CLINICAL PRACTICE GUIDELINE

Cardiac disease

This document should be read in conjunction with the Disclaimer

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Quick Reference Guide

QRG: Cardiac disease and pregnancy

Antepartum

1. **Preconception:** Consider MFM Preconception clinic for assessment and counselling. **Refer** early pregnancy to tertiary centre counselling, education and assessment
2. **Baseline evaluation** Risk assessment carried out early in pregnancy by consultant obstetrician, physician & anaesthetist. **Careful check-up of women from developing countries.** Complete physical examination, arrange maternal Echo as required, ECG & other tests; all results to be reviewed by Obstetric Physician.
3. Fetal **Ultrasound** (1st trimester screen; tertiary fetal anatomy scanning at 18-22 weeks & 2nd trimester fetal echocardiography if maternal congenital cardiac disease).
4. Maternal Echocardiogram: At 13 weeks & physician review of echocardiogram result
5. **Regular antenatal care**
   - Visits every 2-3 weeks >20wks, fortnightly >28wks, weekly >36wks
   - Women with valvular disease, including Rheumatic Heart Disease are seen by physician in early pregnancy and again at 28-32 weeks (at minimum) AND to ensure a plan regarding management in labour is documented on MR 004.
   - Check blood pressure (BP) manually; check for signs/ symptoms of cardiac failure (auscultate lungs, pulse rate/rhythm, jugular venous pressure) & monitor for atypical signs of ischaemia.
   - MSU at first appointment to screen for asymptomatic bacteriuria (if not already done)
   - Anaemia prevention and management
6. **Birth planning** (Multidisciplinary team approach)
   - **Document intrapartum plan** (analgesia, labour supervision, birth mode, second stage management, oxytocic, PPH prevention, thromboprophylaxis & antibiotic prophylaxis (if indicated) & length of postnatal stay **in medical record on MR004**
   - Vaginal birth (where appropriate) usually carries the lowest risk of complications.
7. **Encourage rest** & admit if chest infection or cardiac failure occurs.
8. **Ask** Obstetric Physician about endocarditis prophylaxis &antibiotics for dental/surgical procedure

Intrapartum

1. **Notify** Obstetric Registrar (And in *major risk cases*: Senior Obstetric Registrar, Obstetric Consultant, Obstetric Physician, Anaesthetic Registrar, & Labour Suite Consultant Anaesthetist).
2. Additional **observations/care** (Cardiac exam 4 hourly, strict fluid balance chart, oxygen if required, haemodynamic monitoring & pulse oximetry if indicated; respirations, pulse & BP half hourly)
   - If major cardiac risk: Position in sitting or semi-Fowlers.
3. **Continuous fetal heart rate monitoring.**
4. **Consider**: Analgesia (e.g. epidural) & monitoring intravenous fluids; Antibiotics & Shortened second stage when major cardiac risk present.
5. **Prevent PPH:** Use oxytocin infusion 80units in 500mL Hartmann's solution and halve the rate of administration.
6. Do **not** use ergometrine routinely.

Postpartum

1. **Manage** high risk cases in Adult Special Care Unit (ASCU) until maximum risk period passed.
2. **Thromboprophylaxis**: Anti-embolic stockings & early ambulation; delay warfarin (where applies).
3. **Breastfeeding**: Encourage, where not medically contraindicated. Encourage rest & educate on signs/ symptoms of mastitis/ infection & action to take if develops.
4. **Discuss** contraception, future pregnancy guidance & regular cardiac reviews.
5. **Follow up** at 6 weeks (& 6 months if continued concerns), then return to usual cardiac care.

Note: This flowchart represents minimum care & should be read in conjunction with the following full guideline & disclaimer.
Additional care should be individualised as needed.

Aim

- To provide information on the management of cardiac disease in pregnancy for the antenatal, intrapartum and postnatal periods.

