Cardiac disease in Pregnancy

Classification:	Guideline
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Authors Division:	Maternity
Departments/Group this Document applies to:	Obstetrics and Gynaecology

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Guideline to be followed by (target staff): This guideline applies to all women with cardiac problems in pregnancy and the appropriate management procedures to deal with such situations.

To be read in conjunction with the following documents:

- Postpartum haemorrhage guideline

Are there any eCARE implications? No

CQC Fundamental standards:

Regulation 9 – person centered care
Regulation 10 – dignity and respect
Regulation 11 – Need for consent
Regulation 12 – Safe care and treatment
Regulation 13 – Safeguarding service users from abuse and improper treatment
Regulation 14 – Meeting nutritional and hydration needs
Regulation 15 – Premises and equipment
Regulation 16 – Receiving and acting on complaints
Regulation 17 – Good governance
Regulation 18 – Staffing
Regulation 19 – Fit and proper

Disclaimer

Since every patient's history is different, and even the most exhaustive sources of information cannot cover every possible eventuality, you should be aware that all information is provided in this document on the basis that the healthcare professionals responsible for patient care will retain full and sole

responsibility for decisions relating to patient care; the document is intended to supplement, not substitute for, the expertise and judgment of physicians, pharmacists or other healthcare professionals and should not be taken as an indication of suitability of a particular treatment for a particular individual.
The ultimate responsibility for the use of the guideline, dosage of drugs and correct following of instructions as well as the interpretation of the published material **lies solely with you** as the medical practitioner.

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Guideline Statement

Cardiac disease continues to be the leading cause of indirect maternal mortality and the leading overall cause of maternal mortality in the UK since the 2000–02 triennium. At the last report, 1 in 50,000 women died to due to a cardiac cause during and up to one year after pregnancy. Although there was a small decrease in mortality in the latest report, this was not statistically significant (MBRRACE 2021). Deaths from cardiac disease have been attributed to increasing maternal age, increasing levels of obesity, smoking, diabetes and more precise recognition of cardiac diseases by pathologists at autopsy.

Some degree of substandard care was present in over half the cases investigated by MMBRACE. Continuing to have a low threshold for investigation and having a multi-disciplinary approach to management can help us improve the care we provide for these women.

All women presenting with cardiac symptoms including shortness of breath, chest pain or palpitations should have a thorough history, including risk factors for cardiac disease and physical examination together with a MEOWS score. Red flag signals include chest pain requiring opioids; persistent sinus tachycardia; syncope during exertion; all should have consideration of a cardiac cause and a diagnosis made. Senior clinician and a medical review should be sought when concerns arise. Prompt investigation including ECG, chest X-ray, ABG, echocardiography, CT should not be prevented by pregnancy.

Executive Summary

Cardiac disease is the most common indirect cause of maternal death in the United Kingdom. Neonatal morbidity and mortality from fetal growth restriction, prematurity and pre-eclampsia are markedly increased in women with cardiac disease. Some women will embark on pregnancy with no previous knowledge of undiagnosed cardiac disease, therefore women presenting with cardiac symptoms, such as breathlessness, palpitations and chest pain should be approached with a high degree of suspicion and clinicians should have a low threshold to investigate.

Women with pre-existing or congenital heart disease should ideally have a planned pregnancy managed by a multidisciplinary team which includes Obstetricians, Cardiologists, Anaesthetists, Neonatologists and Midwives. Pre-pregnancy counselling should be individually tailored and concerns for pregnancy and the neonate discussed. All physicians should be able to offer adequate contraception.

In pregnancy, stenotic valves are associated with a higher risk than regurgitant valves, as pregnancy requires a significant increase in cardiac output. This may be limited if women have significant valve stenosis. Pregnant women with mechanical prosthetic valves are at very high-risk of thrombosis during pregnancy and need careful monitoring if using low molecular weight heparin (anti Xa levels) or warfarin (INR).

Ischaemic heart disease including myocardial infarction in pregnancy is also increasing and is a significant cause of maternal death. If acute coronary syndrome is suspected in a pregnant woman, she should be investigated, managed and treated in the same way as if the woman were not pregnant. No investigation or treatment should be withheld due to pregnancy.

Early referral to cardiology and obstetric services for multidisciplinary care throughout the pregnancy is important. All patients should have a clearly documented individualised plan of care for birth and the immediate postpartum period.

