Greater Manchester and Eastern Cheshire SCN

Cardiac Disease in Pregnancy Guideline

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Document Control

Ownership

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Contents

1. Introduction and Scope

Cardiac disease is the leading cause of maternal death (MBRRACE, 2020)

A woman may know she has cardiac disease before she becomes pregnant, or it may be diagnosed during pregnancy or in the postpartum period. This guideline relates to women with pre-existing, suspected or newly diagnosed heart disease and includes congenital, acquired and inherited cardiac disease.

2. Obstetric Cardiac Services within GMEC SCN

Saint Mary's, Oxford Road is the lead provider of maternity care for women with congenital heart disease within the North West England Congenital Heart Disease Network. It also provides a tertiary care service for women with acquired and inherited cardiac disease.

There is a Joint Obstetric Cardiology service at the following hospitals. St Mary's Hospital is the lead provider of maternity care for women with congenital heart disease within the North West England Congenital Heart Disease Network.

Hospital	Obstetrician	Cardiologist	Frequency
Wigan	Dr A Verma	Dr H Hamdan	Monthly 3rd Tues am
St Mary's Hospital*	Dr S Vause Dr A Roberts Dr S Bonner	Prof Clarke Prof Keavney Dr D Cullington	Weekly Tues am

*see Appendix 1 for contact details

3. Obstetric cardiac risk stratification

All women with cardiac disease should be risk stratified using the Modified World Health Organisation Classification of maternal cardiovascular risk (mWHO) (see *Appendix 2*). The adapted version in this appendix (includes conditions not mentioned in the mWHO guidance) provides a framework for appropriate location of care and delivery. However, it is important that each woman is assessed, and care individualised.

Women stratified as mWHO I should have most of their pregnancy care and delivery at their local hospital, with cardiac reviews in whichever centre they would usually attend for their cardiac care. If this is uncertain or there are concerns in the local hospital, they should be referred to the obstetric cardiology clinic for review or advice.

Women stratified as mWHO II may be referred to the obstetric cardiology clinic for advice as deemed appropriate by the local hospital. For uncomplicated cases, women may be referred back to the local hospital, after review for continuing care and delivery as per mWHO I.

Women stratified as mWHO II-III should be reviewed by the local obstetric cardiology clinic. An assessment will then be made about where care and delivery is most appropriately located. For some women, delivery may be appropriate in their local unit.

Women stratified as mWHO III and mWHO IV should have their care during pregnancy and their delivery managed at Saint Mary's in the Obstetric Cardiac Clinic, irrespective of where they usually attend for their cardiac care. This is to ensure that the team caring for the woman around the time of delivery is familiar with her obstetric and cardiac problems; to provide continuity of care for the woman; and to ensure appropriate co-location of facilities and clinicians. These are the women who are most likely to decompensate and require urgent intervention and/or preterm delivery. It is therefore important that the care of these women is not fragmented across more than one site.

Detailed advice about the management of individual cardiac conditions can be found within the European Society of Cardiology (ESC) guidelines 2018. However, antenatal monitoring is primarily aimed at detecting deteriorating ventricular function, arrhythmias, worsening valvular function or increasing risk of aortic dissection. To this end, an echocardiogram and an ECG should be performed at each obstetric cardiology clinic visit (unless deemed unnecessary), with other investigations being organised as clinically indicated.

Routine antenatal care will also be conducted in the Obstetric Cardiology clinic unless the woman has received this locally.

At each appointment women should be offered ongoing opportunities for information and education.

4. Pre-pregnancy Counselling and Support

Pre-conceptual appointments should be offered to:

- Any woman who is, or who should be, under regular cardiological review
- Any woman planning to undergo assisted reproduction who has significant risk factors for cardiac disease
- Any woman with a family history or genetic confirmation of an inherited cardiac condition (cardiomyopathy, aortopathy, channelopathy)

(MBRRACE-UK, 2019).

NB Members of the woman's family should not be used as interpreters during pre-conceptual consultations.

The pre-pregnancy consultation should include:

- Assessment and information gathering
- Previous cardiac history, obstetric history and co-morbidities
- Assessment of current functional status (history, echo, ECG and possibly other investigations such as Cardiopulmonary Exercise Testing (CPET), cardiac MRI to facilitate provision of information about pregnancy risks)

Optimisation

- Optimise condition – medical, surgical or other interventions
- Lifestyle modification, smoking cessation, folic acid and vitamin D supplementation.

