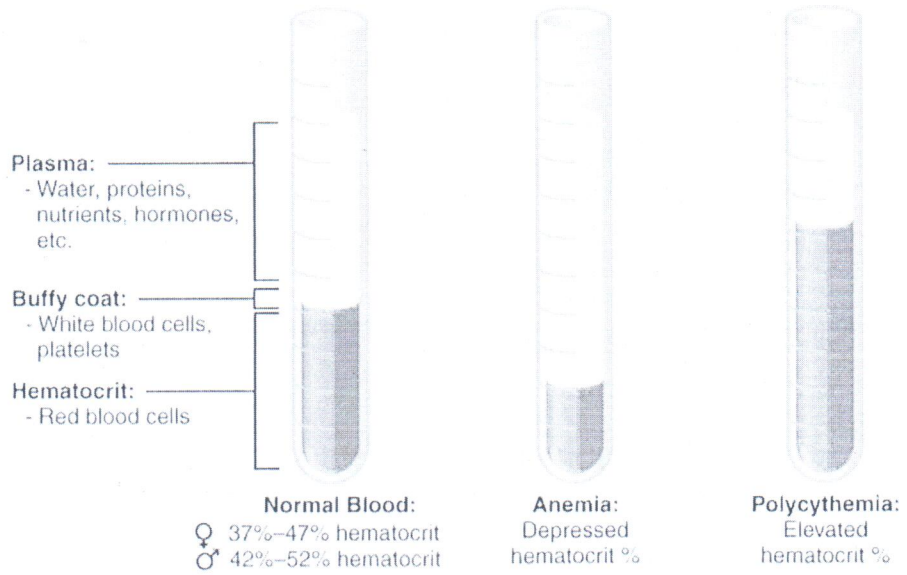


Figure 1: Blood test components in normal and abnormal blood

Common blood tests:

Blood is drawn for two common tests.

(i) **A complete blood count (CBC)** checks your blood for signs of infection, immune system problems, bleeding problems, and anemia (low iron).

(ii **A blood chemistry panel** gives your doctor information about your muscles, bones, heart, and other organs. It also checks your blood sugar, calcium, and other minerals.

(iii) **Blood enzyme tests** Enzymes are substances that control chemical reactions in your body. There are many types of blood enzyme tests. Some of the most common types are troponin and creatine kinase tests.

(iv) **Blood tests to check for heart disease** These include cholesterol tests and a triglyceride test.

(v) **Blood clotting tests** also known as a coagulation panel. These tests can show if you have a disorder that causes too much bleeding or too much clotting.

Getting too many blood tests has risks:

Blood tests are very safe. But they can cause other problems if you have them every day.

(i) **Anemia:** This can happen if you lose too much blood. With anemia, your blood cells can't carry enough oxygen to the rest of your body. Anemia can make it harder for you to heal. It is especially dangerous for people with heart or lung problems.

(ii) **Increased risk of infection:** Blood tests have a low risk of infection. But the more tests you have, the more risk you have.

(iii) **Less sleep:** Nurses often wake patients up to get blood tests. Poor sleep can affect how you heal.

The most common way to do a blood test

(i) **Venipuncture:** During venipuncture, a lab professional, known as a phlebotomist, will take a blood sample from a vein in your arm, using a small needle. After the needle is

inserted, a small amount of blood will be collected into a test tube or vial.

(ii) **A finger prick test:** This test is done by pricking your fingertip to obtain a small amount of blood. Finger prick testing is often used for at-home test kits and rapid tests. Rapid tests are easy to use tests that provide very fast results and require little or no special equipment.

(iii) **A heel stick test:** This is most often done on newborns. During a heel stick test, a health care provider will clean your baby's heel with alcohol and poke the heel with a small needle. The provider will collect a few drops of blood and put a bandage on the site.

(iv) **Arterial blood test:** This test is done to measure oxygen levels. Blood from arteries has higher levels of oxygen than blood from a vein. So for this test, blood is taken from an artery instead of a vein.

