INVESTIGATIONS IN CARDIOLOGY

INTRODUCTION

- Investigations in cardiology are tests or procedures for evaluation of cardiovascular diseases.
- The investigations are carried out either at;

➢ Bedside and/or

➢ Laboratories

OBJECTIVES OF INVESTIGATIONS IN CARDIOLOGY

The objectives of the investigations are to

1. establish the diagnosis;
2. determine the aetiology;
3. identify the risk factors;
4. detect the complications;
5. monitor the disease progression;
6. evaluate associated co-morbidities and
7. make prognosis.

LIST OF INVESTIGATIONS IN CARDIOLOGY

1. **Chest X-Ray**
2. **Electrocardiogram**
3. Electrophysiological Studies
4. **Echocardiography** (Cardiac Ultrasonography)
5. Cardiac Magnetic Resonance Imaging (CMRI)
6. Cardiac Catheterization
7. Coronary arteriography
8. Cardiac Enzymes and Troponins
9. Brain Natriuretic Peptide (BNP)
10. Lipid Profiles
11. Blood Sugar
12. Electrolyte, Urea and Creatinine (E&U)

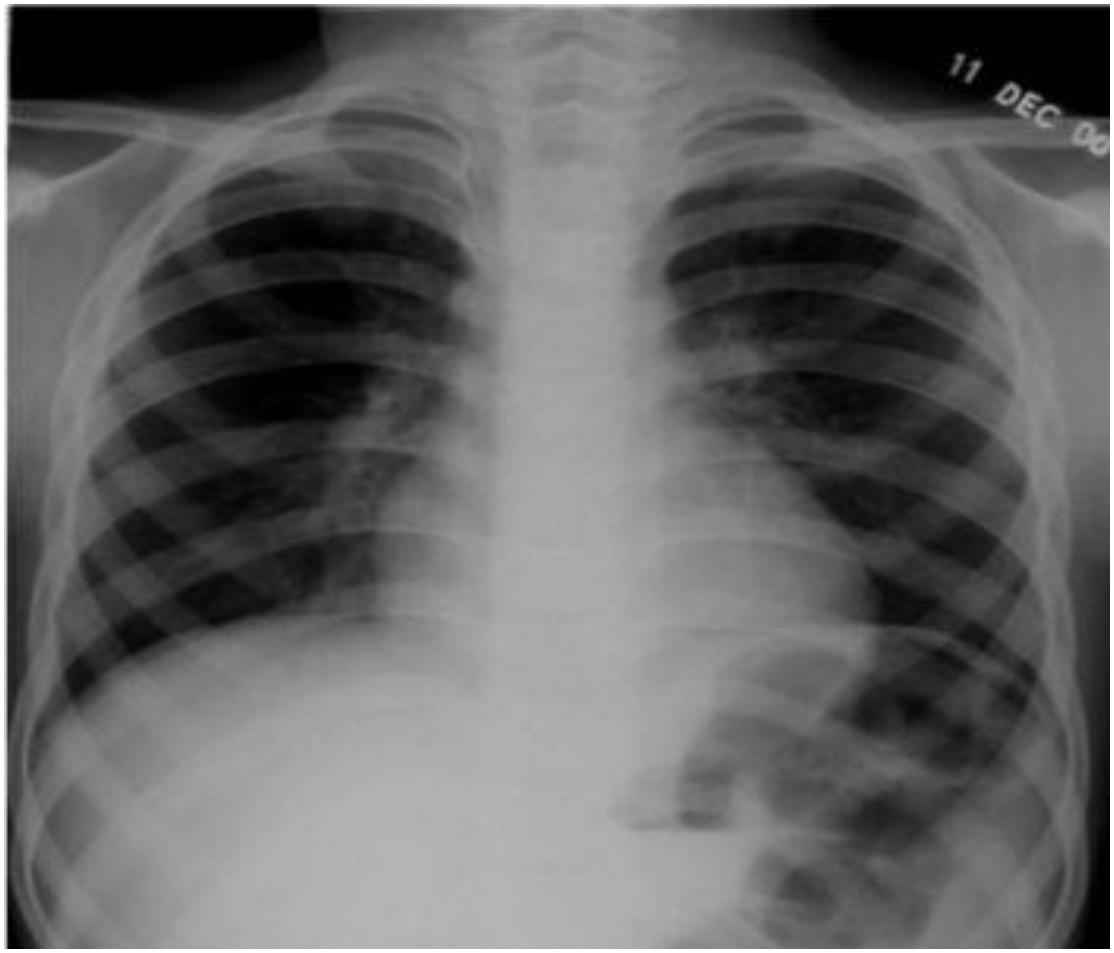
Non-Invasive versus Invasive Investigations