1.0 Roles and Responsibilities:

- Obstetricians – decision making, discussion, planning care
- Cardiologists – responsible for detailed individualised management plan
- Midwives, Nurses and Student Midwives – ante-, intra- and postpartum care

2.0 Implementation and dissemination of document

This guideline is available on the Trust intranet and has followed the full guideline review process prior to publication.

3.0 Processes and procedures

3.1 Common cardiac symptoms in pregnancy (chest pain, shortness of breath and sinus tachycardia)

3.1.1 Dyspnoea or "air hunger" is a common symptom in pregnancy and will often start in early pregnancy. This is secondary to an increase in minute ventilation due to increased tidal volume. It is particularly noticeable to women when talking or sitting at rest. Respiratory rate and Peak expiratory flow rate, however should NOT change and therefore is a useful sign of underlying pathology. A mild respiratory alkalosis is normal in pregnancy due to increased exhalation of C02, therefore an ABG in a woman with asthma needs to be carefully inspected due to potential CO2 retention if the pH is normal. Any women presenting with raised respiratory rate, sudden onset shortness of breath or orthopnoea should have a full investigations for potential respiratory, cardiac or metabolic cause if there is no other diagnosis, eg pneumonia.

3.1.2 Chest pain can occur in a number of benign conditions, however ischaemic chest pain presents the same during pregnancy as outside of pregnancy. Any woman presenting with chest pain should be investigated and treated for ischaemia (angina / myocardial infarction).

Aortic dissection is also a rare, but potentially fatal cause of severe chest pain, which needs immediate management. This condition often presents with severe tearing chest pain through to the back and often will require opioid analgesia. These women need senior input and MDT approach and quick access to CT imaging for the aorta. Uncontrolled hypertension can preceed dissection and occur with this condition. BP should be measured in both arms, a difference of >20mmHg can indicate a proximal (type A) dissection, though the *absence* of a difference does not exclude a dissection. Key to management is prompt systolic blood pressure control with IV labetolol (aim SBP < 120 mmHg on the right arm measurement).

3.1.3 Palpitations are also a common symptom in pregnancy, often due to a sinus tachycardia (up to 115 bpm) which may be considered normal in pregnancy for some women. During pregnancy there is a rise in the resting heart rate by approximately 10-20 bpm. Green et al (2020) demonstrated that there is a wide range of normal resting heart rates, although most will range from 70 – 115 bpm. There should be a low threshold for organizing an ECG and considering other diagnoses, after considering other secondary causes including sepsis, concealed haemorrhage, hyperthyroidism and pulmonary emboli.

An ECG or 24 hour tape may also identify benign ventricular ectopics which may not need treatment in pregnancy, as well as an arrhythmia (either narrow or broad complex tachycardia).

Further investigation with an echocardiogram to look for structural heart abnormalities, and review for potential treatment, including electrical cardioversion, should be considered in pregnancy .

3.1.4 Red flag symptoms

- *Persistent sinus tachycardia* should be considered a red flag (MBRRACE) & needs investigation (ECG, 24 tape and echo for structural abnormalities)

- Any woman with *chest pain severe enough to require morphine* need investigation (consider CXR, ABG, ECG, troponin, echo, CT aorta)

- Any woman presenting with potential symptoms of cardiac disease should have a full history and examination, together with a MEOWS score. There needs to be consideration of other potential causes other than cardiac disease, namely respiratory or metabolic causes; see appendix 1
  Differential diagnosis of breathlessness and chest pain in pregnancy.

Symptoms which should arouse suspicion of significant disease

- Sudden onset shortness of breath (consider PE, pneumonia)
- Shortness of breath associated with chest pain, dizziness/fainting, sweating (consider significant arrhythmia)
- Presence of orthopnoea or paroxysmal nocturnal dyspnoea (consider Cardiomyopathy, pulm oedema)
- Central severe chest pain (consider MI or aortic dissection)
- Pleuritic chest pain (consider pneumonia, PE, pneumothorax)

Through the history and examination risk factors should also be considered:

- Increased maternal age (> 40yr)
- Smoker
- Obesity
- Diabetes (pre-existing)
- Hypertension, or pre-eclampsia
- Multiple pregnancy
- Recent surgery or immobilization
- Medical history (IBD, sickle cell, thrombophilia for PE; valve disease)
- Known connective tissue disease (Marfans, Loeys-Dietz syndrome)

Any woman presenting with severe chest pain or significant breathlessness should have a MEOWS score and be reviewed in line with the RAG triage system. Senior review including consultant obstetrician should be sought quickly and review by medical team should be prompt when appropriate.