Background

Cardiovascular disease (CVD) affects approximately 0.2% to 4% of pregnant women.[1] Maternal mortality in pregnant women with CVD is about 1%, which is 100 times higher than women without CVD.[2] In western countries CVD is increasing[2, 3] and is a major cause of maternal mortality in pregnancy.[1, 4] Congenital heart disease (CHD) is the predominant type of CVD in first world countries,[4-6] whilst rheumatic cardiac disease is still an important cause of morbidity and mortality in developing countries, groups living in poor socio economic conditions, and Indigenous Australians.[3] Furthermore, ischaemic heart disease in pregnancy is becoming more prominent with a higher number of older women giving birth, obesity, smoking, hypertension,[2] hypercholesterolaemia and the incidence of diabetes increasing.[3]

Mortality of women with cardiac disease is low except in certain conditions such as Eisenmenger's syndrome, pulmonary hypertension, severe systemic ventricular dysfunction, and Marfan's syndrome with pathology of the aorta, where pregnancy may be contraindicated[3]. Careful monitoring through pregnancy is required as there are altered physiological demands on the woman's body, including cardiovascular system, glucose, cholesterol and coagulation homeostasis.[1]

Classification of cardiac disease

Cardiac disease is classified according to functional status[7]:

1. Class I asymptomatic with normal activity.
2. Class II symptoms with normal activity.
3. Class III symptoms with less than normal activity.
4. Class IV symptoms with any physical activity or at rest.

Key points

1. An electrocardiogram (ECG) is required by all women who have chest pain in pregnancy. Additionally, if the pain is severe, a computed tomography (CT) or magnetic resonance imaging (MRI) scan of the chest and serum troponin levels may be ordered, as decided by the Obstetric Medical team.[8]
2. If the woman has congenital heart disease the risk of fetal congenital heart disease varies between 6 to 50%.[9]
3. Pregnant women with cardiac disease are at risk of serious morbidity such as heart failure, arrhythmias and stroke.
4. Because there are so many types of cardiac disease, often with very different implications, it is important that a risk assessment of any woman with a heart murmur or a history of any cardiac defect (e.g. Valvular Heart disease or Rheumatic Heart disease) should be carried out early in pregnancy by a consultant obstetrician, obstetric physician and / or cardiologist and anaesthetist. [8]
5. All patients with valvular heart disease, including those with Rheumatic Heart

Disease, are seen by a physician in early pregnancy and 28-32 weeks gestation as a minimum AND to ensure a plan regarding management in labour is documented on MR004.

6. Mitral valve stenosis is the most common lesion in Rheumatic Heart disease and the one that carries the highest risk. This may be a difficult clinical diagnosis and there should be a low threshold for maternal echocardiography.

Acute Cardiac Failure

If **acute cardiac failure** develops:

- Sit the woman up and lower her legs
- Administer oxygen[7]
- Intravenous frusemide 40mg (diuretics[7]) and/or intravenous morphine[7] 5mg to 10mg administered slowly
- Consult the physician.

Except in an emergency, digoxin is to be commenced by the obstetric physician and is rarely utilised.

Postpartum: Angiotensin Converting Enzyme (ACE) Inhibitors including enalapril and ramipril may be used, and are safe to use in breastfeeding mothers.[10]

Antenatal

1. **Pre-conception counselling**, education and assessment.[1, 3, 11, 12] Ideally women with known cardiac disease will have been assessed in the preconception period.[1, 8] Significant pulmonary hypertension in pregnancy is a high risk situation.[3] Preconception counselling should be undertaken with multidisciplinary specialists as to the risks posed by the pregnancy, including risk of maternal death. Exercise stress testing may be useful for assessing functional status. In the event of an unplanned pregnancy, early consultation is essential for assessment of maternal risk if the pregnancy continues and discussion of all options.[3]
2. **Referral** of high risk women to a tertiary maternity service (dependent on CVD complexity, risks and services available) and early pregnancy management.[3, 11]

   Referral sent to Obstetric Physician for women with:

   - A past history of cardiac disease
   - Symptoms or signs of cardiac disease
3. **Baseline evaluation** early pregnancy with physical examination.
   - An **ECG** shall be done on referral; other investigations should be left to the obstetric physician.
   - Risk stratification assists in determining appropriate level and timing of antenatal care.[10]
   - **Careful screening with a physical examination should be performed on women who come from developing countries[8] as the incidence of rheumatic heart disease is high in these areas**.[3]