- **Non-invasive investigations**: procedures or tests limited to the body surface e.g Standard 12-Lead ECG, transthoracic echocardiography
- **Invasive investigations** : procedures or tests that involve penetration of the vascular system or body tissues e.g electrophysiological studies, cardiac catheterization, transoesophageal echocardiography, angiography

CHEST X-RAY

- Utilizes ionization radiation called X-Ray for cardiac evaluation
- It mainly useful in the study of cardiac structure and changes in the pulmonary circulation which may be of cardiac origin

Chest X-ray(PA view) showing the cardiac silhouette



Uses of Chest X-Ray in Cardiology

- To diagnose cardiomegaly
- To identify features of heart diseases such as hypertension, heart failure, cardiomyopathy, congenital heart diseases, pericardial effusion, coarctation of aorta, valuvular and pericardial calcifications
- To diagnose acute pulmonary oedema
- To identify precipitants of heart failure e.g. chest infection

Cardiomegaly

Chest X-ray criteria for diagnosis of cardiomegaly in adults

1. Cardiothoracic Ratio(CTR) >50%
2. Maximum transverse cardiac >15.5cm

- *Cardiothoracic ratio refers to the ratio of the maximum transverse cardiac diameter to maximum internal diameter of the thoracic cage (expressed in percentage).*

ELECTROCARDIOGRAM (ECG)

- Electrocardiogram is the graphical record of electrical activities of the heart obtained at the body surface.

