Cardiac disease in pregnancy

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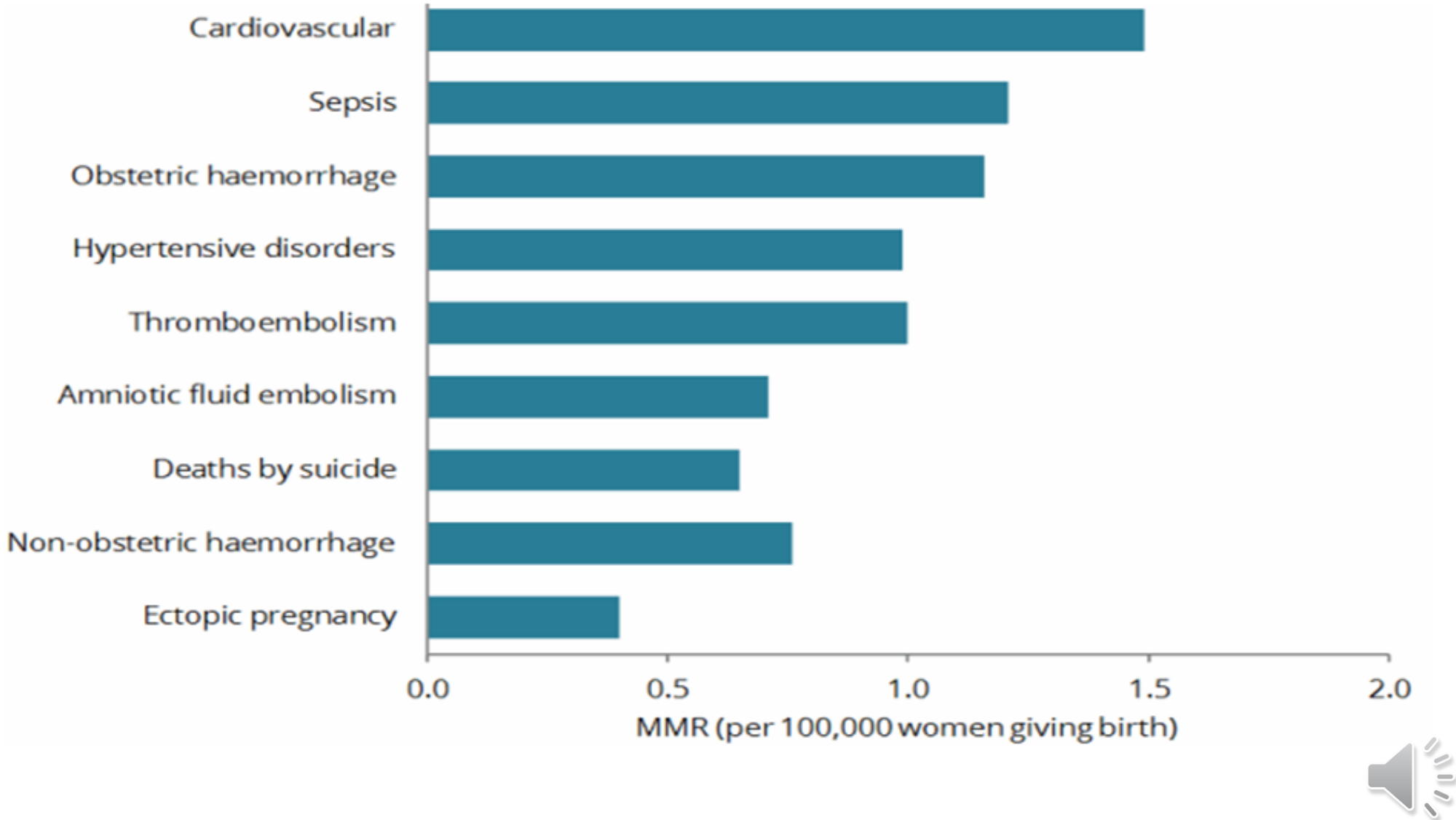
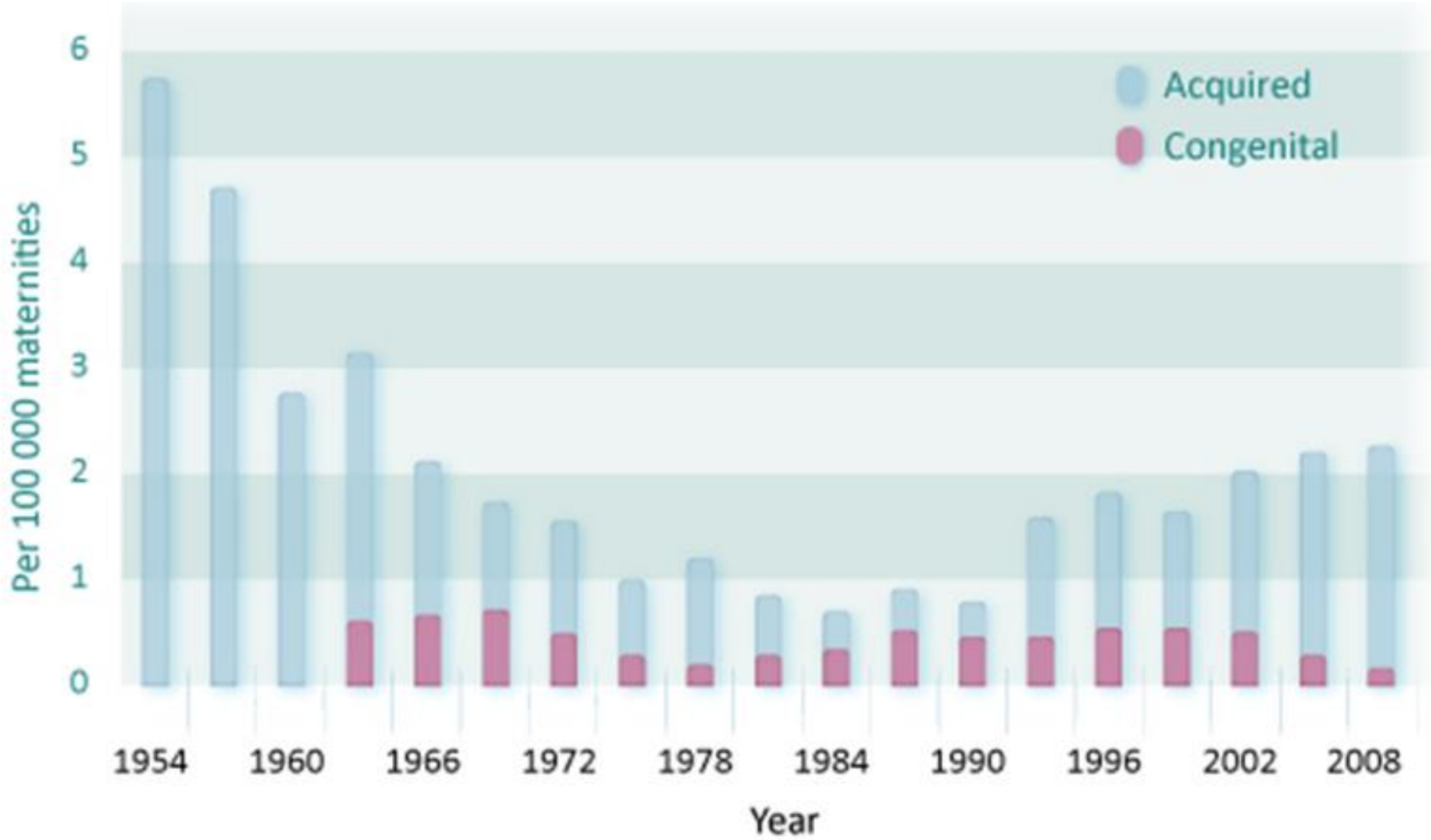
- It’s a leading cause of maternal mortality, third of these deaths are due to IHD and another third due to peripartum cardiomyopathy