Instruments used for Blood test

1. Hematology Analyser / Cell Counter
2. Bio-chemistry Analyser
3. Electrolyte Analyser
4. Urine Analyser
5. Coagulometer
6. HB1Ac machine
7. Eliza Plate Washer & Reader
8. Microscope

9. Centrifuge

(i) Hematology analyzers are also called cell counters as they are used to make a complete blood count (CBC) including red blood cell (RBC), white blood cell (WBC), hemoglobin, and platelet counts, as well as hematocrit levels and many other parameters. The most common discussion regarding cell counters is around 3-part differential cell counters and 5-part differential cell counters.

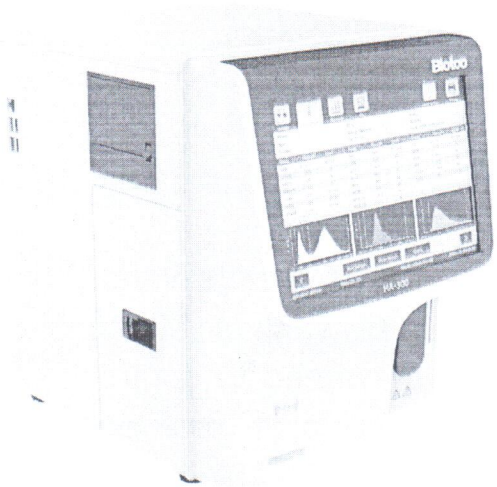


Figure 2: Hematology analyzer

(ii) Centrifugation is the process that uses centrifugal force for the separation of two liquids in a mixture. In this process, the denser component of the mixture migrates away from the axis and the lighter component migrates towards the axis. In laboratories performing biochemical analyses on body fluids, centrifuges are routinely used to separate blood cells from serum/plasma, to separate sediment from urine, to measure the volume fraction of erythrocytes in blood (the hematocrit), and to separate bound from free components in protein binding and immunoprocedures.

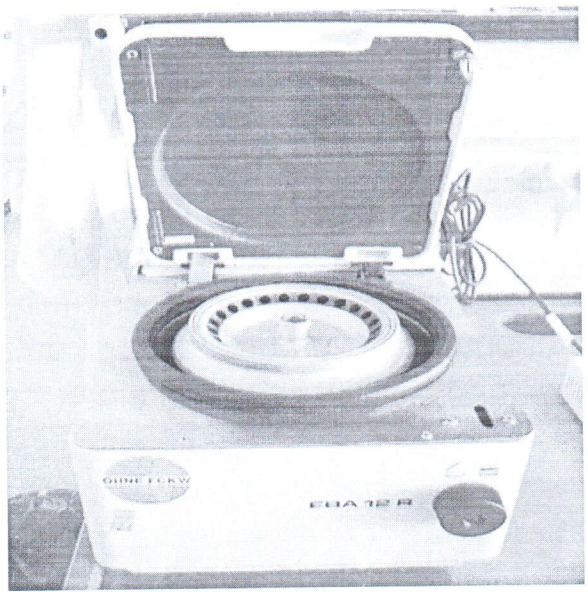


Figure 3: Centrifuge

(iii) Eliza Plate Washer is a wide variety of experimental assays require a series of washes. Microplate washers are laboratory instruments designed to control the procedure of washing experimental samples arranged in plate-based formats. Users load a plate and select a program; microplate washers then dispense, soak and aspirate liquids from the plate in seconds.

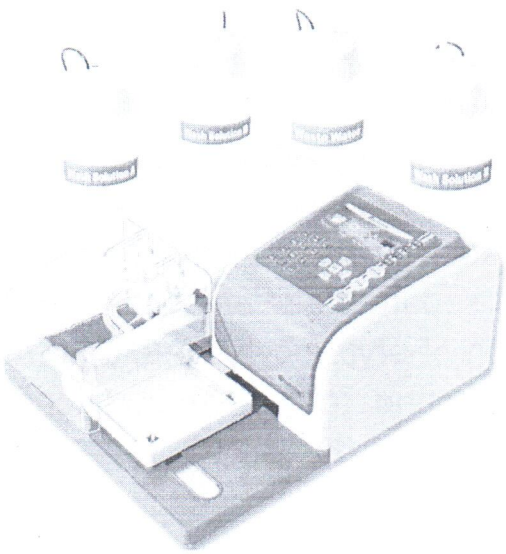


Figure 4: Eliza Plate Washer

(iv) A urine analyser is a device used in the clinical setting to perform automatic urine testing. The units can detect and

quantify a number of analytes including bilirubin, protein, glucose and red blood cells.

