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The rhythm of arrhythmias in pregnancy

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Take Home Messages

- Arrhythmias in pregnancy are significant but underrecognized contributors to maternal morbidity and mortality
- Electrical cardioversion is safe in all trimesters if needed for hemodynamically unstable cases.
- Catheter ablation is an option in refractory cases of arrythmia but should ideally be deferred postpartum

Introduction

According to the Mothers and Babies: Reducing Risk through Audit and Confidential Enquiries (MBRRACE-UK's) 2023 report, cardiac disease was a leading cause of maternal mortality during the peripartum to a year postpartum – contributing to 14% of all maternal deaths in the UK (1). The precise impact of arrhythmias on mortality is uncertain, as deaths caused by arrhythmias are not analysed separately from other cardiovascular causes. However retrospective studies from the USA have shown that arrythmias contributed to 10.7% of all maternal cardiovascular deaths (2). As per the MBRRACE 2022 data there were 11 maternal deaths attributed to cardiac arrythmias in a morphologically normal heart (3). This editorial aims to highlight the high burden of morbidity and mortality arrythmias can pose in pregnancy, pathophysiology and ultimately how to improve management of these patients.

Pathophysiology of arrhythmias in pregnancy

Cardiac arrhythmias may appear for the first time in pregnant women who have no history of heart disease or in those with underlying structural heart disease. The exact mechanism of why arrythmia burden increases during pregnancy has not been fully elucidated but is thought to be secondary to adaptive cardiovascular changes that occur. Pregnancy-related hemodynamic changes include increased cardiac output (30-50% above pre-pregnant levels), expanded blood volume, reduced systemic vascular resistance (SVR) and blood pressure (BP), and a small increase in heart rate (4) (**Figure 1**). Mechanical effects of atrial and ventricular stretch (from

expanded blood volume), increased sympathetic tone from increased plasma catecholamine concentrations and hormonal changes are all believed to contribute to pro-arrhythmic milieu (5).

Re-entrant arrhythmias

Supraventricular tachycardia (SVT) is a common arrhythmia with reported prevalence of atrioventricular nodal re-entrant tachycardia (AVNRT)/atrioventricular re-entrant tachycardia (AVRT) in the region of 22-33 per 100000 pregnancies (6). Vagal manoeuvres remain first line in the management of acute SVTs. Adenosine can be used safely in pregnancy (though data on use in the 1st trimester when there is the highest risk of teratogenicity is lacking). Beta-blockers and calcium channel blockers can also be used in the management of acute SVTs; however, caution should be used as these antiarrhythmic drugs (AADs) can increase conduction over accessory pathways. As such, they should be avoided in patients with known pre-excitation, when flecainide/procainamide should be used instead. Digoxin should also be avoided in this population of patients as it increases risk of conduction over accessory pathways, which can lead to pre-excited AF (5). Table 1 summarises the safety profile of common AADs during pregnancy and when breastfeeding. In cases of hemodynamic instability, urgent electrical cardioversion (DCCV) should be considered. Non-fluoroscopic ablation using electroanatomic mapping systems and intracardiac ultrasound can be performed safely in experienced centres for patients with drug refractory arrythmias (7), but ideally catheter ablation should be deferred to the post-partum period due to the concern of potential adverse maternal and fetal outcoms..

Atrial Fibrillation (AF)/Atrial Flutter (AFL)

In a large prospective multinational observational study (1321 patients), it was found that AF/AFL occurs in 1.3% of pregnant patients with structural heart disease and tends to be most common at the end of 2nd trimester (8). In a registry on pregnancy and cardiac disease **(**ROPAC**)** study, it was noted in pregnant patients with AF, the mortality was significantly higher than those without **(**11.8% vs. 0.9%; p = 0.01**)** (8). Rhythm control should be considered as the preferred treatment strategy during pregnancy (9). 2020 ESC guidelines for the diagnosis and management of atrial fibrillation confer a class I recommendation for immediate DCCV inhemodynamically unstable AF and AFL (10). For rhythm control in the setting of recurrent or refractory AF, flecainide or sotalol can be used (5). Amiodarone causes many adverse foetal outcomes and therefore should not be used during pregnancy (11). Anticoagulation is an important

