

Tachycardia in pregnancy: when to worry?

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ABSTRACT

Tachycardia in pregnancy is common, and distinguishing between physiological and pathological causes can be a challenge. Understanding the cardiovascular changes that take place in pregnancy can help to direct investigations. The finding of a persistent tachycardia, regardless of symptoms, should always prompt clinical review and consideration of investigations (such as blood tests, electrocardiography and echocardiography), where indicated. Treatment of tachyarrhythmias in pregnancy differs very little from a non-pregnant adult, and unstable arrhythmias should follow Resuscitation Council UK guidelines. Pregnant women with pathological arrhythmias need to be cared for under a multidisciplinary team, including obstetricians, obstetric anaesthetists, specialist midwives, cardiologists and obstetric physicians.

Introduction

Analysis of obstetric early warning systems across the country has shown great variability in what are considered 'normal' vital signs in pregnancy.¹ Traditionally, clinicians have been taught that physiological changes in pregnancy lead to an increase in resting maternal heart rate of 10 to 20 beats per minute (bpm) accepting slightly higher values in women with higher body mass index. However, recent data from a large-scale cohort study of healthy pregnancies in the UK suggest gestation-specific vital signs vary more widely than previously thought. This showed that from 18 weeks of gestation, heart rates of over 100 bpm (and from 28 weeks, over 105 bpm) occurred in more than 10% of observations.²

With this recent evaluation of physiological parameters in pregnancy, an absolute value for the upper limit of normal in pregnancy is difficult to define. A threshold of 100 bpm will be too low for many women and result in unnecessary investigations, while 120 bpm is likely to be too high resulting in false reassurance and the potential to miss important diagnoses. Somewhere between these two levels therefore seems reasonable, but there is

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no clear threshold supported by recent data that can be applied to all pregnant women.

Cardiac disease remains the largest single cause of indirect maternal deaths in the UK and there has been no significant change to maternal mortality rate from cardiac disease over the last few years.³ A key recommendation from the MBRRACE-UK (Mothers and Babies: Reducing Risk through Audits and Confidential Enquiries across the UK) 2019 report is the importance of investigating 'a persistent sinus tachycardia' as this is considered a red flag, particularly when there are associated symptoms such as breathlessness or chest pain.⁴ There are, therefore, conflicting pressures on clinicians caring for pregnant women to identify when a tachycardia may represent concerning pathology and identifying when tests are required, and not over-investigate otherwise well women who can safely be reassured without further investigation. The aim of this review is to provide

Key points

There is no defined upper limit of normal for heart rate in pregnancy, but thorough history and basic investigations should be carried out in all pregnant women with a persistent tachycardia.

Premature complexes (atrial and ventricular) are the most common finding on electrocardiography (ECG). Supraventricular tachycardia is the most common pathological tachyarrhythmia.

Investigations include blood tests to check for anaemia and infection, an ECG and, where appropriate, echocardiography.

Any tachyarrhythmia in pregnancy causing haemodynamic instability requires urgent cardioversion as per adult life support guidelines.

All women with a tachyarrhythmia need to be cared for by a team consisting of an obstetrician and specialist midwife, obstetric anaesthetist, obstetric physician (where available) and cardiologist so that safe and effective delivery plans can be made and appropriate follow-up arranged.

KEYWORDS: pregnancy, tachycardia, arrhythmia, cardioversion, echocardiography

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a robust approach to the investigation and management of a persistent tachycardia in pregnancy.

Clinical assessment

Cardiovascular changes take place from the first trimester onwards, however, heart rate changes occur later and rises progressively towards an average of 91 bpm (range 68–115) at around 34 weeks.² A persistent tachycardia in early pregnancy is, therefore, less likely to be physiological than later in pregnancy, which emphasises the importance of knowing an accurate gestational age. Screening for infection is also crucial, including enquiring about urinary symptoms, vaginal discharge and abdominal pain.

While this list is not exhaustive, these are examples of important screening questions to assess for pathological causes of tachycardia.⁵ Is there any history of:

- > palpitations with chest pain, breathlessness or feeling faint
- > any known heart conditions
- > an arrhythmia
- > a family history of sudden or unexplained death in a young member of the family
- > a temperature or symptoms of infection
- > any venous thromboembolism (VTE) risk factors in pregnancy?⁶

Further investigations are likely to be required if any abnormalities are identified by those questions. If there are no concerning features of the history, the patient has normal observations for pregnancy, a normal electrocardiography (ECG) and blood tests, then it is likely that the patient can be reassured after senior review without further investigation (Box 1).