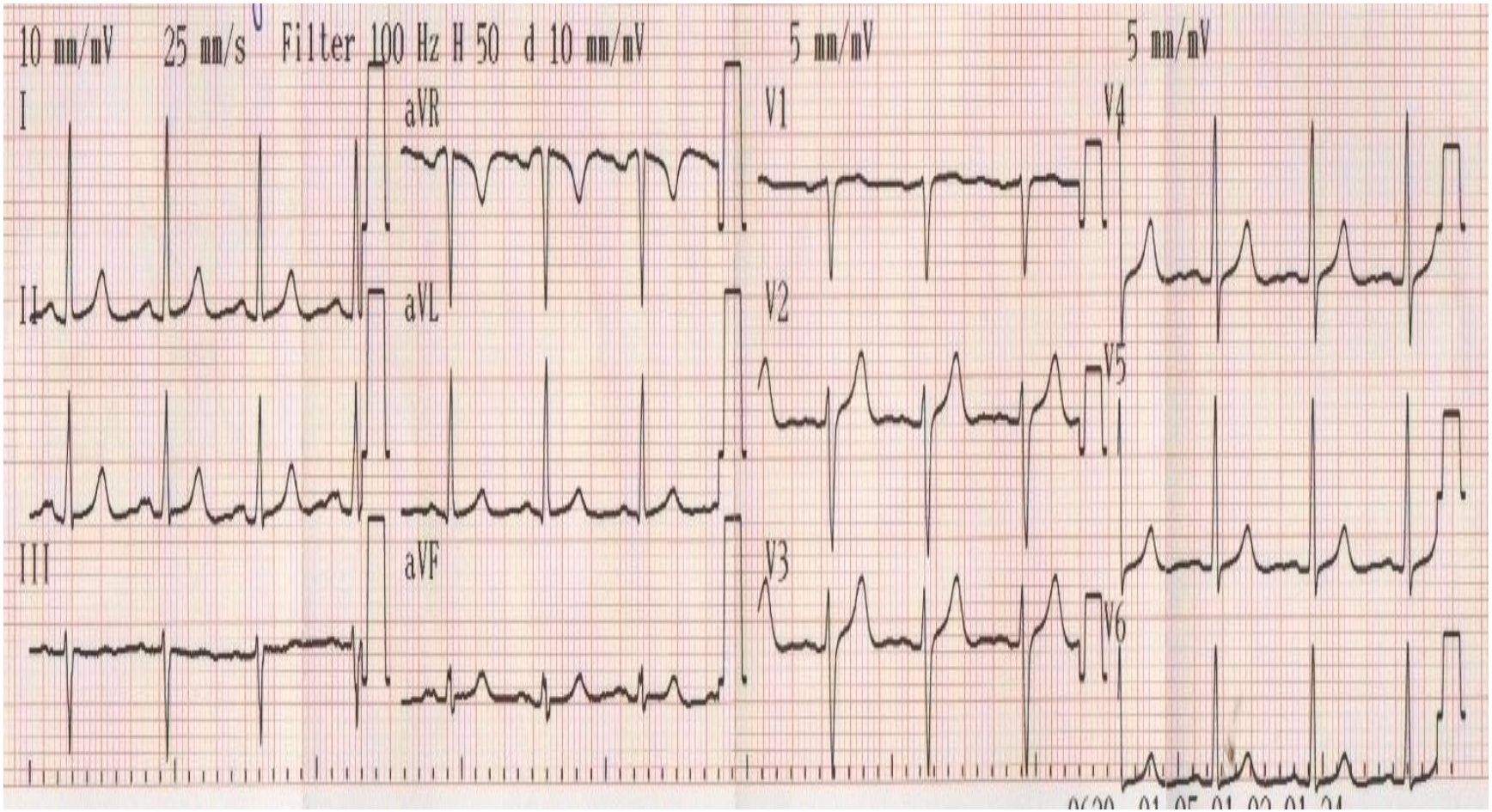
Forms of ECG

- **Standard 12-lead ECG**:

1. Utilizes 12 leads
2. Recorded at rest a period of 10-20secs
3. Most widely used form of ECG

- **Holter Monitoring/Ambulatory ECG** : Records ECG for 24hours
- **Stress ECG**: ECG recorded during exercise.

A STANDARD 12-LEAD ECG



An ECG Machine

Indications for ECG

1. Chamber abnormalities e.g ventricular hypertrophy, Left atrial abnormalities
2. Cardiac arrhythmias
3. Heart Blocks; atrioventricular blocks, bundle branch blocks
4. Pre-excitation syndromes e.g Wolff-Parkinson-White syndrome
5. Ischaemic heart diseases
6. Myocarditis
7. Cardiomyopathies
8. Pericardiac diseases
9. Congenital heart diseases
10. Cardiac arrest
11. Electrolyte derangement e.g hyperkalaemia, hypokalaemia
12. Drug effect e.g digoxin toxicity
13. Pulmonary embolism
14. Cor pulmonale

ELECTROPHYSIOLOGICAL STUDIES

- Invasive procedures for studying cardiac arrhythmias and pre-excitations syndromes such as Wolff-Parkinson-White syndrome

ECHOCARDIOGRAPHY

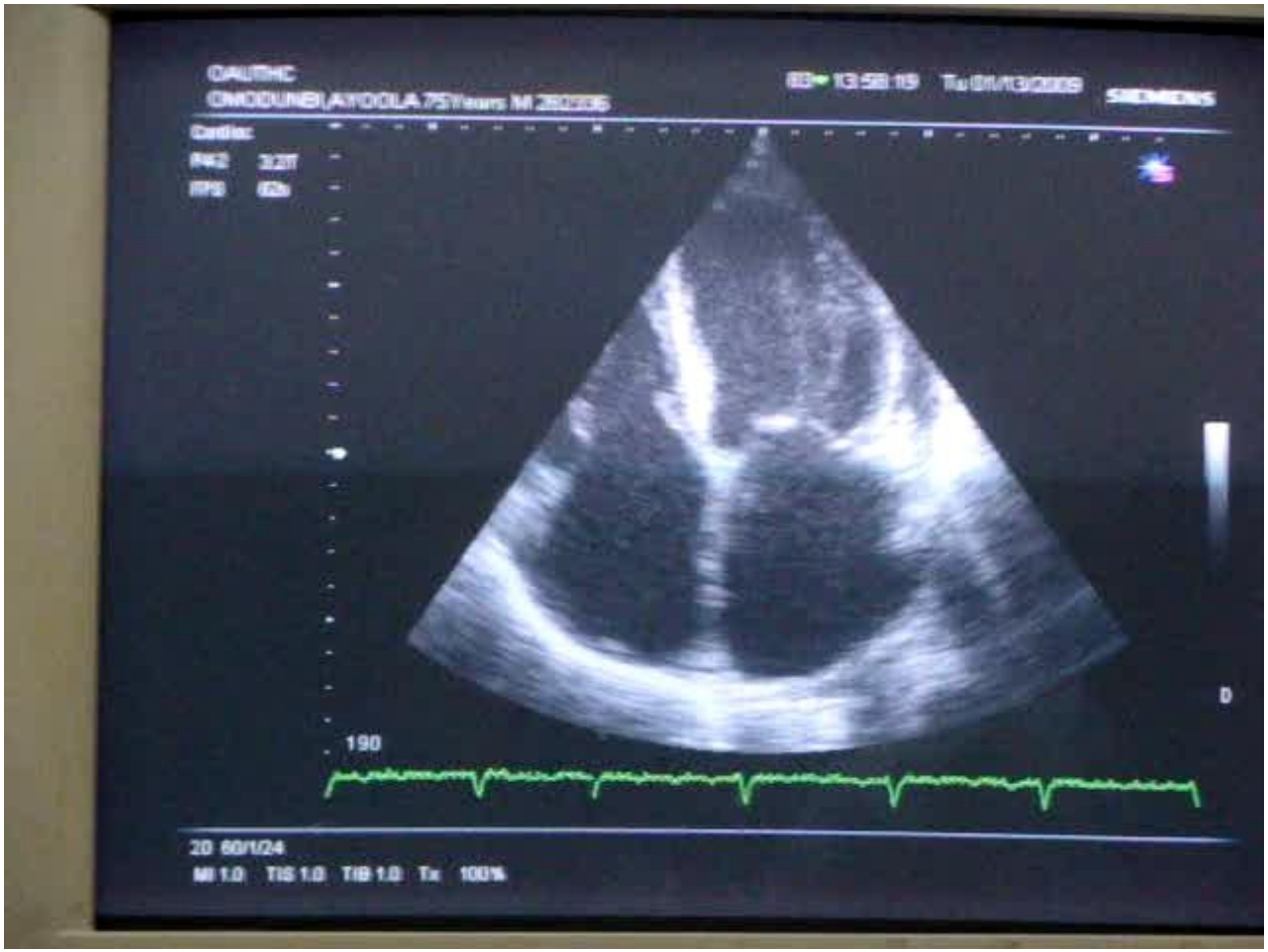
- **Echocardiography :** cardiac imaging using ultrasound.
- It is otherwise known as cardiac ultrasound.