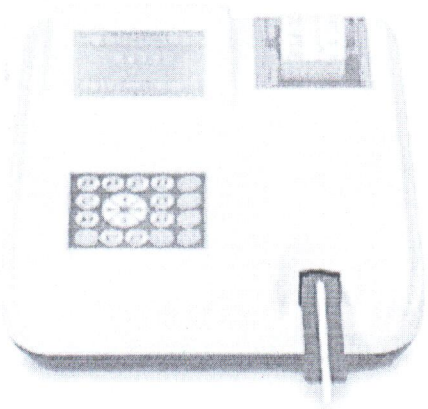
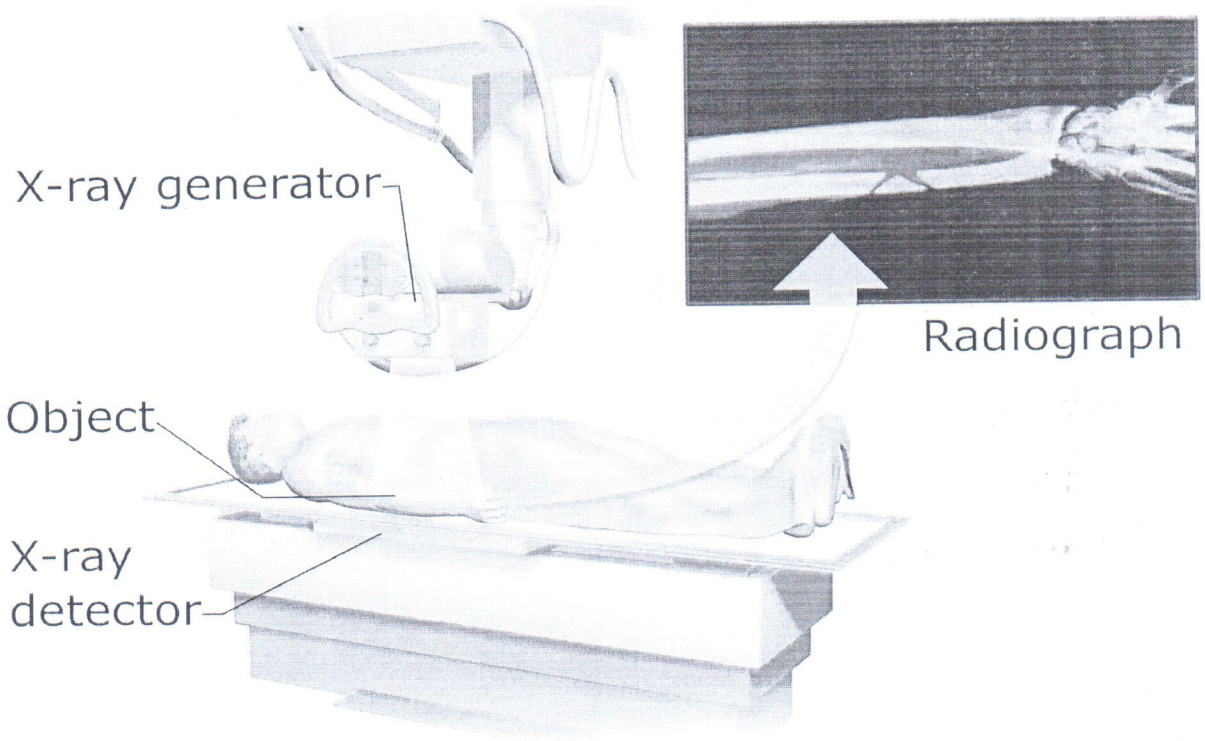


Figure 5: Urine analyser

X-ray



X-rays are a form of electromagnetic radiation, similar to visible light. Unlike light, however, x-rays have higher energy and can pass through most objects, including the body.

