

# CONTENTS

## BASIC ECHOCARDIOGRAPHY SERIES

- page 1-10 Part 1 Obtaining the basic two dimensional views
- page 11-13 Multiple Choice Test
- page 13 Instructions for answering of Multiple Choice Test, On-line



### Dawid R de Wet

NDIP Clin. Tech.(Cardio)., B Tech.(Cardio)., B. Tech. ACLS

Dawid is a qualified Cardiology Clinical Technologist.

He trained at the Universitas Hospital in Bloemfontein in the Department of Cardiology in the early 90's.

With more than 17 years experience in Cardiac Physiology and Emergency Cardiac Care he is currently in private practice with a special interest in Cardiac Sonography.

# BASIC ECHOCARDIOGRAPHY SERIES

## Part 1 Obtaining the basic two dimensional views

The purpose of this tutorial is to provide guidelines and a basic understanding on how to start conducting a cardiac ultrasound examination by obtaining the basic two dimensional views. This is the first tutorial in the Basic Echocardiography series and is aimed at the novice scanner.

### 1 PURPOSE OF THE TWO DIMENSIONAL STUDY OF THE HEART

The purpose of the 2D examination is to investigate the structural and functional integrity of the cardiac chambers, walls and valves. Sonographically the pericardium will appear almost white with the myocardium and papillary muscles in a medium grey. The valves are slightly bright and fluid filled structures such as chambers and great vessels will appear black.

### 2 PREPARATION

An ultrasound machine with good resolution is used. M Mode (Motion mode), Colour Doppler and Continuous Wave functionalities are necessary for a complete echocardiography study. Colour Doppler and Continuous Wave are used to perform proper flow studies of structures in the heart. M Mode is used to assess movement of various structures over time.

A 2.5 MHz phased array transducer is most commonly used in adult echocardiography.

Both patient and sonographer should be in a comfortable position for the duration of the examination. A front-opening gown will allow for easy access to all the acoustic windows used.

The examination room is usually equipped with soft lighting in order to provide optimal conditions visualising onscreen images.

### 3 PLANES & VIEWS

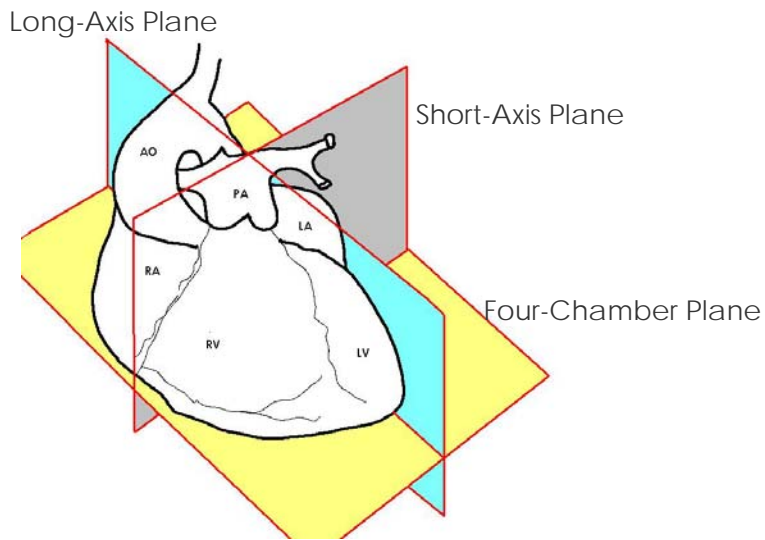


Figure 1

Image planes are used in order to provide structure and standards in ultrasound assessment of the human heart.

Each tomographic image is defined by its acoustic window and view. The standard three orthogonal image planes (**Figure 1**) are determined by the axis of the heart itself rather than by skeletal or external body landmarks.