consideration in pregnancy as pregnancy is a prothrombotic state; however this should be balanced with the risk of bleeding during delivery. CHA_2DS_2-VASC has not been validated for the use in pregnancy. According to 2018 ESC guidance for the management of cardiovascular diseases during pregnancy, the same criteria used to stratify stroke risk in non-pregnant females should also be applied for pregnant women . When significant mitral stenosis (MS) is present, patients should be fully anticoagulated even if in sinus rhythm (12). According to the ACC/AHA guidance for hypertrophic cardiomyopathy (HCM), anticoagulation is recommended regardless of the CHA_2DS_2VASC score (13). Currently heparin (unfractionated or low molecular weight heparin - LMWH) are preferred anticoagulants in pregnant patients due to their inability to cross the placenta, however it may be appropriate to carry on vitamin K antagonists in patients with mechanical valves due to their low incidence of valve thrombosis compared to patients on LMWH (12) Patients on anticoagulation require MDT approach especially when planning delivery.

Ventricular Arrythmias

Ventricular tachycardia (VT)/ventricular fibrillation (VF) is rare in pregnancy with a prevalence of 2 per 100000 pregnancies (14). There is a higher prevalence of VT in patients with structural heart disease, especially in women with congenital heart disease (prevalence of 4.5-15.9 per 1,000 pregnancies) (14). These patients are at higher risk of sudden cardiac death compared to those with structurally normal hearts (15). In the setting of hemodynamic instability, DCCV should be performed emergently. If the patient is haemodynamically stable, lidocaine can be trialled first. Procainamide can also be used if lidocaine is ineffective. Amiodarone can be considered in life threatening scenarios refractory to other therapies, however has high placental transfer and associated with a range of fetal problems – please see table 1 below for more information (5).

Conclusions

Arrhythmias in pregnancy, while uncommon, represent a significant clinical challenge due to their association with maternal morbidity and mortality. A clear understanding of their pathophysiology and management, alongside a multidisciplinary approach, is essential for improving outcomes. Timely interventions, judicious use of medications, and coordinated care

during delivery are key to mitigating risks for both mother and foetus.

Disclosures

Nothing to declare.

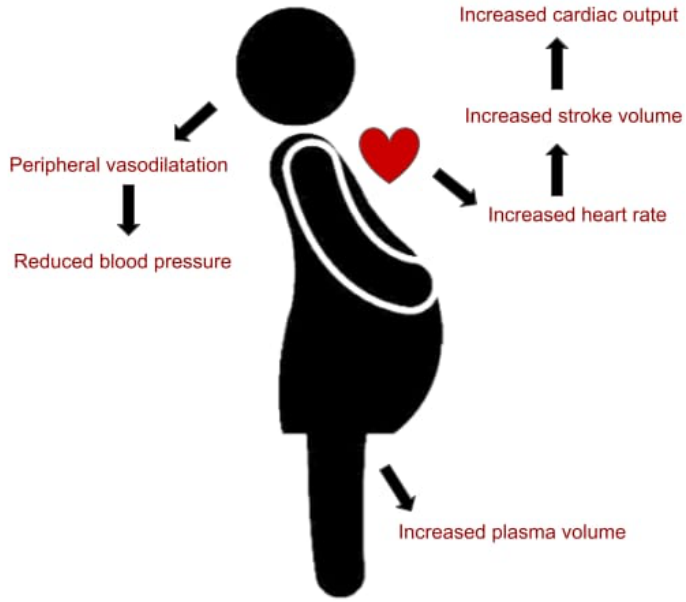

Figure 1: Original image describes the cardiovascular adaptations in pregnancy.