- Maternal death due to cardiac problems are on the rise, this is mainly attributable to acquired heart disease, other causes:

  - Increasing rates of obesity
  - More older ladies getting pregnant
  - Survivors of congenital heart diseases who were operated on


Cardiovascular
Sepsis
Obstetric haemorrhage
Hypertensive disorders
Thromboembolism
Amniotic fluid embolism
Deaths by suicide
Non-obstetric haemorrhage
Ectopic pregnancy
0.0
0.5
1.0
1.5
2.0
MMR (per 100,000 women giving birth)


Acquired
Congenital
Per 100 000 maternities
6
5
4
3
2
1
0
1954
1960
1966
1972
1978
1984
1990
1996
2002
2008
Year

- Profound hemodynamic alterations occur during pregnancy, labour, delivery, and the postpartum period

- Normal pregnancy is associated with fatigue, dyspnea, decreased exercise capacity, peripheral edema, and jugular venous distention

Changes during pregnancy

- Blood volume increases 40% to 50% during normal pregnancy

- Cardiac output increases 30% to 50% above baseline by 20 to 26 weeks' gestation, peaks at the end of the second trimester, and then plateaus until delivery. This increase is mediated by:
  1. Rise in maternal heart rate of 10 to 15 beats per minute
  2. Increased preload due to the rise in blood volume
  3. Reduced afterload due to a fall in systemic vascular resistance

Labour and delivery

- During labour and delivery, hemodynamic fluctuations can be profound
    - Each uterine contraction results in the displacement of 300 to 500 mL of blood into the general circulation
    - Stroke volume increases, causing a rise in cardiac output of an additional 50% with each contraction
    - Blood loss during delivery can further alter the hemodynamic state

Postpartum

- Immediately postpartum, uterine involution leads to autotransfusion, which increases cardiac output dramatically
- In addition, there is a relief of vena caval compression after delivery. Increased venous return augments cardiac output and prompts brisk diuresis.

- **The cardiovascular system returns to the prepregnant baseline within 3 to 4 weeks postpartum**

Cardiac disease and pregnancy

- Signs and symptoms of cardiac disease overlap common symptoms and findings in pregnancy and include fatigue, shortness of breath, orthopnea, palpitations, edema, systolic flow murmur, and a third heart sound

- Evaluation of cardiac disease
  1. Thorough history and physical examination
  2. Electrocardiogram (ECG)
  3. Chest radiograph
  4. Echocardiogram

- ECG changes in pregnancy:

1. Leftward shift of the electrical axis, especially during the third trimester when the diaphragm is pushed upward by the uterus.
2. Ventricular extrasystoles
3. Small Q wave and inverted T wave in lead III
4. ST segment depression and T wave inversion in the inferior and lateral leads

- Routine chest radiographs are used to assess cardiomegaly and pulmonary vascular prominence

- Echocardiographic evaluation of ventricular function and structural anomalies is invaluable for diagnosis of cardiac disease in pregnancy

Management of patients with cardiac disease –preconception

- Women with pre-existing cardiac lesions should receive preconception counselling regarding maternal and fetal risks during pregnancy and long-term maternal morbidity and mortality

- **The New York Heart Association (NYHA) functional class** is used as a predictor of outcome

NYHA Class	Symptoms
I	No symptoms and no limitation in ordinary physical activity such as shortness of breath when walking or climbing stairs.
II	Mild symptoms (mild shortness of breath and/or angina) and slight limitation during ordinary activity
III	Marked limitation in activity due to symptoms, even during less than ordinary activity such as walking short distances (20-100 m); comfortable only at rest
IV	Severe limitations. Experiences symptoms even while at rest; mostly bedbound

- A risk index using four risk factors has been shown to accurately predict a woman's chance of having adverse cardiac or neonatal complications:

1. A prior cardiac event
2. Cyanosis or poor functional class (NYHA class III or IV)
3. Left heart obstruction
4. Systemic ventricular dysfunction (ejection fraction < 40%)

Score (number of risk factors present)	Chance of cardiac complications in pregnancy
0	5%
1	27%
> 1	75%