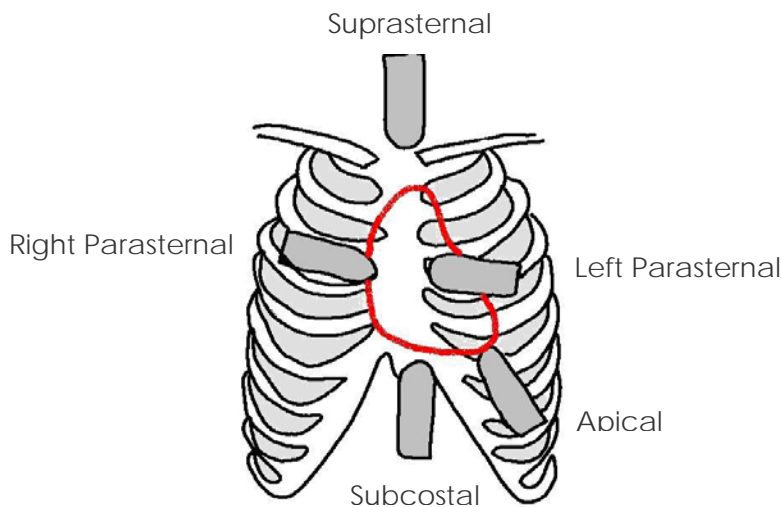
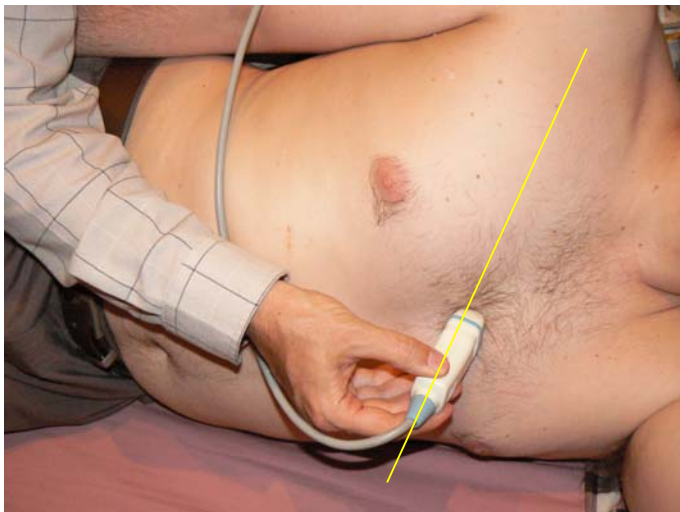


Figure 2

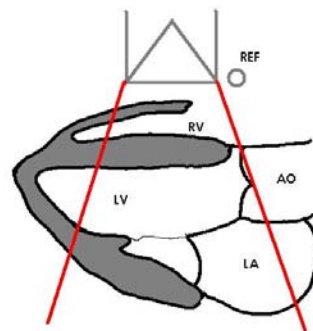
The five standard acoustic windows (**Figure 2**) are the left parasternal long-axis & short-axis, apical four chamber, suprasternal, subcostal and right-parasternal views.

The suprasternal, subcostal and right-parasternal views are less commonly used and will be discussed in future tutorials.