3.2 Management of women with known Cardiac Disease

Women with known cardiac disease (congenital heart disease or acquired – rheumatic valve conditions) should be encouraged to have pre-pregnancy counselling with multidisciplinary input (Obstetrician, Anaesthetist and Cardiologist) and embark on a planned pregnancy. Adequate contraception should be enquired and prescribed if pregnancy is not desired, usually a Long acting progesterone based contraception eg progesterone implant (Nexplanon) or intra-uterine system (Mirena) are most appropriate.
During pregnancy, these women should be seen in the Maternal Medicine clinic and with cardiology input and review as needed. Specific birth plans need to be discussed antenatally and available in eCare for labour and the puerperium.

3.2.1 Preconception

- Women need to be informed of their potential higher risk of morbidity and potential mortality during pregnancy, depending on the nature of their condition eg congenital abnormality and whether this has been surgically corrected. This information should be individually tailored.

- Reliable contraception (including use of LARCs – implant, IUCD) should be discussed from the age of 12 to ensure avoidance of unplanned pregnancy.

- The importance of planning pregnancy needs re-iterating, ensuring the patient understands implications for themselves (potentially of cardiac events irreversibly reducing their functional capacity for physical activity and potential risk of mortality) and their baby (growth restriction, prematurity) depending their particular cardiac condition. This needs to cover stopping any medications not compatible with pregnancy (eg ACE inhibitors) either prior to pregnancy or once they have a positive pregnancy test, advocating healthy lifestyle with normal BMI and stopping smoking.

- Discussion should provide overview of any planned of pregnancy with potential need for fetal echocardiogram (if congenital abnormality), need for regular antenatal clinics with review of BP, pulse and oxygen saturations, regular growth ultrasounds and need for adjustments to labour.

- Assessment of issues arising in pregnancy can be helped by assessing the womans NYHA classification (assessing function / day to day limitations on activities) and considering the WHO classification system (conditions ass with increasing morbidity and mortality in pregnancy. Appendix 2 *NYHA and WHO pregnancy risk classification*.

3.2.2 Antepartum management

- Early referral for any woman not seen pre-conceptually to a Maternal Medicine clinic

- Full history of nature of cardiac condition, cardiovascular examination (documenting pulse – rate and rhythm, blood pressure, O2 saturations) and early investigations (ECG, Echo, CXR) organized, together with Cardiology review as needed

- Cardiovascular assessment (BP, pulse, oxygen sats) as well as auscultation of heart and lungs should be carried out at regular intervals in antenatal clinic.

- All women with personal history of structural congenital heart disease (whether surgically corrected or not) should be offered a **fetal echocardiogram** with a Fetal Medicine specialist around 22-24 weeks after anomaly scan.

- A specific birth plan should be discussed with MDT input (obstetrician, cardiologist and anaesthetist) and written on eCare. This describes potential adjustments for birth (need for early epidural, fluid balance, adjustments to oxytocin, elective assisted birth, need for Caesarean, drugs for third stage and PPH).

- The plan should also include how long the patient should remain on labour ward /post natal ward (due to the significant changes in the cardiovascular system in the first 24 – 48 hours post birth) and need for obstetric and cardiology review. VTE prophylaxis clearly stated.

- All patients with an active cardiac issue (eg cardiomyopathy with pulmonary oedema, significant arrhythmia) should be managed on a CARDIOLOGY ward and liaise with obstetric team.

- Women presenting unexpectedly with cardiac disease in pregnancy should be seen by the consultant obstetrician, consultant Anaesthetist on call and a cardiologist. A plan of ongoing care should then be formulated.

3.2.3 Management of women with cardiac disease during delivery

A detailed birth plan should be available for all women with known cardiac disease. Should a woman present in labour without a birth plan or there is suspicion of an undiagnosed cardiac condition, seek immediate review by consultant obstetrician, consultant Anaesthetist on call and a cardiologist. A plan of ongoing care should then be formulated.

General care on admission

- Avoid caval compression, by ensuring patient mobilized or lies in left lateral or use a Wedge.

- Consultant Obstetrician / Senior Registrar and anaesthetist to review on admission and with any changes in clinical condition. *Should there be significant deterioration with potential cardiac cause, low threshold for asking for cardiology review on Labour Ward*.

- Baseline examination (BP, pulse, respiratory rate, auscultate heart and lungs).

- Insert IV line (FBC, U+E, Group and Save, consider troponin and BNP)

- Continuous pulse oximetry, BP and pulse at least hourly record on MEOWS chart.

- Meticulous fluid balance is important - accurate input/ output recordings.