An X-ray is produced when a negatively charged electrode is heated by electricity and electrons are released, thereby producing energy. That energy is directed toward a metal plate, or anode, at high velocity and an X-ray is produced when the energy collides with the atoms in the metal plate.

Medical x-rays are used to generate images of tissues and structures inside the body. If x-rays traveling through the body also pass through an x-ray detector on the other side of the patient, an image will be formed that represents the "shadows" formed by the objects inside of the body.

One type of x-ray detector is photographic film, but there are many other types of detectors that are used to produce digital images. The x-ray images that result from this process are called radiographs.

How do medical x-rays work?

To create a radiograph, a patient is positioned so that the part of the body being imaged is located between an x-ray source and an x-ray detector. When the machine is turned on, x-rays travel through the body and are absorbed in different amounts by different tissues, depending on the radiological density of the tissues they pass through. Radiological density is determined by both the density and the atomic number (the number of protons in an atom's nucleus) of the material being imaged. For example, our bones contain calcium, which has a higher atomic number than most other tissues. Because of this property, bones readily absorb x-rays and therefore produce high contrast on the x-ray detector. As a result, bony structures appear whiter than other tissues against the black background of a radiograph. Conversely, x-rays travel more easily through less radiologically dense tissues, such as fat, muscle, and air-filled cavities such as the lungs. These structures are displayed in shades of gray on a radiograph.

X-ray technology is used to examine many parts of the body.

Bones and teeth

- **Fractures and infections.** In most cases, fractures and infections in bones and teeth show up clearly on X-rays.
- **Arthritis.** X-rays of your joints can reveal evidence of arthritis. X-rays taken over the years can help your doctor determine if your arthritis is worsening.
- **Dental decay.** Dentists use X-rays to check for cavities in your teeth.
- **Osteoporosis.** Special types of X-ray tests can measure your bone density.
- **Bone cancer.** X-rays can reveal bone tumors.

Chest

- **Lung infections or conditions.** Evidence of pneumonia, tuberculosis or lung cancer can show up on chest X-rays.
- **Breast cancer.** Mammography is a special type of X-ray test used to examine breast tissue.
- **Enlarged heart.** This sign of congestive heart failure shows up clearly on X-rays.
- **Blocked blood vessels.** Injecting a contrast material that contains iodine can help highlight sections of your circulatory system to make them visible on X-rays.

Abdomen

- **Digestive tract problems.** Barium, a contrast medium delivered in a drink or an enema, can help reveal problems in your digestive system.
- **Swallowed items.** If your child has swallowed something such as a key or a coin, an X-ray can show the location of that object.

TREADMILL TEST

A treadmill exercise stress test is **used to determine the effects of exercise on the heart**. Exercise allows doctors to detect abnormal heart rhythms (arrhythmias) and diagnose the presence or absence of coronary artery disease.

This test involves walking in place on a treadmill while monitoring the electrical activity of your heart. Throughout the test, the speed and incline of the treadmill increase. The results show how well your heart responds to the stress of different levels of exercise.

Description

1. A technologist will explain the test to you, take a brief medical history, and answer any questions you may have. Your blood pressure, heart rate, and electrocardiogram (ECG) will be monitored before, during, and after the test.
2. You will be asked to remove all upper body clothing, and to put on a gown with the opening to the front.
3. Adhesive electrodes will be put onto your chest to capture an ECG. The sites where the electrodes are placed will be cleaned with alcohol and shaved if necessary. A mild abrasion may also be used to ensure a good quality ECG recording.
4. Your resting blood pressure, heart rate, and ECG will be recorded.
5. You will be asked to walk on a treadmill. The walk starts off slowly, then the speed and incline increases at set times. It is very important that you walk as long as possible because the test is effort-dependent.
6. You will be monitored throughout the test. If a problem occurs, the technologist will stop the test right away. It is very important for you

to tell the technologist if you experience any symptoms, such as chest pain, dizziness, unusual shortness of breath, or extreme fatigue.

7. Following the test, you will be asked to lie down. Your blood pressure, heart rate, and ECG will be monitored for three to five minutes after exercise.
8. The data will be reviewed by a cardiologist after the test is completed. A report will be sent to the doctor(s) involved in your care.