Management of patients with cardiac disease –after conception

- Pregnant patients with significant history require cardiac assessment as early as possible

- Patients need close monitoring and follow-up by both a maternal-fetal medicine subspecialist and a cardiologist, with attention to signs and symptoms of possible complications throughout the pregnancy

- Each visit should include the following:

1. Cardiac examination and cardiac review of systems
2. Documentation of weight, blood pressure, and pulse
3. Evaluation of peripheral edema

Management of patients with cardiac disease –antenatally

- The most common cardiac complications in pregnancy include arrhythmia and CHF
- Pregnancy is also a time of hypercoagulability, and anticoagulation should be started if appropriately indicated
- If symptoms worsen, hospitalization, bed rest, diuresis, or correction of an underlying arrhythmia may be required

- Sometimes, surgical correction during pregnancy becomes necessary

- When possible, procedures should be performed **during the early second trimester** to avoid the period of fetal organogenesis and before more significant hemodynamic changes of pregnancy occur

Obstetrics complications

- Miscarriage
- Preterm labour
- Intrauterine growth restriction
- Congenital heart disease in the offspring
  - In about half of these cases the abnormality will be the same as that in the parent
  - Fetal echo should be offered to all women where the mother (or father) has congenital heart disease

Congenital diseases
–Septal defects

- Atrial Septal Defects (ASDs):
  - The ASD is the **most** common congenital heart lesion in adults
  - The ASDs are usually very well tolerated unless they are associated with pulmonary HTN
  - Arrhythmias are the most common cardiac complication and occur in <5% of pregnant women
  - Consider closure prior to pregnancy in view of the risk of paradoxical embolism

- Ventricular Septal Defects (VSDs):
  - The VSDs usually close spontaneously or are closed surgically if the lesion is large (>6 mm). For this reason, significant VSDs are rarely seen in pregnancy.
  - The incidence of VSD in the offspring of affected parents is **4%**; however, small VSDs are often difficult to detect antenatally

Congenital diseases
–Patent Ductus Arteriosus (PDA)

- PDA is not associated with additional maternal risk for cardiac complications if the shunt is small to moderate and if pulmonary artery pressures are normal

- Moderate to large PDA should be repaired prior to pregnancy (may be associated with increased volume, left heart failure, and pulmonary hypertension)

Congenital diseases
–Tetralogy of Fallot (TOF)

- **Most common <u>cyanotic</u> congenital heart disease**

- Characterized by (1) pulmonary stenosis, (2) VSD, (3) right ventricular hypertrophy, and (4) overriding aorta

- About 15% of patients with TOF have deletion of chromosome 22q11, which poses the fetus at risk of congenital heart disease

- Pregnancy is generally well tolerated in patients who have had surgical repair

- If unrepaired, the right to left shunt worsens with pregnancy due to reduced systemic vascular resistance

Congenital diseases
–Marfan syndrome

- Autosomal dominant disorder (1:2 risk of passing it to offspring)
- Characterized by connective tissue fragility
- The most common cardiovascular manifestation is aortic root dilation (which could progress to dissection)
  - Patients with a dilated aortic root > 4 cm are considered high risk
- Patients should be monitored with serial physical exams as well as echocardiography

- Hypertension should be avoided.
  - β -Blockade is recommended for patients with Marfan syndrome from the second trimester onward, particularly if the aortic root is dilated
- Regional anesthesia during labour is considered safe
- Women should labour in the left lateral decubitus position with the second stage shortened by elective forceps delivery
- Rapidly dilating aortic root or a diameter > 4 cm –women should be delivered by elective CS

Rheumatic heart disease
–Mitral Stenosis (MS)

- Mitral valve stenosis is the most common lesion in rheumatic heart disease and the one that carries the highest risk

- Patients with moderate to severe MS often experience hemodynamic deterioration during the third trimester, labour and delivery, and postpartum
  - Increased blood volumes and heart rate lead to an elevation of left atrial pressure, resulting in **pulmonary edema**