Drugs

Determine which drugs can be continued in pregnancy and plans for changing any which cannot be used in pregnancy. Some may need to be stopped or changed prior to pregnancy and the woman reassessed after stopping them.

Refer to the ESC guidelines 2018 as referenced above for specific information on cardiovascular drugs and safety.

Information giving

- Give the woman information about the risks to her and the fetus (including morbidity and mortality)
- Discussion of risk of recurrence of cardiac condition in the fetus and the testing currently available
- Outline a plan of management of pregnancy and delivery
- Clear documentation of discussions/information given to the woman to facilitate her decision on whether to proceed or not with a pregnancy
- Discussion around any additional issues around assisted conception treatment where relevant eg. management of anticoagulation
- Information about appropriate contraception

- Information regarding access to contraception options, termination of pregnancy services and how to access care when pregnant.

5. Termination of Pregnancy

Rapid access to termination of pregnancy services should be facilitated if, for whatever reason, a woman opts for this. Multidisciplinary care will be necessary for some women around the time of termination of pregnancy. For women with severe forms of cardiac disease, it is important that the termination occurs in a NHS hospital setting, with the co-located cardiac facilities. The Whitworth Clinic, at Saint Mary's Hospital (Telephone 0161 276 6283) can provide this level of care.

Clinicians should recognise the difficulty in making these types of decisions and be supportive of a decision to abort in the context of significant maternal cardiac disease.

6. Miscarriage

The care of women who miscarry requires a multi-disciplinary approach, including the appropriate cardiologist, gynaecologist and anaesthetist (general and/or cardiac as appropriate). The multidisciplinary team should decide the best place and method for management of the woman having a miscarriage. The options for management of the miscarriage are surgical evacuation, medical management or Manual Vacuum Aspiration (MVA). These all have their own risks and benefits, particularly in the context of cardiac disease. Surgical evacuation requires an anaesthetic, but has a lower risk of retained products and the timing is more predictable.

Women having medical management of miscarriage need to be managed on the gynaecology ward, where access to senior staff is less predictable than in a theatre setting, if bleeding or vasovagal symptoms occur. Manual Vacuum Aspiration (MVA) performed in a theatre setting (but without an anaesthetic) may be a suitable procedure for some women (less than 9 weeks gestation).

7. Antenatal Care

Women who have been seen pre-conceptually may access care directly. Some women may make contact with the cardiology team, or the Cardiac Liaison Nurses who can also refer women directly to the Obstetric Cardiology Clinic.

Any woman who gives a history at booking of known or suspected heart disease (or aortic disease) should be referred as early as possible for review with an obstetrician to determine her level of risk, and whether onward referral is necessary.

Antenatal appointments for women with cardiac disease should provide care specifically for women with cardiac disease, in addition to the care provided routinely for healthy pregnant women. Table 2 below describes where care for women with cardiac disease differs from routine antenatal care.

All professionals must document their consultations in the woman's hand held maternity record as well as maintaining contemporaneous hospital records.

Table1: Specific antenatal care for women with cardiac disease

Appointment	Care for women with cardiac disease during pregnancy
First appointment	Take a full clinical assessment to establish the extent of cardiac-related disease Identify baseline investigations required Review risk factors and functional status Review medications for cardiac disease and its complications. Identify obstetric cardiac risk Offer information, advice and support Discuss option of termination with women with extremely high risk cardiac disease Refer as necessary to Obstetric Cardiology clinic
By 10-weeks	Confirm viability of pregnancy Discuss information, education and advice about how cardiac disease will affect the pregnancy, birth and early parenting (such as breastfeeding and initial care of the baby).
By 22-weeks	Offer fetal echo to women with structural congenital heart disease
Number and timing of further appointments will be dependent on the nature and severity of cardiac disease. Some appointments may be with the local multidisciplinary maternity team or community midwife.	Start regular tests of fetal-wellbeing for women with cardiac disease who are awaiting spontaneous labour, or offer caesarean section if indicated Refer all women with WHO II – IV cardiac disease to anaesthetist Involve other members of MDT as appropriate Offer information and advice about: • timing, mode and management of birth • analgesia and anaesthesia • fluid balance • medication • need for invasive maternal monitoring and postnatal management • management of the baby after birth • initiation of breastfeeding and the effect of medication on breastfeeding • contraception and follow-up postnatally

All women with confirmed cardiac disease will need referral to the obstetric anaesthetist at the unit in which their delivery is planned.