## 4 THE PARASTERNAL LONG AXIS VIEW



**Figure 3** Patient and transducer position for the parasternal long axis view.

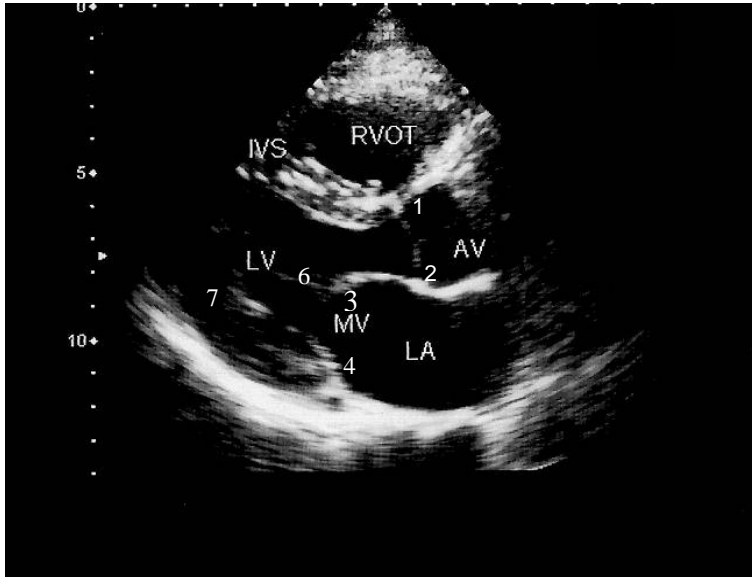


**Figure 4** Diagram of parasternal long axis

The patient should be placed in a left lateral decubitus position with the left arm elevated supporting the head.

Optimal patient positioning will help to separate the ribs, thus opening up the intercostal spaces. This position will allow for improved quality acoustic windows and views.

Images are obtained from the left parasternal position with the transducer in the second, third or fourth intercostal space close to the sternum. The transducer is held with its reference index pointing towards the patients' right shoulder.



**Figure 5** Parasternal long axis view.

The challenge for this view is visualising the ventricle in a horizontal position as seen in **Figure 5**. The horizontal alignment will simplify calculations of the left ventricular function.

The long-axis window allows for the visualisation of:

Right Ventricle (RV)

Inter Ventricular Septum (IVS)

Aortic Valve (AV) with 1 - Right Coronary Cusp & 2 - Non Coronary Cusp

Mitral Valve (MV) with 3 - Anterior leaflet & 4 - Posterior Leaflet

Left Atrium (LA)

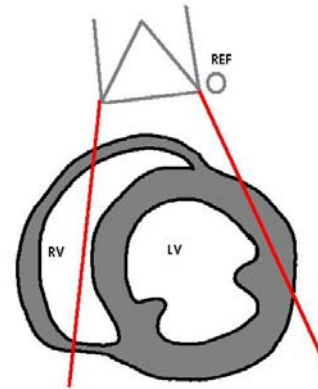
6 - Cordae Tendinae

7 - Papillary Muscle

## 5 THE PARASTERNAL SHORT AXIS VIEW



**Figure 6** Patient and transducer position for the parasternal short axis view

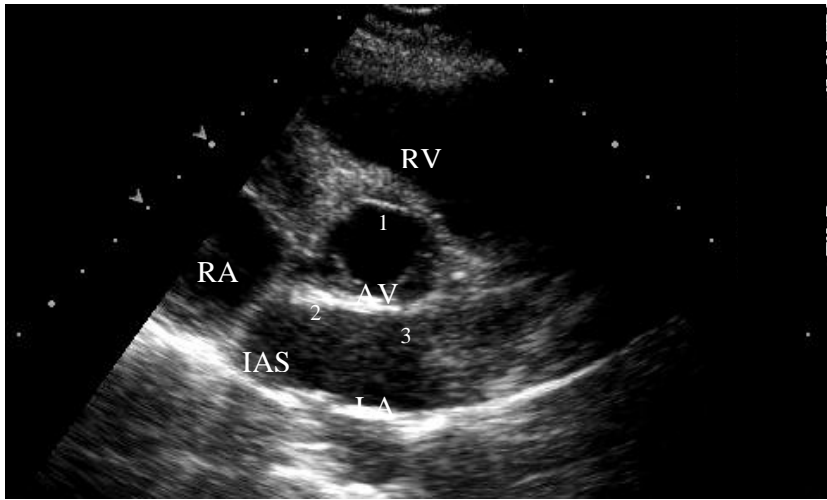


**Figure 7** Diagram of parasternal short axis view at the papillary muscle level.

Short axis views are obtained optimally with the patient in the same position as for the parasternal long axis view. The transducer is rotated 90 degrees clockwise from the long axis position. The transducer reference index will now point towards the patients' left shoulder.

