University Hospitals of Morecambe Bay NHS Foundation Trust

Physiology, clinical examination and echocardiography in normal pregnancy

Cardiomyopathy and Pregnancy Conference

29/04/16

Dr Adrian Brodison

Clinical lead cardiology

UHMBFT

Heart disease in pregnancy

University Hospitals of Morecambe Bay NHS Foundation Trust

- Major cause of maternal mortality (10-15%)
- Majority occur in women with pre-existing conditions
- Most are known before pregnancy
- Some become evident during pregnancy
- Some develop during pregnancy

Social factors contributing

University Hospitals of Morecambe Bay NHS Foundation Trust

- Increasing maternal age at first pregnancy
- Increased smoking
- Earlier coronary artery disease

Physiological changes during pregnancy

University Hospitals of Morecambe Bay NHS Foundation Trust

- Cardiovascular
- Haematological
- Renal
- Hormonal

Pregnancy- cardiovascular

University Hospitals of Morecambe Bay NHS Foundation Trust

- Major changes
- Permit uterus and foetus to receive adequate blood supply
- Well tolerated in a normal heart

Pregnancy- cardiac output

University Hospitals of Morecambe Bay NHS Foundation Trust

- Increases 40-50%
- Starts increasing by 6 weeks
- Maximal towards end of 3rd trimester
- Stroke volume and heart rate
- Decreases slightly at end of pregnancy

Pregnancy- heart rate

University Hospitals of Morecambe Bay NHS Foundation Trust

- Starts increasing in first few weeks
- Peaks early in 3rd trimester
- 10-20bpm

Pregnancy- peripheral vascular resistance

University Hospitals of Morecambe Bay NHS Foundation Trust

- Falls 30-40%
- Minimal level during second trimester
- Due to low resistance placental circulation
- Leads to drop in BP initially as exceeds cardiac output changes

Pregnancy- Blood pressure

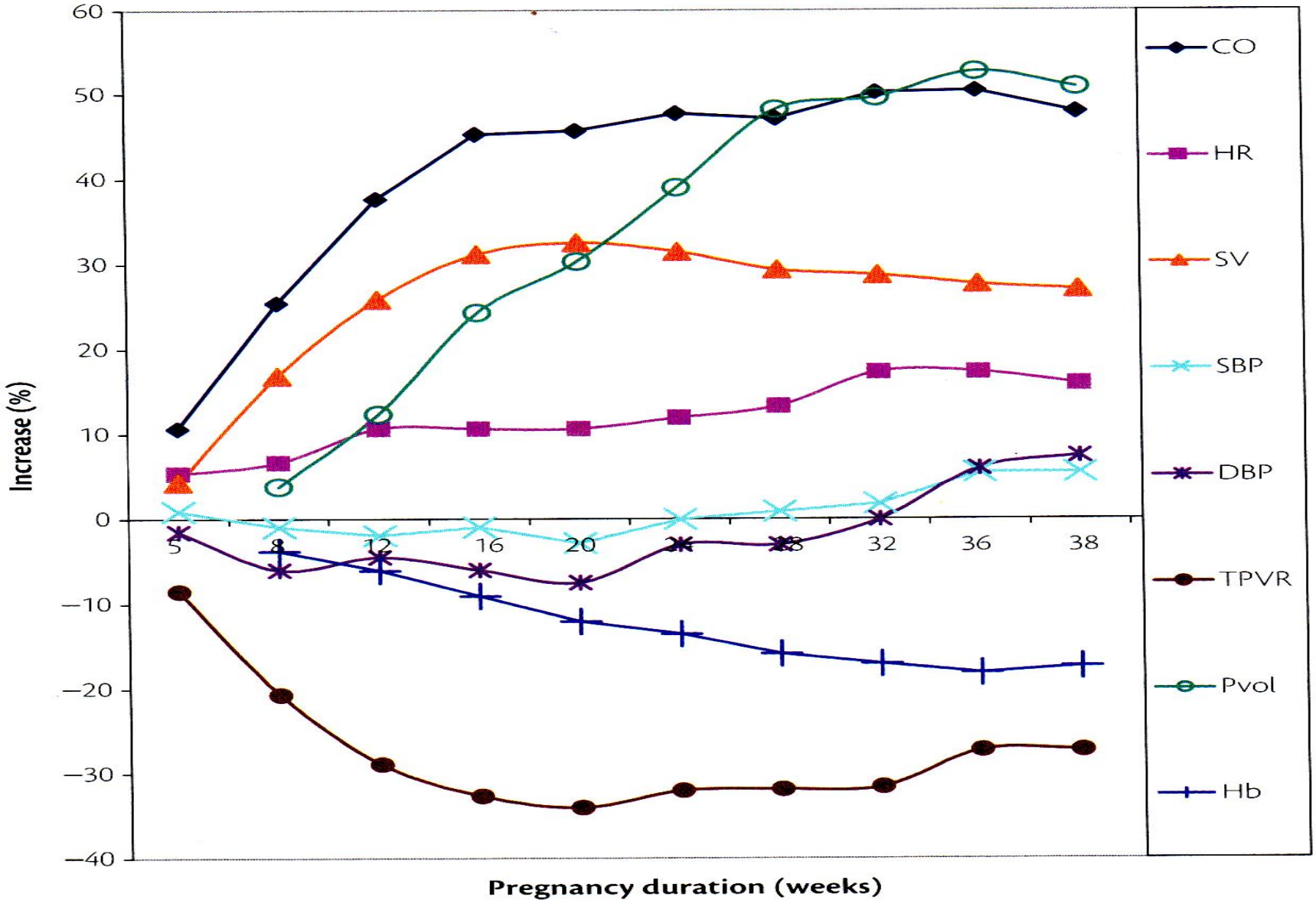
University Hospitals of Morecambe Bay NHS Foundation Trust