Women with inherited cardiac conditions should be referred to the genetics team as they may be offered prenatal diagnosis and the baby will need follow up.

Women with cardiac disease should be offered lifestyle advice and management as appropriate, including counselling/psychology support, dietetics and smoking cessation. Women who live far away from the hospital may need to be given the option of induction to reduce the need to travel a long distance whilst in labour.

High risk women (and some moderate risk women) will be discussed at the Obstetric Cardiology Multidisciplinary Team (MDT) at Saint Mary's (see Appendix 3).
For all moderate and high risk women, individual care plans for the pregnancy and delivery are formulated and documented on a standard proforma (see Appendix 3). This should be disseminated widely to all members of the multidisciplinary team, including those in her local hospital and a copy filed in the woman's hospital notes and hand held notes.

Pharmacological assessment
As with all women, the benefits of any drug given during pregnancy must outweigh the risks.

Drugs with significant risks for the fetus in pregnancy are:

- Warfarin – teratogenic and fetotoxic (intracranial haemorrhage)
- ACE inhibitors and ARBs– teratogenic and fetotoxic (renal impairment)
- Amiodarone – sustained use may cause fetal thyroid goitre
- Statins - may impair myelination and neurodevelopment (no conclusive data)
- Beta blockers – no teratogenic effect, possible slight reduction in birthweight (benefit usually outweighs risk)

All women with cardiac disease who are taking warfarin, ACE inhibitors, ARBs or amiodarone should be referred to the Obstetric Cardiology Clinic at St Mary's Hospital urgently, as soon as they present in pregnancy.

Fetal Screening for congenital malformations (by 20+6 weeks gestation)
Women (or men) with structural congenital heart disease have an increased risk of having a baby with congenital heart disease. Pregnant women with congenital heart disease, or whose partners have congenital heart disease, should be offered a fetal echocardiogram antenatally.

Women or men with functional congenital heart disease (i.e. patent ductus arteriosus (PDA), patent foramen ovale (PFO), atrial septal defect (ASD)) do not need fetal echocardiogram for their pregnancies as these conditions cannot be diagnosed antenatally.

Women with acquired heart disease or inherited cardiac conditions with a structurally normal heart (Marfan's, long QT syndrome) do not need fetal echocardiography.

Fetal echo should be performed by experienced fetal echocardiographers where prognosis and management can be discussed in detail with the woman and her family if an abnormality is detected. (BCCA guideline 2012).

The fetal echo should be performed by 20+6 weeks gestation. A decision may be made to perform it earlier at times. Referral for fetal echo should follow the existing local referral pathways. If the fetus is found to have congenital heart disease a referral should be made to the Fetal Medicine Unit at St Mary's Hospital (0161 276 6385) who will co-ordinate the subsequent management of the fetus according to Fetal Anomaly Screening Programme (FASP Guidelines and regional guidelines .

Monitoring fetal growth and wellbeing

Women who are cyanosed are at risk of intrauterine growth retardation and fetal growth and wellbeing should be monitored regularly.

Beta blockers are often a useful drug in pregnancy but may be associated with a small increased risk of fetal growth restriction. The clinician should be aware of this increased risk and arrange regular growth scans.

Escalation and Transfer

Women booked in units other than Saint Mary's Hospital may have newly diagnosed heart disease in pregnancy, or worsening of pre-existing heart disease. This may precipitate a request for their care to be transferred to Saint Mary's Hospital. A consultant to consultant discussion should take place to decide appropriate timing of transfer (e.g. routine, urgent, emergency) and transport needs (e.g. own car; ambulance with or without accompanying trained/experienced staff from the transferring hospital, or paramedic ambulance) appropriate to clinical need. This can be arranged by contacting the consultant obstetrician on duty at St Mary's Hospital 0161 276 1234 (bleep 6000) or by contacting Dr Vause, Dr Roberts, Dr Bonner, Prof Clarke, Dr Cullington or Prof Keavney through switchboard.

All relevant documentation/information should be communicated from the referring hospital to the receiving hospital and sent in full with the woman (including the woman's records/clinical notes).

Agreement of the woman to transfer should be documented. In emergency situations when a woman is unable to agree to transfer, where possible, the next of kin should be informed of the decision to transfer. The responsibility for transfer rests with the consultant in charge of the woman's care in the referring hospital.