Patient Instructions

Before Your Test

For 48 hours prior to your test, stop Viagra, Cialis and Levitra.

On the Day of Your Test

- For two hours prior to your test: Do not eat or drink.
- Take your usual medications unless otherwise directed by your physician. Bring all of your medications with you in the original bottles.
- Wear comfortable clothes and shoes that are suitable for walking on a treadmill.

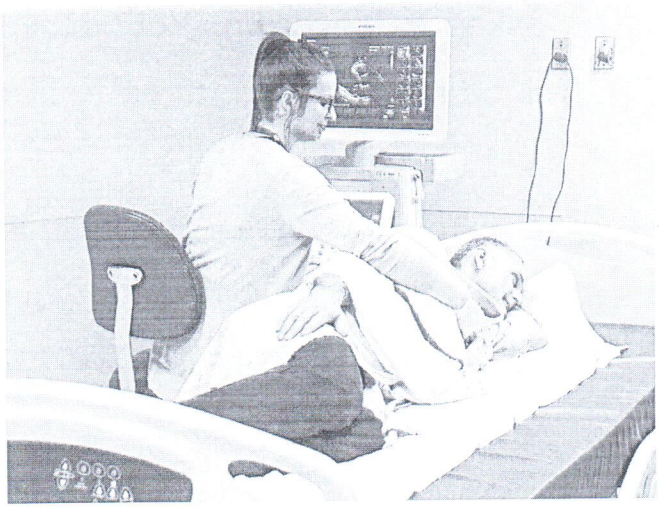
After Your Test

There are no restrictions after the treadmill stress test.

STRESS ECHOCARDIOGRAM

(Also known as: Stress echo, exercise echo, Dobutamine echo)

Purpose



A stress echocardiogram (stress echo) is an imaging test that uses ultrasound to show how well your heart works during the stress of exercise. This test is used to diagnose the presence or absence of coronary artery disease.

An echocardiogram is performed at rest, then during low, moderate and peak levels of exercise using a supine bicycle or using a drug called Dobutamine which simulates exercise.

Anesthesia machine:

The anesthetic machine receives medical gases (oxygen, nitrous oxide, air) under pressure and accurately controls the flow of each gas

individually. A gas mixture of the desired composition at a defined flow rate is created before a known concentration of an inhalational agent vapour is added.

The basic function of an anesthesia machine is to prepare a gas mixture of precisely known, but variable composition. The gas mixture can then be delivered to a breathing system.

- The anesthesia machine can be divided into three basic areas:
  1. a high-pressure system,
  2. an intermediate pressure system
  3. a low-pressure system.
- There are essentially two broad categories of anesthesia machine vaporizers: variable bypass vaporizers and measured flow vaporizer.

- The machine is commonly used together with a mechanical ventilator, breathing system, suction equipment, and patient monitoring devices; strictly speaking, the term "anesthetic machine" refers only to the component which generates the gas flow, but modern machines usually integrate all these devices into one combined freestanding unit, which is colloquially referred to as the "anesthetic machine" for the sake of simplicity.

THE SAFETY FEATURES IN AN ANESTHESIA MACHINE

- Gas supplies: From the central pipeline to the machine as well as cylinders.
- Flow meters.
- Vaporizers.
- Fresh gas delivery: Breathing systems and ventilators.
- Scavenging.
- Monitoring.

The essential components of an anesthesia machine include:

- The Ventilator: used to keep the patient breathing during surgery.
- Breathing Circuits: to keep the air and gasses flowing to and from the patient safely.

- Scavenging Systems: to remove the "used" gasses such as CO_2.
- Safety Mechanisms: to ensure a patient's well-being in the case of an emergency.