- Cardioselective β-blockers, such as metoprolol and atenolol, are used to treat or prevent tachycardia

- Vigilance regarding arrhythmias – treat and anticoagulate

- Patients with severe MS who develop NYHA functional class III to IV symptoms during pregnancy should undergo percutaneous balloon valvotomy

- **<u>In labour:</u>**
  1. Short active second stage (elective forceps delivery)
  2. Good analgesia
  3. Avoid syntometrine (pulmonary edema)
  4. Avoid fluid overload
     - Careful fluid management
     - Judicious diuresis (aggressive diuresis should be avoided to preserve uteroplacental perfusion)

- If undergoing CS, epidural anesthesia is usually better tolerated hemodynamically than general anesthesia

Rheumatic heart disease
–Aortic Stenosis (AS)

- AS can be congenital (bicuspid valve) or as a result of rheumatic heart disease

- Symptoms such as dyspnea, angina pectoris, or syncope usually become apparent late in the second trimester or early in the third trimester

- Symptomatic women or those with severe stenosis are at risk of acute left ventricular failure or sudden death

- Great care must be taken to prevent hypotension, tachycardia, and hypoperfusion caused by blood loss, regional anesthesia, or other medications
  - Spinal and epidural anesthesia are discouraged because of their vasodilatory effects

- Patients should be hydrated adequately and placed in the left lateral position to maximize venous return

Rheumatic heart disease
–Regurgitant valves

- Generally, well tolerated during pregnancy
- Medical management includes diuretics in the rare event of pulmonary congestion or vasodilators for systemic hypertension
- Women with severe regurgitation should undergo surgical repair before conception

Prosthetic valves and pregnancy

- Prosthetic artificial valves need lifelong anticoagulation with warfarin
- Prosthetic tissue valves usually deteriorate with time
- Pregnancy poses an increased risk of thrombosis with a risk as high as 29% and maternal mortality rate of 2.9%

- Anticoagulation choice depends on patient and physician preferences after consideration of the maternal and fetal risks

- The three agents considered during pregnancy are unfractionated heparin (UFH), low-molecular-weight heparin (LMWH), and warfarin

- **<u>Unfractionated Heparin (UFH):</u>**

- Does **not** cross the placenta and is safe for the fetus
- Side effects: maternal osteoporosis, hemorrhage at the uteroplacental junction, and thrombocytopenia (heparin-induced thrombocytopenia)
- Parenteral infusions should be stopped at least 4 hours before CS
- The UFH can be reversed with **protamine sulphate**

- **<u>Low-molecular-weight heparin (LMWH):</u>**

- Does **not** cross the placenta and is safe for the fetus
- Compared to UFH: less likely to cause heparin-induced thrombocytopenia, is easier to administer and monitor, and has lower risk of osteoporosis and bleeding complications
- Can be reversed with **protamine sulphate**

- **<u>Warfarin</u>**:

- Vitamin K antagonist
- Can be reversed with **Vitamin K1**
- Freely **crosses** the placenta and can harm the fetus causing warfarin embryopathy
  - Also known as fetal warfarin syndrome or di Sala syndrome
  - Primarily characterised by nasal hypoplasia and skeletal abnormalities, including short limbs and digits (brachydactyly)

Ischemic Heart Disease (IHD)

- Pregnancy itself raises the risk of acute myocardial infarction by 3 to 4-fold
- Risk factors include hypertension, thrombophilia, diabetes, smoking, transfusion, postpartum infection, obesity, and age >35 years
- Anterior wall MIs are most common
- If delivery takes place within 2 weeks of the acute event, the mortality rate reaches 50%; survival is much improved if delivery takes place more than 2 weeks after the acute event

- For diagnosis: Cardiac troponin I, ECG

- Coronary artery angiogram, with the option of interventional therapeutic techniques, are the intervention of choice in pregnancy and postpartum

Cardiomyopathy

- Cardiomyopathy can be genetic, idiopathic, or caused by myocarditis or toxins and manifests during pregnancy with signs and symptoms of CHF.