Investigations

Blood tests should include:

- > haemoglobin (Hb): the threshold for anaemia in pregnancy is defined by the World Health Organization as Hb <110 g/L in

Box 1. Example of reassurance after baseline investigations

Presentation

A 34-year-old woman was pregnant for the first time. She had no significant medical history and took no regular medications. When she was having her blood pressure measured at her 25-week midwifery visit, she had a resting heart rate of 110 beats per minute (bpm). She did not have any symptoms such as chest pain or breathlessness. Her exercise tolerance was good and she walked her dog for five miles per day. Her observations revealed a resting heart rate of 110 bpm, blood pressure of 115/75 mmHg, respiratory rate of 15 breaths per minute and oxygen saturations of 100% on room air. She was afebrile. 12-lead electrocardiography revealed sinus tachycardia (110 bpm) and blood results were haemoglobin of 112 g/L and thyroid stimulating hormone of 1.67 mU/L.

Recommended course of action

All the above is reassuring and further investigation unlikely to yield any positive results.
No follow-up required.

Outcome

Physiological sinus tachycardia. Reassurance should be provided and the patient can be encouraged to exercise (within own limitations).

Box 2. Electrocardiography changes in pregnancy

Left axis deviation

Transient ST/T wave changes

Q waves in lead III and aVF

Inverted T waves in leads III, V1, V2 and sometimes V3

first trimester, <105 g/L in the second and third trimesters and <100 g/L postpartum⁷

- > thyroid function tests: using pregnancy-specific reference ranges for thyroid stimulating hormone (TSH), T3 and T4 when interpreting results⁸
- > inflammatory markers (C-reactive protein (CRP)) and blood cultures: if infection is suspected.

An ECG is the most important investigation in the context of a tachycardia. If this is performed at the time of an episode of palpitations or tachycardia, and confirms a rhythm abnormality, other investigations may not be required. If the ECG is normal at the time the tachycardia is noted, then a pathological arrhythmia as a cause for the tachycardia is unlikely (Box 2).⁹

Further diagnostic tests include echocardiography and ambulatory monitoring. Echocardiography can further evaluate the presence of structural heart disease and potential causes of tachyarrhythmias.

The duration of ambulatory monitoring depends on the frequency of symptoms and the underlying diagnostic concern. A 24-hour recording can be valuable when it is unclear whether a sinus tachycardia or atrial tachycardia is present. A sinus tachycardia will wax and wane during the course of the day, usually settling at night. However atrial tachycardias may lack this diurnal variation or show abrupt changes in rate, consistent with going in and out of the abnormal rhythm. A 24-hour recording is also useful if ventricular ectopy is present to assess overall ectopy burden. A longer period of recording is recommended for women where symptoms are present, but not on a daily basis or where the pre-test probability of a pathological tachyarrhythmia is increased, such as in women with congenital heart disease or previous concerning arrhythmias.

Differential diagnosis

Supraventricular tachycardia (SVT) affects 0.02%–0.5% of pregnancies and include atrial tachycardias, atrial flutter, junctional tachycardia, atrioventricular nodal reentrant tachycardia (AVNRT) and atrioventricular reentrant tachycardias (AVRT), the latter mediated by an accessory pathway.¹⁰ Typically, an SVT is a narrow complex with an atrial rate over 100 bpm. Women with pre-existing SVT may experience an exacerbation during pregnancy and they can be treated successfully and safely during pregnancy using usual medical therapy such as adenosine (Table 1). For women with more frequent episodes of SVT, preventative medication (such as beta-blockers or calcium-channel blockers) can be given once ventricular pre-excitation has been excluded.¹⁰

Inappropriate sinus tachycardia (IST) is the occurrence of a faster than expected heart rate at unexpected times, for example, at rest rather than on exertion. It can occur for the first time in pregnancy and be associated with symptoms of palpitations.¹¹ IST carries a good prognosis but can be distressing, so reassurance and empathic care are paramount. There is little evidence that

