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M U N D A R I J A

Article / Original Paper

ARRHYTHMIAS IN THE THIRD TRIMESTER: CLINICAL IMPLICATIONS AND EMERGENCY PROTOCOLS

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Annotation: The third trimester of pregnancy is a critical period marked by profound cardiovascular and hormonal changes that can precipitate or exacerbate arrhythmias. This article explores the pathophysiology, types, clinical impact, and emergency management of arrhythmias encountered in late pregnancy. With a focus on maternal and fetal safety, the article reviews current evidence-based strategies and protocols for timely intervention.

Keywords: Arrhythmia, third trimester, pregnancy, supraventricular tachycardia, atrial fibrillation, emergency care, maternal health, fetal outcomes.

UCHINCHI TRIMESTRDAGI ARITMIYALAR: KLINIK AHAMIYATI VA FAVQULODDA YORDAM PROTOKOLLARI

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Toshkent viloyati Respublika ixtisoslashtirilgan ilmiy-amaliy tibbiyot markazi (RShTYoIM) kardiologi

Annotatsiya. Homiladorlikning uchinchi trimestri yurak-qon tomir tizimi va gormonal o‘zgarishlarning chuqur ta’siri ostida bo‘lib, bu aritmiyalarni keltirib chiqarishi yoki ularni kuchaytirishi mumkin bo‘lgan muhim davrdir. Ushbu maqola kechki homiladorlik davrida uchraydigan aritmiyalarning patofiziologiyasi, turlari, klinik ta’siri va favqulodda davolash usullarini o‘rganadi. Ona va homila xavfsizligiga e’tibor qaratib, maqola o‘z vaqtida aralashuv uchun hozirgi dalillarga asoslangan strategiyalar va protokollarni ko‘rib chiqadi.

Kalit so’zlar: Aritmiya, uchinchi trimestr, homiladorlik, supraventrikulyar taxikardiya, qorinchalar fibrillyatsiyasi, favqulodda yordam, ona salomatligi, homila natijalari.

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1.Introduction

Cardiovascular adaptations in pregnancy, such as increased blood volume, cardiac output, and hormonal influences, reach their peak in the third trimester. These physiological shifts are essential for supporting fetal development but can also contribute to electrical instability within the myocardium. The increased sympathetic tone, elevated estrogen and progesterone levels, and myocardial stretch act synergistically to predispose pregnant women to arrhythmic events. In particular, structural changes such as atrial enlargement may provide a substrate for atrial arrhythmias. Additionally, reduced vagal tone and heightened adrenergic activity near term further elevate the risk of supraventricular and ventricular arrhythmias.

These changes can lead to new-onset arrhythmias or exacerbate preexisting conditions, posing risks to both maternal and fetal health. Clinical manifestations may range from benign palpitations to hemodynamically significant episodes requiring urgent intervention. Complications can include decreased uteroplacental perfusion, intrauterine growth restriction, preterm labor, and, in rare cases, maternal or fetal demise. Prompt diagnosis and comprehensive management are vital to minimize adverse outcomes. A multidisciplinary team involving cardiologists, obstetricians, anesthesiologists, and neonatologists is often required to coordinate care. This article discusses common arrhythmias during the third trimester, their underlying mechanisms, and provides a clinical framework for effective and timely emergency management supported by current guidelines and recent research.

2. Common Arrhythmias in Late Pregnancy

2.1 Supraventricular Tachycardia (SVT):

SVT is the most frequent arrhythmia observed in pregnancy, with AVNRT and AVRT being the predominant types. Episodes often present with palpitations, dizziness, or presyncope and can be triggered by increased autonomic tone, expanded intravascular volume, and elevated estrogen levels, all of which contribute to heightened myocardial excitability. Electrocardiographic findings typically include narrow QRS complexes, and diagnosis may require ambulatory monitoring in cases with intermittent symptoms.

While SVT is typically benign in healthy pregnant women, recurrent or sustained episodes can result in maternal anxiety, reduced cardiac output, and compromised uteroplacental perfusion. These outcomes may lead to fetal distress or intrauterine growth restriction in severe cases. Management begins with non-pharmacological approaches such as vagal maneuvers. If ineffective, pharmacologic interventions—most commonly adenosine—are employed due to its rapid onset and proven safety profile in pregnancy (Regitz-Zagrosek et al., 2018). For patients with recurrent SVT or poor response to initial therapies, beta-blockers like metoprolol may be used cautiously. Catheter ablation is generally deferred until postpartum unless arrhythmia poses a significant threat (Tamirisa et al., 2022; Yuldasheva, 2024).