- These include chest pain, dyspnea, paroxysmal nocturnal dyspnea, and cough

Cardiomyopathy
–Peripartum cardiomyopathy

- Is an idiopathic cardiomyopathy that typically develops late in pregnancy or in the early postpartum period (although can happen up to 6 months after delivery) without another identifiable cause of cardiac failure

- It is characterized by left ventricular systolic dysfunction with EF <45%

- **Tends to recur in subsequent pregnancies**

- Risk factors include:
  - Advanced maternal age
  - Multiparity
  - Multiple gestations
  - Black race
  - Obesity
  - Gestational hypertension, preeclampsia (25% of affected women are hypertensive)
  - Family history

- Workup and diagnosis are completed with ECG, echocardiography, and lab studies such as brain natriuretic peptide
- Medical management includes fluid and salt restriction, digoxin, diuretics, vasodilators, and anticoagulants
- The mortality rate is 25% to 50%; half of those die within the first month of presentation
- Of the patients who survive, approximately 50% recover normal left heart function

- For patients diagnosed antenatally:
    - Supplemental oxygen and regional analgesia for pain control should be administered
    - A passive second stage of labour facilitated by operative vaginal delivery should take place
    - Intensive care unit monitoring should continue immediately postpartum

Cardiomyopathy
–Hypertrophic cardiomyopathy

- Autosomal dominant disorder

- Most women with hypertrophic cardiomyopathy do well in pregnancy, and complications are uncommon unless there's severe diastolic dysfunction

- During pregnancy, β -blockers should be continued and the judicious use of diuretics may be required to treat symptoms of dyspnea

Arrhythmias

- Investigations:
  - 12-lead ECG (ideally when an episode occurs)
  - Thyroid function tests
  - Haemoglobin level
  - 24-hour ECG
  - Echocardiography and cardiology review for newly diagnosed arrhythmias in pregnancy to determine whether there is an underlying cardiac problem

- Treatment:
  - Reassurance is sufficient for majority of women
  - Anticoagulation in women with atrial fibrillation
  - Pharmacological treatment if associated with syncope or hypotension
    - Beta-blockers
    - Adenosine to terminate episodes of supraventricular tachycardia (this is safe for the fetus)
  - DC cardioversion if unresponsive to medical treatment.

General principles of care in pregnancy for women with cardiac disease

- Multidisciplinary care throughout the pregnancy and a clearly documented individualised plan of care for delivery and the immediate postpartum period is important
- Ensure adequate rest
- Stop smoking
- Prevent anaemia

- Treat respiratory infections promptly
- Aim for vaginal delivery at term
- Cover with antibiotics
- Low dose oxytocin

- Provide adequate analgesia (epidural anaesthesia is safe)
- Avoid aortocaval compression
- Avoid fluid overload
- Shorten second stage by using forceps or vacuum
- Ergometrine is best avoided

Infective Endocarditis prophylaxis

IE Prophylaxis only recommended for High risk Patients-

- Patients with Prosthetic Cardiac valves
- Patients with previous Infective Endocarditis
- Cardiac transplant patients with valvulopathy
- CHD with Unrepaired cyanotic CHD with palliative shunts or conduits, CHD with repaired prosthetic valves less than 6 months and repaired CHD with residual defects at site or prosthetic device

Cardiac medications in pregnancy

- ACE inhibitors: contraindicated
  - Oligohydramnios, IUGR, renal failure, abnormal bone ossification
  - Can be safely used in breastfeeding
- Furosemide: safe
  - Caution regarding maternal hypovolemia and reduced placental blood flow
- Digoxin: safe
- B-blockers: relatively safe
  - IUGR, neonatal bradycardia and hypoglycemia

Termination of pregnancy

1. Primary pulmonary hypertension
2. Eisenmenger syndrome
3. Coarctation of aorta
4. Marfan syndrome with dilated aortic root

Thank you!

- References:

1. Cardiac disease and pregnancy, RCOG Good practice paper No.13
2. THE JOHNS HOPKINS MANUAL OF GYNECOLOGY AND OBSTETRICS