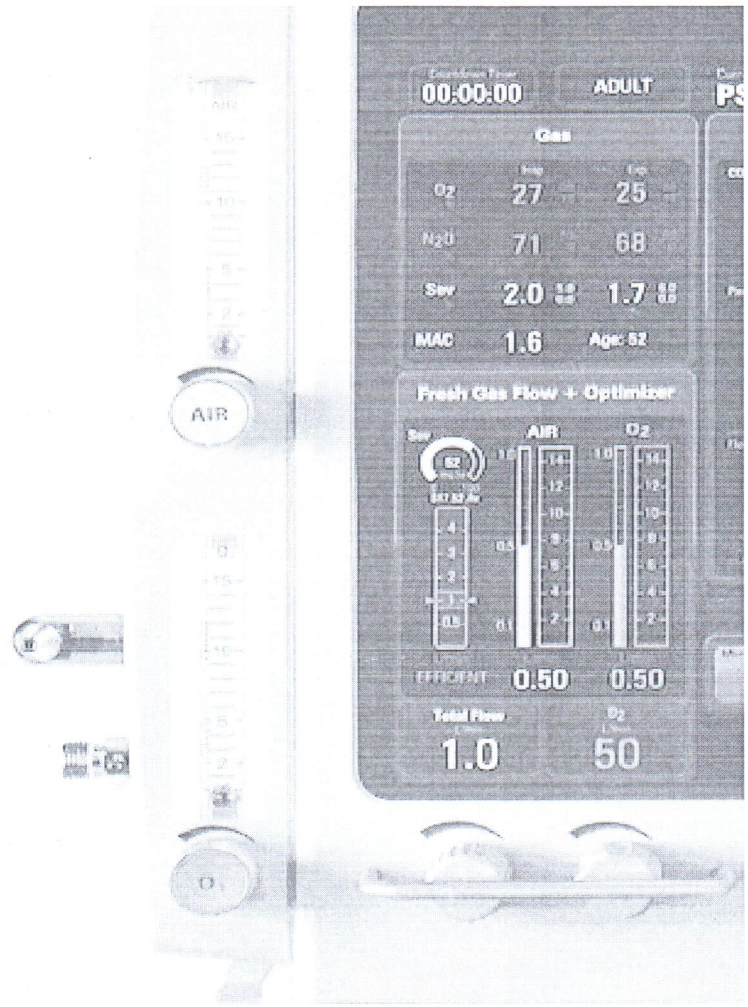
The Ventilator: Ventilators are an important part of all anesthesia machines. The ventilator is essentially a set of external lungs. It breathes for deeply anesthetized patients, maintaining the patient's regular respiratory rates and blood chemistry. In the beginning automatic ventilators were very simple with few modes of ventilation. As time passed, ventilators became more sophisticated .

Breathing Circuits: The breathing circuits are the parts of an anesthesia machine that deliver the essential gasses to a patient and subsequently eliminate the CO_2 exhaled. There are two kinds of breathing circuits: the non-rebreathing circuit and the circle circuit. Non-rebreathing circuits are exactly like they sound – the gasses, once exhaled, are eliminated from the system, and the patient does not rebreathe them. Circle circuits are the opposite they remove the CO_2 exhaled by the patient and allow the rebreathing of the exhaled anesthetic gasses.

Within a breathing system, vaporizers help to add precise amounts of anesthetics to the gas flow. In most machines, the total gas flow enters the vaporizer, which splits the fresh gas into a carrier gas and a bypass gas. The carrier gas receives the anesthetic agent and then meets back up with the bypass gas before entering into the patient's breathing circuit. Operators can control the ratio of the split to decrease or increase the gas concentration, thus controlling the amount of anesthetic a patient will receive.