2.2 Atrial Fibrillation (AF):

AF is less common in pregnancy than SVT, but it can be serious, particularly in women with underlying structural heart disease, hypertensive disorders, or prior arrhythmic history. The incidence of AF is rising due to increasing maternal age and prevalence of comorbidities such as obesity and valvular disease. Clinically, AF may present with palpitations, fatigue, shortness of breath, or signs of decompensated heart failure. AF in pregnancy is associated with increased thromboembolic risk, which can lead to maternal stroke or placental insufficiency. Fetal complications include intrauterine growth restriction, preterm delivery, and increased neonatal intensive care unit (NICU) admissions. Management of AF must weigh the risks and benefits of rate versus rhythm control while prioritizing fetal safety.

Beta-blockers (preferably metoprolol) and non-dihydropyridine calcium channel blockers (such as verapamil) are often used for rate control. Rhythm control may be considered in symptomatic patients or those with poor ventricular rate control, using cardioversion or class III antiarrhythmics such as sotalol under close monitoring. Anticoagulation decisions are guided by thromboembolic risk, though standard scoring systems like CHA2DS2-VASc are not validated in pregnancy. Low molecular weight heparin is

preferred when anticoagulation is indicated (Regitz-Zagrosek et al., 2018; Williams et al., 2021).

2.3 Ventricular Arrhythmias (VAs):

Ventricular tachycardia (VT) and ventricular fibrillation (VF) are rare but potentially fatal arrhythmias that may manifest during the third trimester, particularly in women with underlying structural heart conditions such as dilated cardiomyopathy, hypertrophic cardiomyopathy, or inherited arrhythmia syndromes like long QT syndrome (LQTS) and arrhythmogenic right ventricular cardiomyopathy (ARVC). These conditions may be previously diagnosed or may present for the first time during pregnancy. The physiological stress of late pregnancy, including increased cardiac output, volume overload, and hormonal shifts, can unmask latent ventricular irritability. Clinical presentations often include palpitations, syncope, or hemodynamic collapse. VAs can lead to sudden cardiac death if not promptly treated. Management involves immediate advanced cardiac life support (ACLS) protocols with modifications for pregnancy, including left uterine displacement and continuous fetal monitoring.

Electrical cardioversion is considered safe in all trimesters and is the first-line intervention in unstable VT or VF. In stable patients, beta-blockers and antiarrhythmic medications such as sotalol or lidocaine may be used with careful maternal and fetal monitoring. For patients with known LQTS or frequent recurrent VT, prophylactic therapy with beta-blockers like nadolol and avoidance of QT-prolonging drugs are crucial (Regitz-Zagrosek et al., 2018; Tamirisa et al., 2022). A multidisciplinary approach involving cardiology, electrophysiology, obstetrics, and anesthesia is essential for optimizing outcomes.

2.4 Premature Beats:

Premature atrial contractions (PACs) and premature ventricular contractions (PVCs) are commonly observed in pregnant women and are often benign, especially when infrequent. These ectopic beats may be triggered by hormonal changes, increased intravascular volume, heightened sympathetic tone, or transient electrolyte imbalances. While isolated premature beats do not typically require treatment, their presence warrants clinical attention if they are frequent, symptomatic, or associated with underlying structural heart disease. In particular, a PVC burden exceeding 10% over 24 hours has been associated with the development of PVC-induced cardiomyopathy, even in the absence of preexisting heart disease. This condition is characterized by a reduction in left ventricular ejection fraction, which can worsen maternal hemodynamics and impact fetal perfusion. A prospective study found that pregnant women with a high PVC burden experienced increased risks of adverse cardiovascular events and fetal complications, including small-for-gestational-age infants and preterm birth (Williams et al., 2021).

Management includes reassurance in asymptomatic patients with low PVC burden and normal cardiac function. In symptomatic cases or those with reduced ejection fraction, beta-blockers (excluding atenolol) or calcium channel blockers may be considered. Echocardiographic monitoring is recommended to evaluate for cardiomyopathy in high-burden cases. Postpartum follow-up is essential to ensure resolution of arrhythmias and recovery of cardiac function.