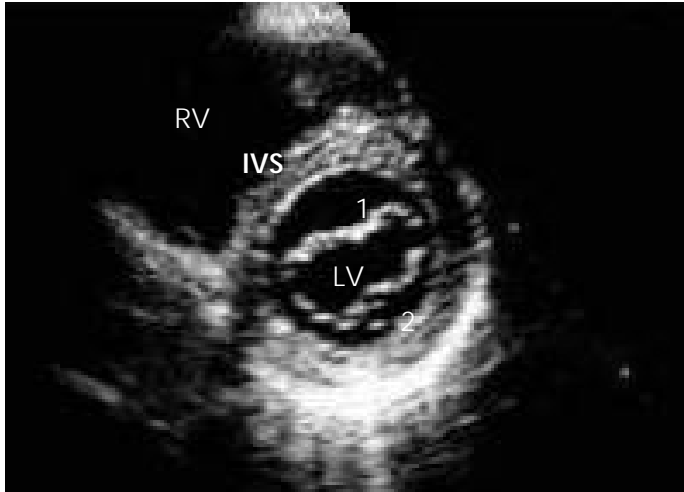
The short axis plane allows mainly for three different views by angulating the transducer from the level of the aortic and pulmonary valves to the left ventricular apex. Starting at a superior medial and tilting to an inferior lateral position, thus tilting the transducer towards the apex.

**Figure 8, 9 & 10** demonstrates the three different views obtained starting superior medially.



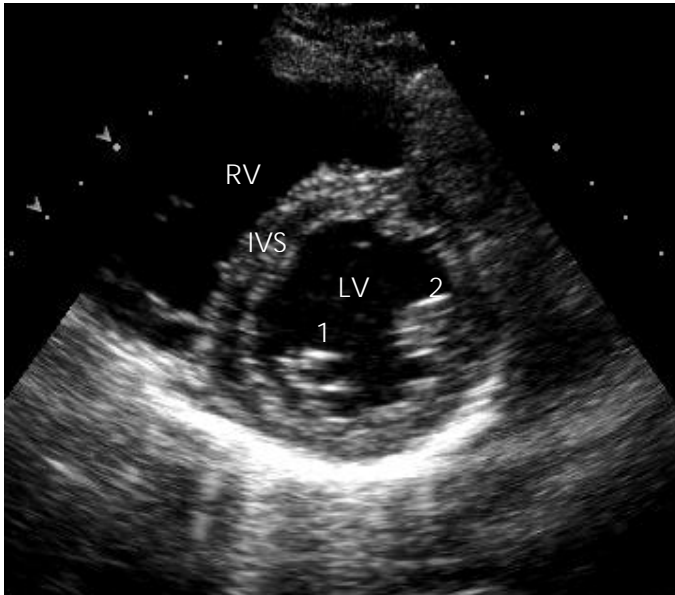
**Figure 8** Short axis view demonstrating the three open aortic valve leaflets.

**Figure 8** demonstrates:  
 Right Atrium (RA)  
 Left Atrium (LA)  
 Intra Atrial Septum (IAS), Right Ventricle with its outflow into the pulmonary artery.  
 The Aortic Valve (AV) is visualized with the three cusps in the open position:  
 1 – Right Coronary Cusp  
 2 – Non Coronary Cusp  
 3 – Left Coronary Cusp



**Figure 9** Short axis view at mitral valve level

**Figure 9** demonstrates the short axis view through the mitral valve.  
 The mitral leaflets can be visualized:  
 1 - Anterior  
 2 - Posterior  
 The Right Ventricle (RV), Left Ventricle (LV) and Inter Ventricular Septum (IVS) can be seen.



**Figure 10** Short axis view at papillary muscle level

**Figure 10** illustrates the short axis view at the papillary muscle level.

The papillary muscles can be seen at 1 & 2.