8. Intrapartum Management

There is a broad spectrum of types and severity of cardiac disease in pregnancy; one protocol is not appropriate for all women. The following principles apply to the management of most women with anything more than mild (WHO I) cardiac disease:

Senior input and multidisciplinary care are imperative
The consultant obstetrician, consultant anaesthetist, and possibly consultant cardiologist, should be informed of the woman's admission. This should be outlined on the care plan.

Facilities
If a woman is being induced, the care plan should specify whether the induction can be performed on an antenatal ward / induction suite or whether it should be done on the consultant led labour ward. Women in labour, or women being induced who are suitable for amniotomy should be cared for on the consultant led labour ward. Women with moderate or high risk cardiac conditions require High Dependency Care on the labour ward.

Minimising any additional load on the cardiovascular system is usually best achieved by aiming for the spontaneous onset of labour. If labour is induced, normal induction regimes can be used but consideration may need to be given to volume restricting syntocinon infusions if they are used.

Supine hypotension must be avoided
If a woman is lying down she should be encouraged to lie on her side or be effectively wedged. Uterine displacement should be used in all cases of maternal collapse or resuscitation.

Anticoagulation
Most women with cardiac disease who require anticoagulation are managed on subcutaneous low molecular weight heparin throughout pregnancy, with close monitoring of Anti Xa levels. There should be an Obstetric Haematology care plan for peripartum anticoagulation management. If not stated, or no care plan has been completed, the consultant haematologist should be contacted when the woman is admitted.
If the woman requires delivery while on warfarin contact the consultant haematologist immediately for advice. Clopidogrel is a platelet aggregation inhibitor. Due to the irreversible binding of platelets, effects can last 7-10 days after exposure Aspirin does not usually cause problems with surgical haemostasis.

Women with cardiac disease who are anticoagulated are at risk of bleeding and haematoma formation. There should be meticulous attention to haemostasis whether this is at LSCS or after a normal delivery. Perineal trauma must be repaired by a senior operator.

Analgesia
Women with cardiac disease should see the obstetric anaesthetist antenatally to discuss analgesia. When a woman with cardiac disease is admitted to the Delivery Unit the anaesthetic staff should be involved early. Whilst any form of analgesia is suitable for

women with mild (WHO I) disease, epidural analgesia has particular benefits for women with more severe disease. It provides effective analgesia, greater cardiovascular stability and facilitates a longer passive second stage prior to active pushing, and is useful should instrumental delivery or caesarean section be needed.

Fluid balance

Accurate assessment in all women with cardiac disease. Large fluid shifts occur around the time of delivery. Hypotension due to hypovolaemia is dangerous for women with some types of cardiac disease, for example aortic stenosis. For many women with cardiac disease fluid overload could precipitate heart failure. An hourly input/output chart and an hourly urometer should be used in high risk cases. An arterial line and/or central venous access may be indicated and this will be specified in the anaesthetic care plan. Blood loss should be assessed as accurately as possible, by weighing swabs and pads, etc. There should be meticulous attention to haemostasis.

Meticulous care

Must be taken to avoid air embolism through intravenous lines particularly if there is a right to left circulatory connection (e.g. ASD). Air embolism is prevented by using bubble traps / filters on all intravenous lines such as those 'built into' electronic pumps. Electronic pumps must therefore be used whenever possible for women with cardiac disease.

Blood Pressure Control

For some cardiac conditions hypotension is poorly tolerated. Prompt and accurate replacement of lost volume is necessary. Vasoactive medications e.g. nifedipine should be used with extreme care and only after discussion with a consultant.
For other cardiac conditions, hypertensive surges may be poorly tolerated.

Prophylactic Antibiotics

Current NICE guidelines state that antibiotic prophylaxis against infective endocarditis should not be routinely offered for gynaecological and obstetric procedures or childbirth. Antibiotics should be given for all the usual obstetric indications but with a lower threshold in women who are at increased risk of endocarditis; for example women with prosthetic valves, endocarditis history, valvulopathy.

Maternal and Fetal Monitoring in Labour

Pulse and blood pressure should be charted on a HDU chart. Maternal monitoring will be dictated by the nature of the cardiac condition.. Women with moderate and high risk cardiac conditions should be cared for in a High Dependency Area on the Delivery Unit and a high dependency chart should be used.
In women with moderate or high risk cardiac disease, shifts in blood pressure may result in hypoxia. For these reasons, continuous electronic fetal monitoring is recommended.

