Assessment of Left Ventricular systolic function
Causes of LV dysfunction

- Ischaemic heart
- Hypertension
- Dilated cardiomyopathy
- Alcohol
- Thyroid problems
- HOCM
- Amyloid
- Sarcoid
- Systemic sclerosis
Which method?

- Ejection Fraction
- Regional wall motion
- Global function
Left ventricular M-mode
Where to measure?

- Diastolic measurements are timed with the onset of the QRS complex.
- M mode measurements are taken “leading edge to leading edge”.
- Systolic LV measurements are made at peak septal and posterior wall deflection (end of T wave).
- LA is measured at maximum dimension.
## Intracardiac dimensions

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left Atrium</td>
<td>3.0-4.5</td>
<td>2.7-4.0</td>
</tr>
<tr>
<td>Left ventricle- diastole</td>
<td>4.3-5.9</td>
<td>4.0-5.2</td>
</tr>
<tr>
<td>Left ventricle-systole</td>
<td>2.6-4.0</td>
<td>2.3-3.5</td>
</tr>
<tr>
<td>Septum-diastole</td>
<td>0.6-1.3</td>
<td>0.5-1.2</td>
</tr>
</tbody>
</table>
Fractional shortening

- FS - This is the percentage change in LV dimensions between systole and diastole.
- Not reliable in the presence of wall motion abnormalities. Normal values 28-44%
- More reliable than using LV volumes (EF)

\[ \% \text{ FS} = \frac{\text{LVEDd} - \text{LVESd}}{\text{LVEDd}} \]
Ejection Fraction

- This is the percentage change in LV volumes between systole and diastole.
- Normal values 55 – 80%
- (Teicholz)
- \[ EF = \frac{(LVEDd)^3 - (LVEDs)^3}{(LVEDd)^3} \times 100 \]
Stroke volume

- Stroke volume = LVDd³ − LVDs³
- Also – Stroke volume = CSA x VTI
  Where CSA = \( \pi (d/2)^2 \) eg. LVOT
  And VTI eg. Area of V1

- Cardiac output = stroke volume x HR
Simpsons rule

- Quantitive method based on dividing the left ventricle into multiple slices of known thickness.
- The thinner the slices the more accurate the measurements.
- Length of LV apex to MV annulus
- End systolic and end diastolic borders traced
- Assumes the left ventricle is elipsoid shaped.
Simpsons
Fig 3.5  Method of measuring end-systolic volume by tracing the endocardium. The area obtained is 15 cm² with a volume estimated at 30 ml.
Regional wall motion

- Can be assessed by looking at each arterial region
- Each wall territory is assessed for wall motion
- Close inspection of wall thickening in systole
Left coronary distribution

- Left Coronary bifurcates :-
- Left anterior descending and circumflex
- LAD responsible for supplying the anterior, septal and part of the apical wall.
- Cx responsible for supplying the posterior wall lateral wall (occasionally inferior)
Right coronary artery

- Responsible for supplying
- Inferior wall
- Right ventricle
- Conduction system
Coronary artery distribution

Distribution of coronary arteries supplying the left ventricular wall segments.
16 segment approach

- 3 different views used.
  - Parasternal Long Axis (four segments)
  - Apical 4ch (six segments)
  - Apical 2ch (six segments)
  - Parasternal short axis  Apical level (four segments)
  - Parasternal short axis Papillary level (six segments)
  - Parasternal short axis Mitral level (six segments)
16 segment approach

Model demonstrating how the left ventricle is divided into 16 segments for echocardiographic wall motion assessment using the four recommended views.
Wall scoring

16 segment approach

- **Motion** score
  - Normal 1
  - Hypokinetic 2
  - Akinetic 3
  - Dyskinetic 4
  - Aneurysmal 5

- LV wall motion score index = total score
  
  number of segments scored
Grading of wall motion

- **Hyperkinetic** - exaggerated movement
- **Hypokinetic** – reduced movement and thickening
- **Akinetic** – absent movement
- **Dyskinetic** – out of phase with rest of ventricle
- **Aneurysmal** -
Localised abnormal wall motion

- Left bundle branch block
- Paced ventricle
- RV volume overload
- Post cardiac surgery
Global function

- Eye ball assessment of overall systolic function.
- EF >60% - Good function
- EF 45-60% - Mildly impaired function
- EF 35-45% - Moderately impaired function
- EF<35%  - Poor function
- EF<25% - Severely impaired function
Spherical versus Elipsoid!
Fig 3.3 Hypokinesis. There is an inferior infarct shown as a bulging region (arrowed in a). The M-mode recording at this level (b) shows hyperkinesis of the septum (s) while the inferior wall (pw) is hypokinetic.