4. **Fetal Ultrasound**:
    - First trimester ultrasounds, particularly around 13 weeks, have been shown to detect major congenital heart disease with 85% sensitivity and 99% specificity, thus providing earlier detection, consideration of options and management.[1] In the case of congenital heart disease of the mother, increased nuchal thickness of the fetus at the 12 week gestation scan is associated with fetal congenital cardiac disease (some studies suggest it may have a sensitivity of up to 90% for cardiac lesions).
    - Fetal echocardiography by a fetal cardiologist should be offered in the second trimester to women with structural cardiac disease.[8]
    - Careful tertiary fetal anatomy scanning at 18-22 weeks should be performed looking for cardiac abnormality.[1]
5. **Maternal Echocardiogram**: Echocardiogram at 13 weeks gestation and Physician review of echocardiogram result.
6. **Antenatal care**:
    - Prevent anaemia.
    - A woman with significant cardiac disease will require more frequent antenatal assessments. The suggested frequency is every 2-3 weeks after 20weeks[11], fortnightly after 28 weeks gestation and weekly after 36 weeks gestation.
    - At each assessment check blood pressure manually and check for signs and symptoms of cardiac failure (e.g. auscultate lungs, check jugular venous pressure, pulse rate and rhythm).[8]
    - Monitor for any atypical signs of ischaemia such as shortness of breath, dizziness or vomiting, with a low threshold for cardiac investigations (e.g. ECG, troponin levels, stress testing).[3]
    - Screen women with CHD for asymptomatic bacteriuria at the first antenatal appointment if not done previously in the pregnancy, due to the risk of pyelonephritis.[13]
7. **Planning for birth** should be undertaken by the Obstetric Medical team in consultation with the woman and other members of the multidisciplinary team which may include cardiologists, maternal fetal medicine specialists, anaesthetists and midwives.[5]
    - The obstetric management plan is to be discussed with the woman and documented in the medical record[10] on the MR 004 Obstetric Special Instruction Sheet. This should occur early in pregnancy[11] and again at 28-32 weeks.[8] Plans include analgesia[1], who should supervise the labour, planned birth mode, second stage management, postpartum haemorrhage (PPH) prevention, oxytocic, thromboprophylaxis, and length of postpartum stay.[8]
    - Vaginal birth usually carries the lowest risk of complications, although ideally long and difficult labours should be avoided.
    - Induction of labour may be appropriate for optimising anticoagulation, specialist medical staff presence, or deteriorating maternal cardiac function as decided by the Obstetric Medical team.[10] Induction may increase the chance

of caesarean birth.[10]

- Document specific instructions for intrapartum antibiotics (where applicable).[10]

8. **Encourage rest** in the third trimester (symptomatic women may need to finish work earlier[11]) and admit to hospital if there is a major risk of cardiac failure. Admit if chest infection or cardiac failure occurs. Women with significant cardiac disease require thromboprophylaxis when admitted to hospital for bed rest in pregnancy, and may require it in the postpartum period.

   For **venous thromboembolism (VTE)** information and **prophylaxis** see VTE in Cardiac Conditions (section below) and Clinical Guideline, O&M, Complications of Pregnancy: Venous Thrombosis and Embolism: Occurring in the Present Pregnancy

9. **Consult** the Obstetric Physician or Clinical Microbiologist on infective endocarditis (IE) prophylaxis. Generally, endocarditis antibiotic prophylaxis is not required for obstetric indications. However routine antibiotic prophylaxis is required for surgical prophylaxis for caesarean section, prevention of group B streptococcal disease, preterm prelabour rupture of membranes and prophylaxis for third & fourth degree tears. See specific guidelines for prophylaxis.
   Rationale: IE is a rare, but serious, condition in pregnancy. It has not been established if labour is a risk factor for IE, and UK (NICE)[8] and European (ESC)[1] guidelines summarise the evidence and state antibiotic prophylaxis for IE is not routinely recommended during any gynaecological or obstetric procedure, including childbirth. The Australian Therapeutic guidelines recommend targeting patients with high risk cardiac disease (table 1) who have an established genitourinary or intra-abdominal infection.[14]

Intrapartum

Labour is potentially the most dangerous period for many women as this is the period with the greatest increase in cardiac output.[5]

Consider two groups:

- **Major Risk** - those women with increased risk of cardiac failure - such as women with Grade III and IV cardiac disease, mitral stenosis and atrial fibrillation.
- **Minor Risk** - those women with relatively minimal disease - such as women with Barlow's Syndrome or a small atrial septal defect.