Vaginal delivery

Is the preferred mode of delivery for most women with cardiac disease unless patient choice, obstetric or specific cardiac considerations determine otherwise.

Limitation of active second stage

If the active second stage is to be limited, allowing maximum descent of the vertex, by facilitating a two hour passive second stage is sensible. Epidural analgesia is useful in this context. After 30 minutes of active pushing the woman should be assessed with a view to performing an instrumental delivery, unless a vaginal delivery appears imminent and she is haemodynamically stable. The increased risk of an instrumental birth and associated increase in risk of perineal trauma and obstetric anal sphincter injury should be explained to women in the birth planning process

Caesarean section

Indications for caesarean section are outlined in Table 3 below. Some women with cardiac conditions pose complex anaesthetic challenges and cannot safely undergo rapid anaesthesia; this should be discussed with the woman antenatally in considered when deciding mode of delivery. There should be close communication with the anaesthetic registrar, consultant obstetrician and consultant anaesthetist over any concerns about the fetal condition and the woman's progress through labour to allow for timely preparation and involvement of critical care and cardiac anaesthetic support if appropriate. If the woman has been seen antenatally by the anaesthetist there should be a plan documented in the notes but the initiation/conduct of any anaesthesia may be prolonged. Women with moderate or high risk cardiac lesions, who are aiming for a vaginal delivery, should be made aware that the decision-to-delivery may be prolonged, as the priority is to maintain maternal safety, and a longer anaesthetic time may therefore be needed.

INDICATIONS FOR CAESAREAN SECTION	
Cardiac Indicators*	Obstetric Indicators
Poor ventricular function Cyanotic heart disease or pulmonary hypertension Myocardial ischaemia Severe aortic or mitral valve stenosis Dilated aortic root	Any obstetric indicators as per local hospital guidelines
* *any cardiac condition where there is limited ability to increase* cardiac output safely	

Premature Labour

Tocolytics should not be commenced without prior discussion with the consultant obstetrician, as they may severely compromise cardiac function, especially nifedipine. Atosiban has the least cardiovascular side effects of all the tocolytics and is the tocolytic of choice for women with severe cardiac disease. If it is not available then the consultant obstetrician on call should be contacted and their advice taken on the choice of tocolytic. Steroids for fetal lung maturity are not contraindicated. Magnesium infusions for neuroprotection can also be used but may cause hypotension, so should be used with care and frequent blood pressure monitoring.

Third Stage

Ergometrine and syntometrine are contraindicated in some women with cardiac conditions as they cause a rapid increase in preload (venous return) and a hypertensive surge. Examples of conditions in which this would be undesirable are women with mitral stenosis, poorly functioning ventricle or aortopathies. A syntocinon bolus can cause tachycardia and

hypotension. For women with moderate or severe cardiac conditions, syntocinon should be given as a slow bolus intravenously (Syntocinon 5 units in 20 ml of Sodium Chloride 0.9% over 20 mins via an infusion pump). In cases where there is uncertainty about what to use for the third stage of labour, then this regime should be used as it has the least vasoactive side effects.

9. Early Postnatal Care

Uterine hypotonia

Syntocinon infusions can be used although in some women the volume of fluid may need to be limited (ie a more concentrated infusion). Mechanical methods such as bimanual compression, B Lynch suture and Bakri balloon can also be used in problematic hypotonia. Misoprostol (1000 micrograms rectally or 800 micrograms sublingually) should be used in preference to carboprost (Haemobate), since the former is less vasoactive. If a woman is becoming unstable because of blood loss due to haemorrhage from uterine hypotonia then syntometrine can be used (in this situation the hypertensive surge won't be a problem). In women who have needed anticoagulation in pregnancy, ask the opinion of a haematologist prior to giving tranexamic acid.

Postnatal Monitoring

This is often a time of decompensation, hence observation in Obstetric HDU (or a planned admission to Level 3 ICU care) is appropriate for women with moderate or high risk cardiac lesions. Fluid balance should be monitored closely. Heart failure is a particular concern, and staff should not become complacent just because delivery has been successfully achieved. A HDU chart should be used. An extended postnatal stay may be indicated. The woman's cardiovascular system should be assessed until the day she leaves hospital.