Right Ventricle (RV)

Left Ventricle (LV)

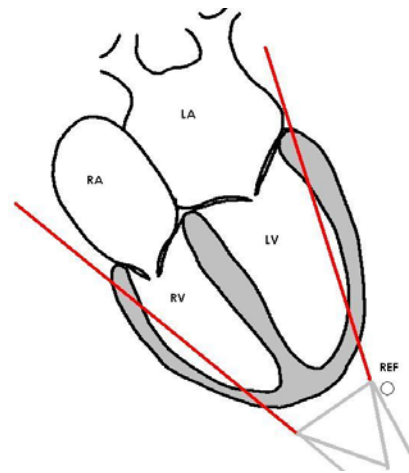
Inter Ventricular Septum (IVS)



## 6 THE APICAL FOUR CHAMBER VIEW

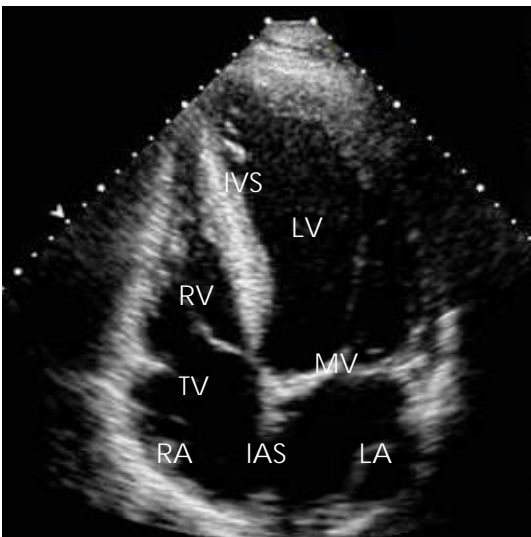


**Figure 11** Patient and transducer positioning for an apical view.

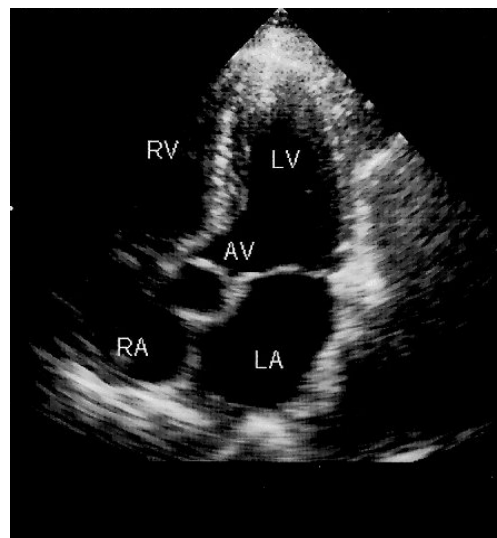


**Figure 12** Diagram of apical view.

Imaging of the heart in the apical region is performed with the patient rotated between 60 and 90 degrees to the left with the transducer applied inferiorly and lateral to the point of cardiac impulse. The reference index of the transducer is pointed towards the left side of the patient.



**Figure 13** Apical four chamber view.



**Figure 14** Apical five chamber

The apical four chamber view (**Figure 13**) illustrates:

Left Atrium (LA)

Right Atrium (RA),

Left Ventricle (LV)

Right Ventricle (RV),

Inter Atrial Septum (IAS)

Ventricular Septum (IVS)

The Tricuspid valve (TV)

Mitral Valves (MV)

The apex of both ventricles and pericardium can be seen.