MANAGEMENT IN LABOUR

1. **Notify**:
   - In all cases - Obstetric Registrar.
   - In all major risk cases - Senior Obstetric Registrar, Obstetric Consultant, Obstetric Physician, Anaesthetic Registrar, Labour and Birth Suite Consultant Anaesthetist (the Obstetric Physician will indicate if he/she is to be notified).
2. In addition to routine labour **observations**:

- Relevant cardiac examination by senior registrar at least 4 hourly.
- **Strict fluid balance chart.**
- Half-hourly blood pressure, pulse and respirations. Women with a major cardiac risk must be nursed in a sitting or semi Fowler's position as much as possible. Auscultate lung fields if there is any change in respiratory status.
- Any deterioration in clinical status should be reported to the Senior Registrar.
- Consider the following:
  - Oxygen, invasive haemodynamic monitoring and pulse oximetry if indicated[5]
  - Chest X-Ray
  - Arterial Blood Gas
  - Nebuliser if indicated

  See clinical guideline O&G: Clinical Deterioration: Recognising and Responding to

3. **Antibiotic cover**: (see table 1below)

Use in all women with cardiac conditions described in table 1 who have an established genitourinary or intra-abdominal infection.[14]

Note: Routine labour antibiotic prophylaxis is not indicated for women with cardiac disease of low risk.[14] Additionally, continuation of antibiotic prophylaxis *postnatally* is not routinely recommended.

Table 1. From Therapeutic Guidelines Australia[14]:

High risk cardiac disease:
Prosthetic cardiac valve or prosthetic material used for cardiac valve repair
Previous infective endocarditis
Rheumatic heart disease in high risk patients
Congenital heart disease but only if: - unrepaired cyanotic defects, including palliative shunts and conduits - completely repaired defects with prosthetic material or devices, whether placed by surgery or catheter intervention, during the first 6 months after the procedure (after which the prosthetic material is likely to have been endothelialised) - repaired defects with residual defects at or adjacent to the site of a prosthetic patch or device (which inhibit endothelialisation)
Cardiac transplantation- consult the woman's cardiologist for specific recommendations

Therapeutic antibiotics

- Treat any suspected infection aggressively with parenteral antibiotics after blood and other appropriate cultures are taken.
- Contact the on-call Clinical Microbiologist for specific advice.

Women **NOT allergic** to beta-lactam antibiotics (e.g. penicillin or cephalosporin antibiotics):	
Amoxicillin	2 grams intravenously (IV).[14]

Women **hypersensitive / allergic to beta-lactams** (e.g. penicillin or cephalosporin antibiotics):	
Vancomycin	15mg/kg IV[14] up to 1.5g over 2 hours (recommended rate 10mg/minute [14])

Note: Dose adjustment may be required in patients with renal impairment, please contact a pharmacist or on call microbiologist for advice.

Prophylactic antibiotics

Women having an Elective / Non-elective **Caesarean Birth**
Initial: Antibiotic prophylaxis at the time of caesarean in accordance with Clinical Guideline (O&G): Infections (Obstetric & Gynaecological): Antibiotic Treatment of: Caesarean section: Antibiotic prophylaxis for i.e. no supplementary IE prophylaxis required for Caesarean section.

4. **Epidural** analgesia may be used for obstetric indications. For high-risk women managing their pain well will decrease their cardiac workload during labour.[1, 12] The Anaesthetic Registrar must first discuss major risk cases with the Anaesthetic Consultant.[5]
5. Continuous electronic **fetal heart rate monitoring**.[1] See also Clinical Guideline (O&G): Fetal Heart Rate Monitoring- Intrapartum
6. Vaginal birth is preferred unless obstetric or specific cardiac condition requires caesarean birth.[8]
7. Shorten the **second stage** if there is major risk of cardiac failure or hypertension.
   - Intervention carries a risk of infection.
   - Avoid routine mid cavity forceps birth.
   - Assisting vaginal birth and limiting active maternal pushing may be necessary dependent on the woman's clinical situation to reduce additional load on the cardiovascular system.[10]
   - Pushing in the left lateral position, rather than supine, lessens cardiovascular changes.[1]