Thromboprophylaxis

Women with cardiac disease who have had a caesarean section should receive low molecular weight heparin thromboprophylaxis. Low molecular weight heparin should not be commenced until 4-hours after removal of the epidural catheter.
Thromboprophylaxis in other circumstances is not contraindicated in women with cardiac disease and should follow local thromboprophylaxis guidelines.

10. Neonatal Care

Babies of women with heart disease should be cared for in the usual way, in accordance with unit guidelines. Babies of mothers with congenital heart disease have an increased incidence of CHD themselves (3-6%). Women with inherited cardiac conditions may have been in contact with the genetics team during the pregnancy with regards to testing the baby. Sometimes testing of cord blood is arranged, and sometimes testing is arranged when the baby is older. Relevant documentation should be available in the case notes.

Pharmacological Assessment
All cardiac medication should be reviewed postpartum as drugs and doses may need changing. Any medication which was discontinued before/during pregnancy may need restarting, taking account of whether the woman is breastfeeding. Warfarin and ACE inhibitors can be used when breastfeeding. Single doses of amiodarone are unlikely to cause neonatal thyroid problems, but sustained use may do and therefore it should be used only when necessary, and with neonatal monitoring. As yet there is insufficient data on the use of newer anticoagulants eg apixaban in breastfeeding so alternatives eg warfarin or LMWH should be used.

11. Contracception

Contraception can be discussed at any clinic visit but it is particularly relevant to pre-pregnancy and postnatal consultations. For some women with heart disease it is important to discuss the option of sterilisation at the time of Caesarean Section during the pregnancy.

For some women with heart disease immediate postpartum contraception with either an (intrauterine device) IUD or long-acting reversible contraceptives (LARC) / progesterone implant is appropriate. This option should be discussed during pregnancy.

Contraceptive options should be discussed with women prior to discharge. Guidance about contraception for women with heart disease is available on the Faculty of Sexual and Reproductive Health website – Contraceptive choices for women with Cardiac Disease 2014

Specialist contraception advice may be required for some women. Within Greater Manchester and Eastern Cheshire this service is provided by the Sexual and Reproductive Health team at The Hathersage Centre on telephone number 0161 701 1555.

12. Subsequent Postnatal Care

Women with cardiac disease should be informed about the risks in future pregnancies and the importance of pre-conception care when planning future pregnancies.

Women with pre-existing cardiac disease who have low risk conditions should be referred back to their routine cardiac care arrangements.

Follow up appointment
A follow-up review appointment should be arranged for approximately 6 weeks after delivery for those women who have had their antenatal care in the obstetric cardiology clinic

At the postnatal appointment in the obstetric cardiology clinic there will be:

- Assessment of cardiac status
- Obstetric review
- Discussion of events around the time of delivery
- Discussion of future pregnancies and advice regarding pre-pregnancy care
- Discussion of contraception
- Referral back to routine cardiac follow up

13. Suspected or Newly Diagnosed Cardiac Disease

Cardiac disease can present for the first time in pregnancy or in the postpartum period. A high index of suspicion is required. In the 2015-17 MBBRACE report 78% of the women who died from cardiac disease were not known to have pre-existing cardiac disease (MBRRACE-UK, 2019).

Repeated attempts to access medical care, extreme anxiety, a raised respiratory rate, chest pain, persistent sinus tachycardia, unexplained cough, pink frothy sputum and orthopnoea are important signs and symptoms which should always be fully investigated. (MBRRACE-UK 2019, NICE 2019)

The emphasis should be on making a diagnosis, not simply excluding a diagnosis. Troponin and N-terminal pro-brain natriuretic peptide (NT-proBNP) are useful biomarkers in the assessment of women with suspected new onset cardiac disease (NICE 2019). Women should not be denied relevant investigations e.g. chest X-ray, simply because they are pregnant.

Early involvement of senior clinicians from the obstetric and cardiology multidisciplinary team is important.

14. Sources of Support

Women should be made aware of sources of support. Women may wish to access support at any stage from the time when they are first considering pregnancy until after the baby is born. Women with heart disease may have difficult decisions to make and may not always have a successful outcome to the pregnancy.

Women may find access to peer support helpful e.g.. British Heart Foundation (BHF) and should be given contact details (see Appendix 4).