Table 1. Tachycardia in pregnancy

Differential diagnosis	Investigations	Management
Asymptomatic tachycardia	All other vital signs should be within normal limits Blood tests: normal ECG: sinus tachycardia Asymptomatic	Usually an incidental finding, monitor for symptoms Provide open follow-up in the event that symptoms develop (Box 1)
Secondary sinus tachycardia	Blood tests: Hb, CRP, WCC, creatinine and TSH ECG: sinus tachycardia Chest X-ray	Look for and treat the underlying cause: anaemia, infection, dehydration or pulmonary embolism
Inappropriate sinus tachycardia	24-hour tape No underlying cause can be found	Benefit of beta blockers is not certain ¹⁴ Reassurance
Supraventricular tachycardia	Most common arrhythmia seen in pregnancy. There may be a history of SVT prior to pregnancy. ECG: Narrow complex tachycardia typically over 150 bpm and regular. Often normal between episodes but check for pre-excitation.	Vagal manoeuvres Adenosine 6–24 mg Beta blockers (metoprolol, bisoprolol) Verapamil or diltiazem administered slowly (verapamil is drug of choice in women with severe asthma where adenosine or beta blockers are contraindicated)
Atrial tachycardia	ECG: abnormal P waves Echo: check for structural heart disease 24-hour tape: periods of acceleration or deceleration during onset or termination of a tachycardia	Discuss with cardiologist Rate control with beta blockers, verapamil or digoxin (see SVT management for women with severe asthma) Rhythm control (either chemical cardioversion such as flecainide or DCCV) where rate control insufficient
Atrial fibrillation	ECG: absent P waves, irregular QRS complexes ECHO: check for structural heart disease Blood tests: Hb, TSH and electrolytes Underlying causes need investigation	Rate control with beta blockers, verapamil or digoxin Discuss with cardiologist (see SVT management for women with severe asthma) Rhythm control: pharmacological or electrical cardioversion Anticoagulation (treatment dose or prophylaxis depending on VTE risk score) Regular follow-up and cardiology review (Box 3)
Ventricular tachycardia	ECG: broad complex tachycardia (idiopathic VT may have a normal ECG between episodes)	Discuss with cardiology Rhythm control with DCCV or pharmacological management (lidocaine or amiodarone) Ablation if medical therapy not sufficient Prophylactic beta blocker especially if underlying structural heart disease

bpm = beats per minute; CRP = C-reactive protein; DCCV = direct current cardioversion; ECG = electrocardiography; ECHO = echocardiography; Hb = haemoglobin; SVT = supraventricular tachycardia; TSH = thyroid stimulating hormone; VT = ventricular tachycardia; VTE = venous thromboembolism; WCC = white cell count.

beta-blockade improves symptoms.¹¹ The symptoms are expected to resolve after delivery.

Women with congenital heart disease or older women are more likely to experience a pathological tachyarrhythmia for the first time in pregnancy, most commonly SVT or atrial fibrillation.⁹ Atrial fibrillation (AF) and atrial flutter are uncommon in pregnant women, but women with previous episodes of AF may have recurrence of their symptoms during pregnancy.¹² Adverse neonatal and fetal events including premature birth (defined as delivery before 37 weeks of gestation), small-for-gestational age (less than tenth percentile for age) and neonatal respiratory distress syndrome are associated with AF and atrial flutter, and these risks escalate with persistence of the tachyarrhythmia.¹² Conventional risk scores such as CHA₂DS₂-VASc are not validated for use in pregnancy and so thromboembolic risk should be determined by standard obstetric risk assessment tools. Low-

molecular weight heparin (LMWH) is safe to give in pregnancy and lactation, in contrast to direct oral anti-coagulants which are advisable to avoid in both scenarios. Warfarin is usually avoided during pregnancy but can be given during lactation. The management of AF/flutter depends on the time of onset. A woman presenting within 48 hours of symptom onset, with a structurally normal heart and low thromboembolic risk, can safely undergo direct current cardioversion (DCCV). Otherwise, beta blockers and digoxin can be used to optimise rate control providing there is haemodynamic stability.

Ventricular arrhythmias in pregnancy are associated with significant adverse neonatal and fetal outcomes including pre-term delivery, but are much less common.¹² Like AF, these arrhythmias are more frequently seen in women with structural heart disease, therefore, investigations for an underlying cardiomyopathy or structural defect should be completed. A

Box 3. Example of regular follow-up and cardiology review

Presentation

A 40-year-old woman presented to the maternity assessment unit having become unwell 5 days following a recent cycle of chemotherapy. She described the clear onset of palpitations 4 hours earlier and denied this happening previously. She was 32 weeks pregnant and was diagnosed with breast cancer in pregnancy. A heart rate of 150 beats per minute (bpm) was identified on her initial observations. Her medications were low-molecular weight heparin (LMWH; prophylaxis); folic acid 5 mg and ondansetron 4 mg as needed. Her observations revealed a heart rate of 150 bpm, blood pressure of 110/62 mmHg, respiratory rate of 18 breaths per minute and oxygen saturations of 98% on room air. She was afebrile.

12-lead electrocardiography revealed atrial fibrillation with fast ventricular response and blood results were haemoglobin of 115 g/dL, potassium of 3.0 mmol/L and magnesium of 0.8 mmol/L.