- Prostin / propess / balloon induction can all be used safely
- Plan for stopping anti-coagulation will be documented on the birth plan. Regional anaesthesia can be given 12 hours after a prophylactic dose or 24hours after a therapeutic dose. Rarely unfractioned heparin infusion is needed.
- Care is needed for those having induction of labour, so that heparin is not withheld for a prolonged induction process.
- Oxytocin can be given for usual obstetric indication unless indicated in care plan.
- Epidural is usually possible if the woman wishes but there should be discussion with a senior Anesthetist due to the potential drop in blood pressure. Beware of vasodilatation in fixed output states (e.g. mitral stenosis).
- If an individual woman is to have antibiotic prophylaxis, this will be indicated in the birth plan. If there is no specific plan, antibiotics are not necessary. (See section below on infective endocarditis)
- Consider CVP line +/- intra-arterial monitoring if a women with know cardiac condition deteriorates or has severe sepsis, pre-eclampsia or MOH (may need admission to DoCC).
- Maintain oxygen saturation in the range 94-98% with supplementary oxygen, if needed.
- Continuous CTG in labour.
- If a caesarean section is required liaise with a senior anaesthetist, consultant obstetrician.

Second stage of labour

- Most women can have normal management of the second stage, any deviation will be documented.
- If an unbooked woman with dilated aortic root, severe mitral or aortic stenosis, presents in labour urgently discuss management of the second stage with Maternal Medicine Consultant and Consultant Cardiologist.
- If prolonged pushing is contraindicated, elective assisted birth can be offered after 2 hour passive second stage. Unless the fetal head is very low, forceps may be preferable to limit maternal effort.

Third stage of labour

If there is no birth plan and Oxytocin is needed, administer Oxytocin via infusion pump.

- *Give a bolus dose of 2 units oxytocin over 10 minutes IV*
- *In uterine atony give 40 units in 50mls normal saline over 4hrs*.

- In PPH, drugs of choice and order of use: Oxytocin Infusion; Misoprostol Rectally, Carboprost and Ergometrine if life threatening.

- Avoid Ergometrine (including Syntometrine) in aortopathies e.g. Marfans; aneurysm, coronary artery disease (CAD) or hypertension or pre-eclampsia. Ergometrine can cause severe hypertension hence risk of stroke, coronary vasospasm and MI; and precipitate pulmonary oedema.

- Caution with Carboprost (PGF2α - Hemabate) DO NOT USE in single ventricle, shunt; elevated PA pressures; asthmatic patients.

Pulmonary oedema most commonly occurs soon after birth.

- Inform Consultant and Anaesthetist if PPH (postpartum haemorrhage) occurs as meticulous fluid balance will be required to replace lost volume without over-loading the woman. CVP or intra-arterial monitoring may need to be considered.

- Low threshold for IV frusemide 40 mg if clinically in pulmonary oedema.

- Women should remain on Labour Ward or Department of Critical Care (DoCC) (as appropriate) for a minimum of 24 hours after birth as documented on birth plan.

- 30 mins observations on the MEOWS chart for 12 hours, then reducing to hourly.

Postpartum

- Breastfeeding can be encouraged for most women

- If there have been cardiac complications during labour, women MUST have a cardiac review before they leave Labour Ward / before discharge home.

- They should also have documented schedule of cardiac follow up in eCare and in the discharge letter.

- They should be given advice about contraception and offered LARCs (implant / IUCD or POP are appropriate can can be prescribed/inserted on the postnatal ward)

- Risk assessment for VTE and start appropriate thromboprophylaxis

3.3 Antibiotics for Infective Endocarditis prophylaxis (IE) at birth

NICE guideline recommends that Antibiotic Prophylaxis is no longer offered routinely for birth, irrespective of the mode of birth.

3.3.1 Suspected infection in women at risk of IE

Any episodes of infection in people at risk of infective endocarditis should be investigated with blood cultures (ideally 3 sets from different sites) and treated promptly to reduce the risk of endocarditis developing.

If a pregnant or postnatal woman at risk of infective endocarditis is receiving antimicrobial therapy for suspected infection such as chorioamnionitis or endometritis, the woman should receive an antibiotic that covers organisms that cause infective endocarditis.

Generally, Intravenous Co-amoxiclav or a combination of Cephalosporins and Metronidazole is appropriate for this purpose.