With angulation of the transducer superiorly the Aortic Valve (AV) and outflow tract can be visualised. This view is known as an apical five chamber (**Figure 14**)

## 7 REFERENCES

1. ROLDAN, RA 2005: The ultimate echo guide: Lippincott Williams & Wilkins
2. OTTO, CM 2000: Textbook of clinical echocardiography: W.B Saunders Company
3. OH, JK, SEWARD, JB, TAJIK, AJ 1994: The echo manual: Little, Brown and Company
4. SUTTON, MG, OLDERSHAW, PJ, KOTLER, MN 1996: Textbook of echocardiography and Doppler in adults and children: Blackwell Science
5. SOKOLOW, M, MCIROY, MB 1986: Clinical cardiology, Second edition: Appleton Century Crofts
6. TEMPKIN, BB 1999: Ultrasound scanning: principles and protocols. 2<sup>nd</sup> ed. USA: WB Saunders Company

## 8 MULTIPLE CHOICE TEST

1 The transducer frequency most commonly used for an adult echocardiography examination is:

- A 5 MHz
- B 7.5 MHz
- C 2 MHz
- D None of the above

2 Colour Doppler and Continuous Wave are most commonly used to assess

- A Flow studies of structures within the heart
- B The size of cardiac structures
- C The movement of cardiac structures
- D None of the above

3 The parasternal five chamber view is obtained from the four chamber view by tilting the transducer:

- A Medially
- B Laterally
- C Superiorly
- D Inferiorly

4 The short axis view through the mitral valve demonstrates:

- A Anterior and posterior mitral valve leaflets
- B Inter atrial septum
- C Aortic root
- D None of the above

5 The parasternal long axis view demonstrates

- A The inter ventricular septum
- B The left atrium
- C The left ventricle
- D All of the above

6 Imaging the apical four chamber view is obtained with the transducer reference index pointing:

- A Towards the right of the patient
- B Inferiorly
- C Superiorly
- D Towards the left of the patient

7 For an echocardiography study the patient is normally positioned

- A In a right lateral decubitus position
- B In a left lateral decubitus position
- C In a supine position
- D All of the above

8 The parasternal four chamber view demonstrates

- A The aortic valve
- B The pulmonary valve
- C The inter ventricular septum
- D All of the above

9 The standard three orthogonal image planes are determined by

- A Skeletal or external body landmarks
- B Transducer position
- C The axis of the heart itself
- D All of the above

10 Short axis views are obtained optimally with the patient in the same position as for the parasternal long axis view. The transducer is:

- A Rotated 180 degrees clockwise from the long axis position
- B Slided 2 inter costal spaces inferiorly
- C Kept in the same position tilted superiorly and not rotated
- D Rotated 90 degrees clockwise from the long axis position

11 Sonographically the following structures in the heart will appear black

A Myocardium and papillary muscles

B Fluid filled structures

C The valves

D Ischemic muscle

12 The following Aortic Valve cusps in the open position can be visualized in the short axis view

A Right Coronary Cusp, Non Coronary Cusp & Coronary Cusp

B Coronary Cusp, Left Coronary Cusp & Non Coronary Cusp

C Left Coronary, Right Coronary & Non Coronary Cusp

D Left Coronary, Right Coronary & Coronary Cusp

## 9 INSTRUCTIONS TO COMPLETE MULTIPLE CHOICE TEST.

To answer multiple choice tests on line:

1. You need to be a registered user with CPD Solutions:

If you have not done this yet, go to [www.cpdolutions.co.za](http://www.cpdolutions.co.za), click on the "Sign up" button and follow the instructions from there.

2. Go to [www.cpdolutions.co.za](http://www.cpdolutions.co.za) and log in with your email address and password.

On the home page, click on the link: "Articles and multiple choice tests".

Click on the community you want to view articles and test for.

Click on the detail block "Answer multiple choice test", next to the article/event title.

Tick your choice of answers in the test and click the "Submit" button.

Your test results will appear on-screen.

To view a summary of your CPD points, click the: "My CPD Points" link on the home page. This is also where you will find an electronic CPD certificate for this activity.

For help and information please email [info@cpdsolutions.co.za](mailto:info@cpdsolutions.co.za) or call Karen 082 491 3590