Forms of Echocardiography

- **Transthoracic echocardiography**: utilizes transthoracic probe or transducer to obtain cardiac imaging from the body surface
- **Transoesophageal echocardiography**: utilizes transoesophageal probe or transducer to obtain cardiac image very close to the heart.

ECHO Machine

ECHO: Apical 4-Chamber View



Uses of Echocardiogram

- To evaluate cardiac structures, functions and dysfunctions.
- To establish diagnosis of some cardiovascular diseases
- To detect complications of cardiovascular diseases

Indications for Echocardiogram

Echocardiogram is useful in the evaluation of cardiovascular disorders such as;

1. Hypertensive heart diseases
2. Congenital heart diseases
3. Rheumatic heart diseases
4. Valvular Heart Diseases
5. Infective endocarditis
6. Cardiomyopathies
7. Pericardial diseases especially pericardial effusion
8. Ischaemic heart disease
9. Heart failure
10. Cardiac masses e.g intramural thrombus, atrial myxoma

CARDIAC MRI

- Utilizes a powerful magnetic field to align the nuclear magnetization of hydrogen atoms in water in the body.
- Does not use ionisation radiation
- Useful in the study of cardiac structure
- Current gold standard for evaluation of left ventricular hypertrophy

CARDIAC CATHETERIZATION

- An invasive procedure involving introduction of catheter through the veins into the heart under fluoroscopy guidance.
- Its useful for evaluation of intracardiac pressures.
- It may also serve therapeutic value in the management of valvular lesions or congenital heart diseases such as atrial or ventricular septal defects

CORONARY ARTERIOGRAPHY

- An invasive procedure which involves the use of contrast agents for evaluation of coronary arteries
- Its useful in the diagnosis and management of coronary artery diseases

CARDIAC ENZYMES AND TROPONINS

- Cardiac enzymes and troponins are markers of myocardial injury.
- The markers are elevated in myocardial infarction.
- Cardiac enzymes include ;

1. Creatine phosphokinase (CK)
2. Aspartate aminotransferase (AST)
3. Lactate dehydrogenase (LDH)

- Troponins include; troponin I and troponin T

Brain Natriuretic Peptide (BNP) and NT-proBNP

- BNP is a 32-amino acid polypeptide produced by the ventricles
- NT-proBNP: 76 amino acid N-terminal fragment polypeptide co-secreted with BNP.
- Both BNP and NT-proBNP are useful in the screening and diagnosis of heart failure.
- They are very useful in establishing prognosis of heart failure.

OTHERS INVESTIGATIONS

- Other investigations are supportive, and are useful in detecting risk factors, complications or co-morbidities.

A. Fasting lipid profiles

Components of fasting lipid profiles include;

1. Total cholesterol (TC)
2. Low density lipoprotein (LDL)
3. High density lipoprotein (HDL)
4. Triglycerides (TG)

Other Investigations contd

B. Blood Sugar: to exclude the presence or not of diabetes mellitus

Blood sugar include; Fasting blood sugar(FBS) and 2-Hours postprandial Sugar (2HPPS)

C. Electrolytes, Urea and Creatinine

Electrolytes include; Na^{+}, K^{+}, Ca^{2+} , $HCO3^{-}$

Urea and Creatinine Cr are analyzed to ;

1. to exclude effects of electrolyte as being responsible for the cardiovascular dysfunction
2. to detect whether or not renal disease is present in the patient.

THANK YOU