Liaise with consultant Cardiologist or Microbiologist if concerned particularly if the woman is at moderate / high risk for IE (eg previous IE, prosthetic heart valves, rheumatic heart disease) or complex congenital heart disease (e.g. Transposition of the great arteries, Fallot's Tetralogy)

3.4 Myocardial ischemia and ischaemic heart disease

- Use a high index of suspicious for myocardial ischaemia (angina/ myocardial infarction) in any woman presenting with chest pain associated with breathlessness, feeling faint, syncope, sweating and/or nausea.
- Document any increased risk factors for cardiac disease.
- The possibility of aortic dissection should also be considered with tearing intra-scapula pain, request urgent CT.
- All women with chest pain in pregnancy should have an ECG (or serial ECGs) and troponin I levels, the same as the non pregnant population (liaise with anaesthetist/cardiologist if concerns with interpretation of ECG)
- Refer to Acute Medicine or Cardiology for individualised management plan.

3.4.1 Management of Ischemic Heart Disease in pregnancy

- Treatment of myocardial infarction during pregnancy is predominantly the same as that outside pregnancy, including beta-blockers and nitrates. It is advisable to use low molecular weight heparin instead of fondaparinux, however this can be discussed as a case by case basis.
- Coronary angiography is safe in pregnancy and percutaneous catheter intervention is used as the first-line treatment.
- Thrombolysis can cause bleeding from the placental site but is still indicated in the management of acute myocardial infarction if percutaneous coronary intervention is not available; consider on a risk/benefit basis.
- In acute management of myocardial infarction load with 300mg of Aspirin should be given. This should be followed up with 75mg aspirin once a day. Any women with a history of IHD can continue with aspirin 75 mg as primary and secondary prevention.

- Clopidogrel appears to be safe and is being used increasingly now. This should be given as loading of 300mg stat followed by 75mg once a day. This medication needs to be stopped at least 7 days before regional anaesthetic.

- Statins should not be started in pregnant women and should be discontinued in pregnancy as are associated with central nervous system and limb defects in the fetus.

3.5 Cardiac arrhythmias

- Pregnancy increases the incidence of cardiac arrhythmia. This is the result of hormonal changes, alterations in autonomic tone, increased haemodynamic demands and mild hypokalemia. The most common arrhythmia precipitated is supraventricular tachycardia (SVT), although most palpitations relate to sinus tachycardia or ectopic beats.

- Untreated persistent arrhythmia can cause thromboembolism and have potentially detrimental effect on the fetus. Treatment with cardioversion (electrical or medical) allowing sinus rhythm or ventricular rate control is important.

3.5.1 Investigations for patients presenting with palpitations

After a full history and cardiovascular examination the following investigations can be considered. Also ask about recent viral infection which can predispose to myocarditis leading to arrhythmia.

- 12-lead ECG (ideally when an episode occurs and repeated 15-30 minutes later)
- Thyroid function tests (hyperthyroidism can precipate arrhythmia)
- Haemoglobin (treat any anaemia)
- 24-hour / 48 hour / 7 day ECG dependent history - clarify frequency of palpitations to ensure correct investigation
- Echocardiography to look for structural abnormalities within the heart
- Cardiology review for newly diagnosed arrhythmias to discuss treatment

3.5.2 Management of arrhythmias

- Management of SVT is the same as outside pregnancy. Start with vagotonic manoeuvres. If this fails, intravenous Adenosine can be used safely with cardiac monitoring. Second-line treatments include Beta-Blockers, Digoxin and Calcium Channel Blockers.

- Amiodarone is contraindicated, as it is associated with fetal hypothyroidism, growth restriction and prematurity.

- Beta-blockers (e.g. bisoprolol) can be used prophylactically.

- Electrical cardioversion is safe in pregnancy and necessary in all women with tachyarrhythmias who are haemodynamically unstable. This would need fetal monitoring and a Consultant anaesthetist for airway management (risk of aspiration)

- Flecainide is the drug of choice for fetal tachyarrthymias. Safe in second and third trimester.

- Women with pacemakers should be reviewed during pregnancy by a cardiologist.

- Women with intracardiac defibrillators need a careful plan for labour considering ECG monitoring and plan for ICD (either covering device with battery to deactivate for Caesarean or magnet in the room for vaginal birth).

- Women with inherited arrhythmias (e.g. long QT syndrome should be offered a consultation with a clinical geneticist to discuss follow-up and testing of the baby at an appropriate age).

3.6 Cardiomyopathy

Peripartum cardiomyopathy can occur de novo, however other diagnoses such as hypertrophic cardiomyopathy, as well as acquired conditions ischaemic or dilated cardiomyopathy may need to be considered. All can present within pregnancy with left ventricular failure and pulmonary oedema, which can develop quickly in undiagnosed women leading to cardiogenic shock.