Recommended course of action

She was admitted to the high-dependency unit where she could have cardiac monitoring. Electrolytes were replaced and she was given a trial of bisoprolol which did not provide sustained rate control. Echocardiography showed a structurally normal heart. Computed tomography pulmonary angiography showed no evidence of pulmonary embolism. After fasting for 6 hours, she was sedated and intubated in theatre for direct current cardioversion (DCCV). After successful restoration of sinus rhythm, she was started on a low-dose beta blocker and treatment dose LMWH and a careful plan regarding her delivery was made. Fetal monitoring was carried out before and after DCCV.

Outcome

Atrial fibrillation (AF) is uncommon in pregnant women. Underlying structural heart disease should be suspected and urgent echocardiography should be arranged. Women with paroxysmal AF need careful venous thromboembolism risk assessment and decisions made regarding either low- or high-dose LMWH.

tachyarrhythmia in the presence of structural heart disease can rapidly result in haemodynamic instability and subsequent placental hypoperfusion, so urgent restoration of sinus rhythm is recommended and concurrent VTE assessment needed.¹⁰ In the presence of haemodynamic instability, the adult life support (ALS) tachyarrhythmia algorithm should be followed.¹³

Conclusion

A careful clinical assessment is paramount in the management of pregnant women where a tachycardia has been identified. The management of tachyarrhythmias in pregnancy is very similar to the non-pregnant population, although expert guidance should be sought to help manage less common arrhythmias including atrial and ventricular tachycardias. Collaboration between teams including obstetricians, obstetric physicians, anaesthetists and

cardiologists is required for women with pathological arrhythmias to ensure they are appropriately cared for and to make safe delivery plans. ■

References

- 1 Smith GB, Isaacs R, Andrews L *et al*. Vital signs and other observations used to detect deterioration in pregnant women: an analysis of vital sign charts in consultant-led UK maternity units. *International Journal of Obstetric Anesthesia* 2017;30:44–51.
- 2 Green L, Mackillop L, Salvi D *et al*. Gestation-specific vital sign reference ranges in pregnancy. *Obstetrics & Gynecology* 2020;3:653–64.
- 3 Knight M, Bunch K, Tuffnell D *et al*. *Saving lives, improving mothers' care: Lessons learned to inform maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2016-18*. University of Oxford, 2020.
- 4 Knight M, Bunch K, Tuffnell D *et al*. *Saving lives, improving mothers' care: Lessons learned to inform maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2015-17*. University of Oxford, 2019.
- 5 Royal College of Physicians. *Acute care toolkit 15: Managing acute medical problems in pregnancy*. RCP, 2019. www.rcplondon.ac.uk/guidelines-policy/acute-care-toolkit-15-managing-acute-medical-problems-pregnancy
- 6 Royal College of Obstetricians and Gynaecologists. *Reducing the risk of venous thromboembolism during pregnancy and the puerperium: green-top guideline no 37a*. London: RCOG, 2015.
- 7 Pavord S, Daru J, Prasannan N *et al*. UK guidelines on the management of iron deficiency in pregnancy. *Br J Haematol* 2020;188: 819–30.
- 8 Alexander E, Pearce E, Brent G *et al*. 2017 Guidelines of the American Thyroid Association for the diagnosis and management of thyroid disease during pregnancy and the postpartum. *Thyroid* 2017;27:315–89.
- 9 Regitz-Zagrosek V, Roos-Hesselink J, Bauersachs J *et al*. 2018 ESC guidelines for the management of cardiovascular diseases during pregnancy: The Task Force for the management of cardiovascular diseases during pregnancy of the European Society of Cardiology (ESC). *European Heart Journal* 2018;39:3165–241.
- 10 Kugamoorthy P, Spears D. Management of tachyarrhythmias in pregnancy - a review. *Obstetric Medicine* 2020;13:159–73.
- 11 Sheldon R, Grubb B, Olshansky B *et al*. 2015 heart rhythm society expert consensus statement on the diagnosis and treatment of postural tachycardia syndrome, inappropriate sinus tachycardia, and vasovagal syncope. *Heart Rhythm* 2015;12:41–63.
- 12 Silversides C, Harris L, Haberer K *et al*. Recurrence rates of arrhythmias during pregnancy in women with previous tachyarrhythmia and impact on fetal and neonatal outcomes. *Am J Cardiol* 2006; 97:1206–12.
- 13 Resuscitation Council UK. *Adult tachycardia*. Resuscitation Council UK, 2021 <https://www.resus.org.uk/sites/default/files/2021-04/Tachycardia%20Algorithm%202021.pdf> [Accessed 29th June 2021]
- 14 Belham M, Patient C, Pickett J. Inappropriate sinus tachycardia in pregnancy: a benign phenomena? *BMJ Case Rep* 2017;2017: bcr2016217026.

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