8. **Prevent PPH** (particularly if surgical intervention) which may lead to cardiovascular instability. [10]
    - **Do not** use ergometrine routinely (can cause acute hypertension).[10]
    - Use **oxytocin** by intravenous infusion in preference to oxytocin 10 units intramuscular or intravenous bolus (as bolus doses may cause hypotension).[1]
    - A suggested regime is **oxytocin 80 units in 500mL Hartmann's solution** by intravenous infusion at half the usual rate. Rapid infusion of oxytocin may cause hypotension and tachycardia so, if given intravenously as a bolus, should be given slowly.[5]
    - In caesarean, uterine compression sutures may be beneficial to control PPH from uterine atony.[8]

Postpartum

1. Manage high-risk cases in Adult Special Care Unit (ASCU) **postpartum**. Haemodynamics do not return to normal for several days. Monitoring in ASCU should be continued until the maximum risk period has passed. [10] This will depend on the nature of the cardiac disease.[5]
2. For VTE prevention: Encourage anti-embolic stockings and early ambulation after birth.[1] Resumption of warfarin anticoagulation (where applicable) should be delayed by 2 days postpartum due to the increased risk of PPH, and close monitoring is required.[10]
3. The woman's choice to breastfeed should be promoted, where not medically contraindicated.[15] Educate the woman on breast care, adequate rest, the signs/ symptoms of mastitis and what to do if she develops these. The risk of bacteraemia from mastitis is low, but early antibiotic treatment should be commenced in high risk patients. Bottle feeding may be medically indicated in women with high risk cardiac condition and severe mastitis.[1]
4. Discuss safe and effective contraception options, future pregnancy guidance and importance of women with significant heart disease having regular cardiac reviews prior to any future pregnancy.[10]
5. Postnatal multidisciplinary follow up assessment at 6 weeks (and at 6 months if there are continued concerns), with the woman then returning to her routine cardiac outpatient care.[10]

Peripartum cardiomyopathy

Peripartum cardiomyopathy is a cardiac condition that develops in the absence of pre-existing heart disease or identifiable cause.[16] It can cause serious complications and maternal mortality,[1, 4] and should be considered in women who present with shortness of breath/ dyspnoea/ orthopnoea (particularly when supine or at night) usually in the third trimester or up to 6 months after birth.[8, 16] Other symptoms include tachypnoea, tachycardia[10], palpitations, peripheral oedema (pitting), excessive third trimester weight gain, chest pain, cough, and frequent night

urination.[16] Risks include multiparity, ethnicity, smoking, diabetes, hypertension or pre-eclampsia, and advanced or teen maternal age.[3] A chest x-ray, echocardiogram and ECG should be considered by the obstetric medical team.[3, 8]

VTE: Cardiac conditions (in pregnancy & puerperium)

Aim

- To guide appropriate anticoagulation of the pregnant woman with a cardiac condition.

Key points

1. Women with cardiac disease shall be managed by a multidisciplinary team[3, 8] consisting of:
    - An obstetric physician or a cardiologist with expertise in the management of pregnant women,
    - An obstetrician or fetal medicine specialist,
    - An obstetric anaesthetist,
    - A neonatal paediatric registrar / consultant, and
    - A midwife
2. Optimal management of the pregnant patient with congenital and acquired heart disease includes accurate diagnosis and an appreciation of the haemodynamic consequences of pregnancy on the cardiac disorder, of the cardiac disorder on the pregnant woman and of the cardiac disorder and its treatment on the baby's development and well-being.[2]
3. Because of the increased risk of thrombosis associated with pregnancy, adequate anticoagulation therapy is important for women at risk of thromboembolic events such as those with mechanical heart valves,[17] atrial fibrillation, impaired ventricular function, or certain abnormal shunts.
4. The optimal form of anticoagulation therapy must be carefully considered for each patient and ideally, discussed before pregnancy in the context of pre conception counselling.[17, 18]
5. High risk women, such as those with first generation mechanical heart valves, have a significant risk of thromboembolic events and anticoagulation regimes are generally more aggressive.[19]
6. Unfractionated (UFH) or low molecular weight heparins (LMWH) are the choice during pregnancy, and warfarin or a suitable oral alternative is safe in the post-partum period. This choice varies dependent on the individual health, circumstances, and co-morbidities of the woman in collaboration with the physician and multidisciplinary team.[17] Warfarin is restricted to situations where heparin is unsuitable (e.g. some women with mechanical heart valves).[20]