3.6.1 Peripartum cardiomyopathy

Peripartum cardiomyopathy typically presents in a woman either when she approaches term or in the first few weeks postpartum; although it can occur up to five months postpartum. Peripartum cardiomyopathy is a diagnosis of exclusion. The aetiology is unknown. As 25% of affected women will be hypertensive, it can be confused with pre-eclampsia.

Symptoms of cardiomyopathy:

- Shortness of breath
- Reduced exercise tolerance
- Palpitations
- Orthpnoea / paroxysmal nocturnal dyspnoea
- Symptoms related to peripheral/pulmonary or cerebral emboli

Signs:

- Tachycardia (sinus or arrhythmia)
- Pulmonary oedema with raised JVP, frothy sputum
- Hypotension or hypertension
- systemic embolism occurs in 25-40% of women and ischaemic stroke in 5%.

Diagnosis requires BNP, Troponin, Chest CXR, ECG, ABG and urgent echo and cardiology review

Echocardiography features are:

- Left ventricular ejection fraction (LVEF) <45%
- Fractional shortening <30%
- Global dilatation of all four chambers
- Markedly reduced left ventricular function

Management:

- Consider need for delivery if patient antenatal after MDT discussion
- Adequate treatment with Beta-Blockers, Diuretics, Hydralazine and Digoxin reduces mortality rates and improve overall prognosis. ACE inhibitors replace hydralazine post-partum.
- Thromboprophylaxis
- Cardiac transplantation is the only choice in severe cases unresponsive to heart failure therapy.

Prognosis and recurrence:

- Maternal mortality rate is reported to be around 2-12.6%.
- About 50% women make a spontaneous and full recovery, however have up to 25% of recurrence in future pregnancy.
- In women in whom left ventricular size or function does not return to normal, there is significant risk of recurrence and worsening heart failure (50%) and death (25%) in subsequent pregnancies.

3.7 Congenital heart disease:

In the UK, congenital heart disease is now more common in pregnant women than acquired heart disease. Many women who were diagnosed as a child and potentially had corrective surgery are surviving into adulthood and considering pregnancy. The prevalence of congenital heart disease is still relatively low 0.8%. Women with congenital heart conditions generally tolerate pregnancy well, however it is dependent on the type of lesion, whether this has been corrected and the overall function of their heart. An echocardiogram pre-pregnancy is ideal, or early in pregnancy with cardiology and Maternal medicine input.

Detailed pre-pregnancy planning is indicated for woman with ongoing cardiac complications particularly if the woman has pulmonary hypertension. Tailored discussion can be aided by using the mWHO classification of maternal risk.

Most patients with repaired valve anomalies with no cardiac symptoms, or limitation to daily activity have a good outcome in pregnancy.

Those who need careful MDT management include those with pulmonary hypertension, Eisermengers syndrome or tetralogy of Fallot or any cyanotic heart disease. These women should have pre-pregnancy planning and Maternal medicine/MDT input if they embark on pregnancy. Certain conditions may be considered as a contra-indication to pregnancy (eg mWHO Class IV – see appendix 2).

Those women with aortic disease, including Marfans, Loeys-Dietz and Turners syndrome are at higher risk depending on the size of their aortic root. They need regular echocardiography during pregnancy at they remain at higher risk of artic dissection, even at normal size, and need careful blood pressure monitoring and treatment.

3.8 Rheumatic heart disease

Up to 25% of women giving birth in the UK were born abroad, some from developing countries with poor healthcare standards. Some of these women may have undiagnosed rheumatic heart disease causing valvular disease.

For any woman presenting with cardiac sounding symptoms should have a careful assessment of symptoms together with a full cardiovascular examination. It is the mitral valve followed by the aortic valve which are most commonly damaged, and initially become stenosed. The significant stenosis of the mitral valve can limit the increase in cardiac output required for pregnancy and often symptoms can present early in pregnancy but may be dismissed as physiological. Use a low index of suspicious for mitral stenosis in woman with a history of rheumatic fever in childhood or women with little access to healthcare prior to coming to the UK. There should be a low threshold for organizing an echocardiogram for these women and subsequently have an MDT approach through a maternal medicine clinic.

Heart failure is most common when the stenotic mitral valve area is < 1.5cm^2 . Consider bisoprolol +/- digoxin therapy with anticoagulation if atrial fibrillation is present.