- Early drop
- Slight increase towards full term
- Pulse pressure widens

Pregnancy- blood volume

University Hospitals of Morecambe Bay NHS Foundation Trust

- Doubles by full term
- Starts by 6th week
- Rapid increase in 2nd trimester


60
50
40
30
20
10
0
−10
−20
−30
−40
Increase (%)
5
8
12
16
20
32
36
38
Pregnancy duration (weeks)
CO
HR
SV
SBP
DBP
TPVR
Pvol
Hb

Pregnancy- haematological changes

University Hospitals of Morecambe Bay NHS Foundation Trust

- Red cell mass increases
- Less than plasma volume
- Haemodilution
- Anaemia of pregnancy
- Aldosterone increased sodium retention
- Total body water increases 6-8 Litres

Pregnancy- haemostasis

University Hospitals of Morecambe Bay NHS Foundation Trust

- Hypercoagulable state
- Decreased Tissue plasminogen activator
- Reduced protein S levels
- Combat risk of haemorrhage

Labour

University Hospitals of Morecambe Bay NHS Foundation Trust

- Dramatic changes
- Venous return increases during uterine contraction
- Cardiac output can increase 25% during contractions
- Pain further increases cardiac output and BP

Post partum

University Hospitals of Morecambe Bay NHS Foundation Trust

- Increased cardiac output
- Blood shift from uterus to systemic circulation
- Inferior vena caval decompression
- All cardiovascular adaptions regress by 6 weeks.

Cardiovascular evaluation

University Hospitals of Morecambe Bay NHS Foundation Trust

- May mimic cardiovascular disease
- Fatigue
- Chest pain at rest- oesophageal
- Dyspnoea
- Palpitations

Pregnancy-heart sounds

University Hospitals of Morecambe Bay NHS Foundation Trust

- Loud S1
- S1 splitting may mimic S4
- Physiological S2 splitting may become fixed
- S3 common often present by week 20