Appendix 1: Referral Process for the Obstetric Cardiac Service

What is the Obstetric Cardiac service?
The Obstetric Cardiac service is a specialised service for women with heart disease who are pregnant, or who are thinking about having a baby. Women from across the North West of England, North Wales and the Isle of Man use this service. A large team of clinicians contribute to this service including obstetricians, cardiologists, midwives, anaesthetists, cardiac technicians and many others. The service provides preconceptual, antenatal, intrapartum and postnatal care. The aim is to provide pregnancy focussed, woman centred care.

How does the service work?
The team run a clinic on Tuesday mornings seeing women for preconceptual advice, antenatal care and postnatal care. Most women attending this clinic will have an echo and an ECG performed before seeing the midwife, obstetrician (Dr Sarah Vause,Dr Anna Roberts, Dr Samantha Bonner) and a cardiologist (Prof Bernard Clarke, Dr Damien Cullington, Prof Bernard Keavney). An anaesthetist is also available in clinic and fetal echocardiography and obstetric ultrasound can be done at the same visit. If women are admitted to hospital they are cared for by the same team on the ward.

Where does the clinic run?
The clinic is held in the Antenatal clinic on the ground floor of Saint Mary's Hospital, Oxford Road Campus, Manchester.

Who should be referred to the clinic?
Please refer to appendix 2 for guidance based on risk stratification.

How do I refer a woman to the Joint Obstetric Cardiac service?

1. Identify need for referral with reference to appendix 2
2. Email 'mft.obstetriccardiac@nhs.net' with full details of patient and relevant background information.
3. Email referrals will be monitored twice weekly by the obstetric cardiac team
4. For referrals deemed to require more urgent attention or advice needed please telephone Gemma Mulholland, PA to obstetric Cardiac service on 0161 2766426 who will arrange for you to discuss with a member of the clinical team
5. For urgent in patient referrals, please contact on call consultants in obstetrics and cardiology as applicable
6. Please ensure you include the following information in your referral:
   - Full name, DOB, NHS number
   - Parity, gestation and EDD
   - Name of hospital currently booked at and name of consultant(s) to whom correspondence should be sent
   - Cardiac diagnosis
   - Current clinical status; cardiac and obstetric issues, other relevant past medical history
   - Current medication
   - Results of any relevant recent investigations eg echo, cardiac MR, holter.
   - Copies of reports where possible/relevant
   - Full details of any previous surgery or cardiac procedures if available

Appendix 2: Risk Stratification of conditions and location of care

	mWHO	mWHO II	mWHO II-III	mWHO III	mWHO IV
Diagnosis (if otherwise well and uncomplicated)	Small or mild - pulmonary stenosis - patent ductus arteriosus - mitral valve prolapse Successfully repaired simple lesions (atrial or ventricular septal defect, patent ductus arteriosus, anomalous pulmonary venous drainage) Atrial or ventricular ectopic beats Isolated	Unoperated atrial septal or ventricular defect Repaired tetralogy of Fallot Most arrhythmias (supraventricular arrhythmias)	Mild left ventricular impairment (EF >45%) Hypertrophic cardiomyopathy Native or tissue valve disease not considered WHO I or IV (mild mitral aortic stenosis) Marfan or other HTAD syndrome without aortic dilatation Aorta <45 min in bicuspid aortic valve pathology Repaired coarctation Repaired coarctation Atrioventricular septal defect AND Turners Syndrome without aortic dilatation (mWHO II) All channelopathies (event rate not applicable below)below)	Moderate left ventricular impairment (EF 30-45%) Previous peripartum cardiomyopathy without any residual impairment of left ventricular function Mechanical valve Systemic ventricle with good or mildly decreased ventricular function Fontan circulation. If otherwise the patient is well and the cardiac condition uncomplicated Unrepaired cyanotic heart disease Other complex heart diease Moderate mitral stenosis Severe asymptomatic aortic stenosis Moderate aortic dilatation (40-45 mm in Marfan syndrome or other HTAD; 45-50mm in biscuspid aortic valve, Turner syndrome ASI 20-25 mm/m2, tetralogy of Fallot <50 mm) Ventricular tachycardia	Pulmonary arterial hypertension (managed in Sheffield PH service) Severe systemic ventricular dysfunction (EF <30% or NYHA class III-IV) Previous peripartum cardiomyopathy with any residual left ventricular impairment Severe mitral stenosis Severe symptomatic aortic stenosis Systemic right ventricle with moderate or severely decreased ventricular function Severe aortic dilatation (>45mm in Marfan syndrome or other HTAD, >50 mm in biscuspid aortic valve, Turner syndrome ASI >25 mm/m2, tetralogy of Fallot >50mm) Vascular Ehlers-Danlos Severe (re)coarctation Fontan with any complication