3.9 Neonatal outcome

- The rate of neonatal complications is significantly increased in all women with heart disease.
- They include growth restriction, prematurity (both iatrogenic and spontaneous) which can lead to respiratory distress syndrome, intraventricular hemorrhage and death.
- Maternal predictors of adverse neonatal outcome are more severe cardiac limitation, multiple gestation, smoking and need for anticoagulation.
- Any children of a mother with congenital heart disease are also at increased risk of inheriting a congenital heart disease. These woman are offered extra fetal echocardiography and in some cases can have a clinical genetist appointment regarding other inherited cardiac conditions.
- Marfan syndrome is an autosomal dominant condition and, therefore, has a 50% recurrence rate in offspring.

3.10 Cardiac indications for caesarean section:

Birth plan will be made for each woman with cardiac disease in conjunction with an MDT approach from Maternal medicine Obstetricians, Cardiologists and Obstetric Anaesthetists.

It will be considered for women with aortic dissection, aortic root > 4cm and women with pulmonary hypertension.

4.0 Statement of evidence/references

Statement of evidence:

References:

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Surveillance of maternal deaths in the UK 2012–14 and lessons learned to inform maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2009–14.

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External weblink references:

5.0 Governance

5.1 Document review history

Version number	Review date	Reviewed by	Changes made
6	11/2021	Anja Johansen-Bibby, A Ram Mohan, E Khan	Complete review

5.2 Consultation History

Stakeholders Name/Board	Area of Expertise	Date Sent	Date Received	Comments	Endorsed Yes/No
Harry Boardman	Cardiology Consultant	01/09/2021	15/09/2021	Yes	Yes
Zainab Alani	Pharmacist	17/11/2021	17/11/2021	No	
Women's Digital review group	Maternity	16/09/2021	30/09/2021	Yes	Yes
Maternity guideline meeting group	Maternity	27/10/2021	27/10/2021		
Maternity CIG	Women and children	03/11/2021	03/11/2021	No	
Trust Documentation committee	Trust Approval Committee	16/11/2021	17/11/21	Yes	Yes

5.3 Audit and monitoring

Audit/Monitoring Criteria	Tool	Audit Lead	Frequency of Audit	Responsible Committee/Board
• Intrapartum management of patients with structural cardiac defects • The use of Uterotonics in cardiac patients	Statistics IRIs and statements of concern	Obstetrician	Every three years	Labour Ward Forum

• Management of patients with cardiac disease in pregnancy Management of the 3rd stage of labour in heart disease in pregnancy				

5.4 Equality Impact Assessment

As part of its development, this Guideline and its impact on equality has been reviewed. The purpose of the assessment is to minimise and if possible remove any disproportionate impact on the grounds of race, gender, disability, age, sexual orientation, religion or belief, pregnancy and maternity, gender reassignment or marriage and civil partnership. No detriment was identified. Equality Impact assessments will show any future actions required to overcome any identified barriers or discriminatory practice.

Equality Impact Assessment			
Division	Women and Children	Department	Maternity
Person completing the EqIA	Erica Puri	Contact No.	Ex 87153
Others involved:	Anja Johansen-Bibby, A Ram Mohan, E Khan	Date of assessment:	17/01/22
Existing policy/service	Yes	New policy/service	No

Will patients, carers, the public or staff be affected by the policy/service?	Yes
If staff, how many/which groups will be affected?	*All maternity staff*

Protected characteristic	Any impact?	Comments
Age	NO	Positive impact as the policy aims to recognise diversity, promote inclusion and fair treatment for patients and staff
Disability	NO	
Gender reassignment	NO	
Marriage and civil partnership	NO	
Pregnancy and maternity	NO	
Race	NO	
Religion or belief	NO	
Sex	NO	
Sexual orientation	NO	

What consultation method(s) have you carried out?
Emails and meetings.
How are the changes/amendments to the policies/services communicated?