Pregnancy- murmurs

University Hospitals of Morecambe Bay NHS Foundation Trust

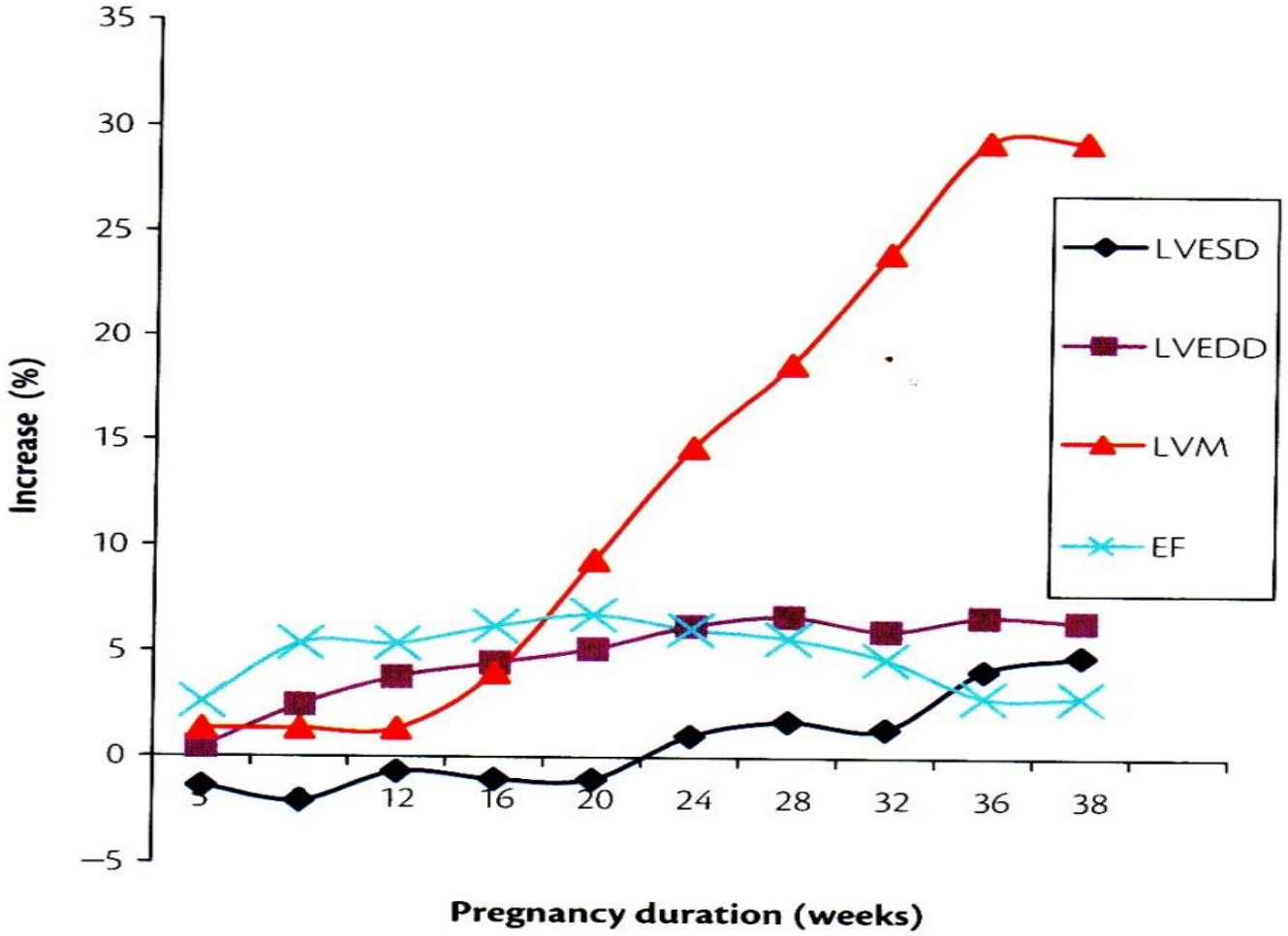
- Present in nearly all pregnant women
- Soft mid systolic – increased pulmonary blood flow
- Continuous murmur – increased flow of breasts “Mammary Souffle”
- Further evaluation requires – loud systolic, diastolic, continuous

Diagnostic tools- echo

University Hospitals of Morecambe Bay NHS Foundation Trust

- Ideal diagnostic tool
- Increased cardiac output
- LV end-diastolic volume
- LV wall thickness
- Slight increase in atrial size
- Mild AV valve regurgitation

Echo changes in pregnancy



Diagnostic tools

University Hospitals of Morecambe Bay NHS Foundation Trust

- CxR- small foetal dose, avoid especially in first trimester
- MRI- rare indications but non contrast probably safe
- CT- rarely used, higher doses mainly for pulmonary embolism
- Cardiac catheterization/ intervention- rarely performed, high dose but can be life saving, month 4 is probably safest.

Cardiovascular assessment

University Hospitals of Morecambe Bay NHS Foundation Trust

- Understand the physiology
- Recognise normality
- Identify warning signs
- Use non invasive testing where possible
- Ideally identify those at risk pre pregnancy
- Pre pregnancy counselling

Cardiovascular assessment

University Hospitals of Morecambe Bay NHS Foundation Trust

- **Phone a friend if concerned**