	mWHO	mWHO II	mWHO II-III	mWHO III	mWHO IV
Risk	No detectable increased risk of maternal mortality and no/mild increased risk in morbidity	Small increased risk of maternal mortality or moderate increase in morbidity	Intermediate increased risk of maternal mortality or moderate to severe increase in morbidity	Significantly increased risk of maternal mortality or severe morbidity	Extremely high risk of maternal mortality or severe morbidity
Maternal cardiac event rate	2.5-5%	5.7-10.5%	10-19%	19-27%	40-100%
Counselling	Yes	Yes	Yes	Yes: expert counselling required	Yes: pregnancy contraindicated: if pregnancy occurs, termination should be discussed
Care during pregnancy	Local hospital	Local hospital Refer Obstetric Cardiology Clinic, if local unit wishes	Obstetric cardiology Clinic	Obstetric Cardiology Clinic	Obstetric Cardiology Clinic/ PH service. Sheffield
Minimal follow-up visits during pregnancy	Once or twice	Once per trimester	Bimonthly	Monthly or Bimonthly	Monthly
Location of delivery	Local hospital	Local hospital	Individualised assessment after review	Expert centre for pregnancy and cardiac disease (ORC)	Expert centre for pregnancy and cardiac disease (ORC)

Appendix 3: Cardiac Disease in Pregnancy Care Plan

Obstetric Cardiac Pathway
Patient Summary

Date **Current gestation** **EDD** **Next appointment**	**Patient Details**
Cardiac diagnosis	
Current cardiac function	
Parity	
Relevant obstetric history	
Relevant Medical/Anaesthetic History	
Medication / Allergies	
Thromboprophylaxis	

Obstetric Cardiac Pathway
MDT Summary

MDT members	
Questions to be addressed by MDT	
MDT view	
Action plan	
Diagram of Cardiac Anatomy for more complex circulations	

Obstetric Cardiac Pathway
Delivery Plan

<table>
<tr><td colspan="2">Planned mode of delivery
(date if applicable)</td><td colspan="2"></td></tr>
<tr><td colspan="2">Staff alert</td><td colspan="2">Green/amber/red</td></tr>
<tr><td rowspan="2">LSCS</td><td>Indication</td><td>If labours spontaneously</td></tr>
<tr><td>Location</td><td>Location post op</td></tr>
<tr><td>Vaginal delivery</td><td colspan="2">HDU chart – Yes / No

Prophylactic antibiotics - Yes / No

Special considerations in labour –

Second stage –</td></tr>
<tr><td>Induction</td><td colspan="2">Location

Syntocinon regime</td></tr>
<tr><td>Third stage</td><td colspan="2">Syntocinon 5 units in 20mL saline over 20 mins or Usual management

Drugs to avoid:</td></tr>
<tr><td>Post delivery</td><td colspan="2">Stay on CSITU Yes / No
Stay on labour ward Yes / No (how long?)
Stay in hospital (how long?)

Medication plan (?breastfeeding)

Daily examination by Doctor - Yes / No
Echo before discharge - Yes / No</td></tr>
</table>

General care of cardiac women on labour ward:

- Use a wedge to avoid supine hypotension
- Careful monitoring of fluid balance

Atosiban appropriate if tocolysis needed in preterm labour

Postpartum haemorrhage:

- Mechanical compression methods preferable
- Weigh pads etc to accurately estimate loss
- Hourly urometer
- Consider arterial line
- CAREFUL fluid balance
- Use misoprostol in preference to haemobate

Staff Alert

- **Red:** inform all on call staff immediately on admission, immediate HDU care
- **Amber**: Inform on call team within 4 hours
- **Green:** routine care with attention to care plan

Appendix 4: Support groups for women with Cardiac Disease

British Heart Foundation Website: www.bhf.org.uk	
Somerville Foundation Support for young people and adults with congenital heart disease Website: https://thesf.org.uk/	

Appendix 5: Equality Impact Assessment Tool

Insert local Equality Impact Assessment Tool

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