Drug	Reported adverse effects	Placental transfer	Transfer in breast milk	FDA Category	MHRA Recommendation
Class I: Sodium Channel Blockers					
Quinidine	Generally considered safe; has been used.	Yes	Safe; minimal transfer to breast milk;	Category C	May be used if benefits outweigh risks; monitor fetal and maternal status.
Procainamide	Generally safe; may cause maternal hypotension or lupus-like syndrome.	Crosses placenta; fetal levels are 50%–90% of maternal levels.	Likely safe; limited data, but no significant adverse effects reported in breastfeeding infants.	Category C	Use with caution; close monitoring recommended during treatment.
Lidocaine	Considered safe for acute use	Crosses placenta; detectable fetal levels but usually non-toxic.	Safe; minimal milk transfer and unlikely to cause adverse effects in the infant.	Category B	Safe for acute use; fetal exposure minimal if used for short durations.
Flecainide	Maternal visual disturbances, acute interstitial nephritis, obstetric cholestasis, fetal bradycardia.	Crosses placenta; fetal levels 30%–60% of maternal levels.	Likely safe; low concentrations found in breast milk; monitor for infant bradycardia	Category C	Reserved for when benefits outweigh risks; regular fetal monitoring advised.
Class II: Beta-Blockers					
Metoprolol	Considered safe; extensively studied. May cause fetal bradycardia or growth restriction in	Crosses placenta; fetal levels are 50%–100% of maternal levels	Safe; excreted in small amounts in milk; monitor infant for bradycardia or lethargy.	Category C	Use with caution; monitor for fetal growth and neonatal bradycardia.

	rare cases				
Propranolol	Relatively safe; used widely in pregnancy.	Crosses placenta; fetal levels are lower than maternal levels.	Safe; low milk levels; monitor for bradycardia or poor feeding in infants.	Category C	Generally considered safe; monitor for neonatal bradycardia and hypoglycaemia.
Bisoprolol	Limited safety data; used cautiously; no significant teratogenic effects reported	Crosses placenta; fetal exposure possible but levels not well studied	Likely safe; minimal milk transfer, but monitoring recommended.	Category C	Use only if no safer alternatives available; monitor fetal growth and neonatal outcomes.
Atenolol	Associated with fetal growth restriction; not typically recommender	Crosses placenta; significant accumulation in the fetus.	Use with caution; higher milk levels compared to other beta-blockers; monitor infant for bradycardia.	Category D	Not recommended unless benefit clearly outweighs risk; fetal growth restriction is a concern.
Class III: Potassium Channel Blockers					
Amiodarone	Congenital goitre, thyroid disorders (hypothyroidism), QT prolongation, neurodevelopmental abnormalities and premature birth. Use only after other antiarrhythmics have failed	High placental transfer; fetal levels similar to maternal levels.	Significant transfer to milk and risk of infant thyroid and cardiac issues.	Category D	Avoid in pregnancy unless life-threatening maternal arrhythmias necessitate its use.

Sotalol	Use cautiously; can cause fetal bradycardia or electrolyte imbalances.	Crosses placenta; fetal levels 30%–90% of maternal levels.	Use with caution; excreted in breast milk	Category B	Use with caution; fetal heart monitoring advised due to potential bradycardia and QT prolongation
Class IV: Calcium Channel Blockers					
Verapamil	Generally considered safe; used for acute arrhythmias	Crosses placenta; detectable fetal levels	Safe; low levels in breast milk	Category C	Can be used; fetal and neonatal heart monitoring recommended during treatment
Diltiazem	Skeletal abnormalities, IUGR	Crosses placenta; fetal levels not well studied	Use with caution; limited evidence suggests low levels in milk	Category C	Use with caution; avoid in first trimester unless absolutely necessary
Digoxin	Considered safe; widely used for maternal arrhythmias and heart failure. Do not use in evidence of pre-excitation.	Crosses placenta; fetal levels are 60%–80% of maternal levels.	Safe; minimal milk transfer and no known adverse effects on breastfeeding infants.	Category C	May be used; monitor maternal to avoid toxicity
Adenosine	Safe for acute use; rapidly metabolized.	Minimal placental transfer due to rapid metabolism	Safe; extremely short half-life; negligible milk transfer	Category C	Safe for acute use

Table 1: Demonstrates AAD safety profile. The FDA categories as are follows; Category A: No risk in human studies. Category B: No risk in animal studies, but no human studies available Category C: Risk in animal studies; human risk unknown

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