Email and meetings.			
What future actions need to be taken to overcome any barriers or discrimination?			
What?	Who will lead this?	Date of completion	Resources needed
Review date of EqIA	11/2024		

Appendix 1: Differential diagnosis of breathlessness/ chest pain in pregnancy (not comprehensive)

Clinical condition	Sign/symptoms	Investigations	Treatment
Aortic dissection	Main symptom often tearing chest pain, with SOB. Hypertension	ECG, CXR, urgent CT aorta, bloods	IV labetolol – aim systolic <120mmHg. Cardiology/vascular team
Anaemia	Ass with lethergy	FBC	Iron supplements 200mg OD with folic acid 5mg OD
Asthma	Wheeze, nocturnal cough	PEFR CXR +/- ABG if severe	Inhalers / nebulisers/ steroids ? O2 on admission. Medical RV
Diabetic ketoacidosis	Kusmaul breathing with tachypnea. Ketotic smell	ABC, full bloods and glucose level	IV rehydration with potassium and sliding scale. Medical RV
Hyperventilation / anxiety	Ass with parsthesia of lips/ mouth and hands	ABC hypocapnia	Settles with reassurance
Angina, MI	Central crushing chest pain radiating to left arm/jaw	ECG, CXR, troponin and cardiac enzymes level	O2, aspirin, morphine, cardiology RV
Mitral stenosis (often rheumatic)	Orthopnoea, paroxysmal nocturnal dyspnoea, haemoptysis. Diastolic murmur, sinus tachycardia	ECG, echo, CXR	If in pulm oedema – for frusemide 40 mg Cardiology RV
Peripartum cardiomyopathy	Lethargy, SOB, orthopnoea. Third trimester – and postpartum.	ECG, ECHO, CXR may need ABG	O2, frusemide if pulm oedema present. Cardiology RV.
Pneumonia	Pleuritic chest pain ass with fever, cough, sputum production	WBC, CRP, CXR sputum culture	O2 if needed, antibiotics if bacterial, analgesia. Medical review if not improving
Pneumothorax	Sudden onset of acute pain with SOB	CXR, ABG	Medical review re thoracentesis or chest drain insertion
Pulmonary embolism	Sudden onset chest pain, with SOB, sinus tachycardia	ECG, pre and post exercise sats, ABG, CXR, V/Q or CTPA	O2, therapeutic LMWH, medical review if severe, consider echo
Pulmonary oedema	SOB with tachypnoea worse when lying flat, raised JVP, orthopnoea, PND, frothy sputum with cough	ECG, CXR, ABG, Echo, inc troponin and BNP	O2, frusemide, cardiology input

Appendix 2: NYHA CLASSIFICATION

Class	Description
I	No limitation of physical activity. No symptoms with ordinary exertion. Generally good prognosis during pregnancy
II	Slight limitation of physical activity. Ordinary activity causes symptoms Generally good prognosis during pregnancy
III	Marked limitation of physical activity. Less than ordinary activity causes symptoms. Asymptomatic at rest. Potential increased risk of cardiac events, increased morbidity (irreversible)
IV	Inability to carry out any physical activity without discomfort. Also, symptoms at rest Increased risk of cardiac events, increased morbidity (irreversible) and mortality

The 2018 European Guidelines for managing cardiovascular diseases during pregnancy uses the WHO classification of maternal risk.

	mWHO 1	mWHO II	mWHO II-III	mWHO III	mWHO IV
Diagnosis	Small/mild pulm stenosis Mitral valve prolapse Previously repaired simple lesions Isolated ectopic beats	Atrial / ventricular septal defects Repaired ToF Most arrhythmias Turners syndrome (without aortic dilatation)	Mild LV impairment (EF>45%) Hypertrophic cardiomyopathy Marfans without aortic dilatation Aorta <45mm in bicuspid valve AV septal defect repaired coarctation	Moderate LV impairment (EF30-45%) Previous peripartum CMO (without residual impairment) Fontan circulation Unrepaired cyanotic disease Moderate mitral stenosis Moderate aortic dilatation (>40mm) Ventricular tachycardia	Pulm art hypertension Severe LV dysfunction LVEF < 30% Previous peripartum cardiomyopathy with residual impairment of LV function. Severe mitral / aortic stenosis Marfans aortic >45mm Aortic dilatation > 50 mm with aortic disease / biscuspid valve
WHO pregnancy risk	No detectable increased risk in mortality. No or mild increase in morbidity	Small increased risk in mortality. Moderate increase in morbidity	Managed as WHO II or III depending on symptoms	Significant increased risk of maternal mortality or severe morbidity. Intensive specialist (cardiology and obstetrics needed)	PREGNANCY CONTRA-INDICATED Extremely high risk of maternal mortality, and severe morbidity.
Maternal cardiac avent rate	2.5-5%	5.5-10%	10-19%	19-27%	40-100%

Care in pregnancy	Manage in MKUH	Manage in MKUH	Input / transfer to Oxford	Oxford / specialist centre	Oxford / specialist centre

LV – left venticle
ToF – Tetralogy of Fallot
CMO – cardiomyopathy