    Warfarin, pregnancy category D,[21] is associated with a higher rate of fetal complications, including miscarriage, stillbirth, small for gestational age and congenital malformations.[18, 21] UHF, pregnancy category C,[22] is associated with

higher risk of thromboembolic events in pregnant women with mechanical heart valves. LMWH, pregnancy category C,[23] provides more consistent anticoagulation over 24 hour period, without crossing the placenta and may be preferred in pregnancy[18], however is associated with maternal complications in pregnant women with mechanical heart valves, including valve thrombosis, postpartum haemorrhage, and maternal death.[17]

7. When UFH is used, heparin induced thrombocytopenia needs consideration,[24] and the platelet count should be checked[22] every 6-8 weeks.
8. UFH may also cause osteopenia[24], and osteoporosis[22, 25]. Women receiving UFH for more than 2 weeks should also receive calcium and vitamin D,[25] with serum calcium checked every 6-8 weeks.
9. Women who require therapeutic anticoagulation before pregnancy also require it during pregnancy e.g. those with mechanical heart valves, atrial fibrillation or complex intracardiac shunts.[17] Women with impaired cardiac function are usually treated with prophylactic dose anticoagulation using low molecular weight heparin or UFH.
10. Low-dose aspirin (100-150 mg daily[18]) is a safe and possibly effective adjunct to LMWH in pregnant women with mechanical heart valves or an otherwise increased risk of intracardiac thrombosis.[18, 25] Aspirin is inadequate on its own as a thromboprophylactic in obstetric patients.[20]
11. Because of the increased risk of postpartum haemorrhage (PPH) in women with heart disease who are anticoagulated, the introduction or reintroduction of warfarin should be delayed until at least five days postpartum, (and longer in women at increased risk of PPH)[26] with INR checked on day 2. Meticulous monitoring of anticoagulation and prescription of anticoagulation medication is essential.
12. These women may require regional analgesia and or anaesthesia for labour and birth, therefore consultation with the anaesthetist is essential if complications related to the timing of anticoagulation are to be avoided.[27] Provide education and monitor for signs of neuraxial haematoma.[18]

Management

- Therapeutic anticoagulation with UFH or warfarin requires careful monitoring with APTT/INR[21] and should be supervised by the Obstetric Physician, and not by junior staff.
- Prophylactic/therapeutic doses of LMWH anticoagulation do not need routine blood monitoring. However, some women using LMWH, will require doses to be carefully monitored, guided by anti-Xa levels.[3]
- The choice of which regimen to use is complex, requiring a detailed discussion with the woman to individualise her management. This is ideally performed before pregnancy, but in the event of an unplanned pregnancy should be

resolved with urgency. Anticoagulation in pregnancy may take one of three forms as detailed below:

- UFH or LMWH in **therapeutic** doses in the first trimester changing to warfarin in mid pregnancy, then transferring to heparin[28] from approximately 36 weeks [29] until postpartum.
- UFH or LMWH in **therapeutic** doses throughout pregnancy.[28, 30] LMWH is safer, its pharmacodynamics more predictable, and more effective than UFH,[24] so the latter is only used close to birth, in late pregnancy.
- UFH or LMWH in **prophylactic** dosage throughout pregnancy.

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Related WNHS policies, procedures and guidelines

KEMH Clinical Guidelines:

- Obstetrics & Gynaecology (Complications of Pregnancy): Venous Thrombosis and Embolism Occurring in the Present Pregnancy
- O&G: Clinical Deterioration: Recognising and Responding to
- O&G: Fetal Heart Rate Monitoring: Intrapartum
- O&G: Infections (Obstetric & Gynaecological): Antibiotic Treatment of: Caesarean section: Antibiotic prophylaxis for
- Pharmacy: A-Z: Amoxycillin; Enoxoparin; Heparin; Vancomycin; Warfarin

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