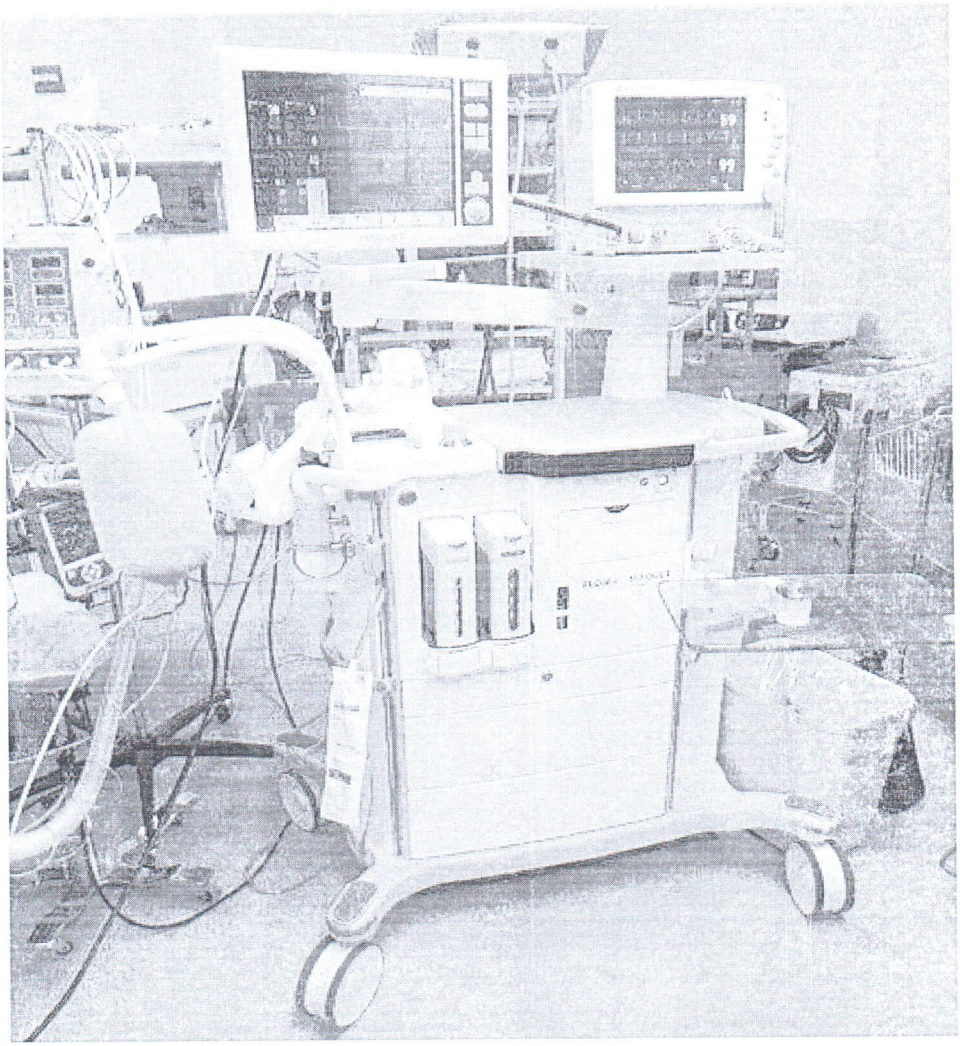
Scavenging Systems: Scavenging systems in an anesthesia machine collect and expel anesthetic gases from the operating room. In an active system, suction removes gases. Passive systems allow the gas to escape through a ventilation exhaust. When anesthesia machines implore an active system, doctors must protect the patient's airway from the suction device. By contrast, passive systems require only pressure monitoring. Anesthesia machines release a surprising amount of greenhouse gasses into the Earth's atmosphere, hence the healthcare industry's push towards low-flow delivery whenever possible.

Safety:



An anesthesia machine has many alarms that inform the medical team when a patient might be entering a critical or dangerous state.

When a patient is connected to a ventilator during surgery, these "disconnect alarms" are activated. Anesthesia workstations boast at least three disconnect alarms: one that informs the team of low pressure in the breathing circuit, a second that notifies of a low exhaled tidal volume, and a third that cautions of low exhaled carbon dioxide. Each of these states could mean that the patient is in danger. Thus, doctors must closely monitor them to ensure the safety of the patient during surgery.



Conclusion:

The hospital visit helps to know all kinds of medical diagnostics devices used in the hospital and the working procedure of it and also to know what can be improved to get better results.

Annexure:

Host: Dr. BEENA ULLALA MATA B N (Associate Professor)

Sign.

Sl no.	List of Participants
1	Aakanksha Mahesh Vetekar
2	Aqila Nazifa
3	Amruta Renake
4	Likhitha D Atada
5	Nisha N
6	Preksha A Das
7	Senbagavalli S
8	Shreya Bharatesh Pattankude
9	Spoorthi S
10	Supritha S