3. Pathophysiological Triggers

Hormonal changes, electrolyte imbalances, anemia, and increased sympathetic tone all contribute to arrhythmogenic risk in the third trimester. The substantial elevation in estrogen and progesterone levels affects ion channel regulation, which can alter the myocardial action potential and increase susceptibility to both atrial and ventricular arrhythmias. These hormonal shifts are particularly influential in promoting automaticity and enhancing reentry mechanisms in cardiac tissues.

In parallel, physiological anemia and hemodilution reduce oxygen-carrying capacity, which may exacerbate myocardial irritability under stress. Heightened sympathetic activity—further amplified by physical discomfort, emotional stress, and labor pain—stimulates beta-adrenergic receptors, promoting increased heart rate and myocardial excitability. These effects are compounded by pregnancy-related changes in electrolyte levels, particularly hypokalemia or hypomagnesemia, which disturb the cardiac resting membrane potential and facilitate ectopic activity.

Structural heart strain caused by volume overload and increased cardiac output results in chamber dilation, especially of the atria. This geometric remodeling creates an ideal substrate for atrial arrhythmias such as SVT and AF. Moreover, increased myocardial sensitivity to catecholamines—due to both endogenous stress and pharmacologic agents used during pregnancy or delivery—can precipitate severe arrhythmic episodes in susceptible individuals (Yuldasheva, 2024; Tamirisa et al., 2022; Regitz-Zagrosek et al., 2018).

4. Clinical Implications

Maternal symptoms of arrhythmias in the third trimester can range from mild palpitations and fatigue to severe chest discomfort, lightheadedness, syncope, or signs of heart failure. These symptoms may be transient or persistent and often overlap with physiological symptoms of late pregnancy, making diagnosis more challenging. It is essential to distinguish between benign and pathological arrhythmias to avoid unnecessary interventions or delayed treatment. Fetal implications are closely tied to maternal hemodynamic status. Sustained tachyarrhythmias or bradyarrhythmias can impair cardiac output, reduce uteroplacental blood flow, and lead to fetal hypoxia, intrauterine growth restriction (IUGR), or preterm labor. Some arrhythmias, if untreated, may necessitate urgent delivery to prevent fetal compromise.

Hemodynamically unstable arrhythmias, including sustained ventricular tachycardia or atrial fibrillation with rapid ventricular response, may result in acute maternal decompensation and are obstetric emergencies. In such cases, early stabilization and coordinated multidisciplinary decision-making are essential, potentially including pharmacologic therapy, electrical cardioversion, or expedited delivery.

Clinical vigilance is crucial, especially in women with known cardiac disease or previous arrhythmic episodes. Continuous ECG monitoring, echocardiographic evaluation, and fetal heart rate surveillance may be warranted. The goal is to balance maternal symptom relief and rhythm control while minimizing risks to fetal development and pregnancy outcomes.

5. Emergency Management Protocols

Managing arrhythmias in the third trimester requires immediate action to stabilize the mother while minimizing risks to the fetus. A multidisciplinary, protocol-driven approach should be employed in all emergency settings. The primary objectives are to restore

hemodynamic stability, manage the arrhythmia safely, and ensure continuous fetal monitoring.

5.1 Initial Stabilization

The initial evaluation should follow the ABCDE approach (Airway, Breathing, Circulation, Disability, Exposure), with specific adaptations for late pregnancy:

- **Positioning**: Place the mother in a left lateral decubitus position to reduce aortocaval compression and optimize venous return.
- **Oxygen Therapy**: Administer oxygen via a face mask or nasal cannula to maintain maternal oxygen saturation >95%.
- **Intravenous Access**: Establish large-bore IV access to allow for fluid resuscitation or medication administration.
- **Continuous ECG Monitoring**: To assess rhythm type, rate, and potential ischemic changes.
- **Fetal Monitoring**: Apply continuous external fetal heart rate monitoring to detect early signs of fetal distress.
- **Vital Signs and Labs**: Monitor blood pressure, heart rate, and respiratory rate. Order labs including complete blood count, electrolytes (K^+, Mg^{2+}), thyroid function, and troponins if myocardial ischemia is suspected.

5.2 Pharmacologic Management

Pharmacologic treatment depends on the arrhythmia type and the maternal-fetal risk profile. Most drugs used in pregnancy are off-label, and choices must be guided by safety classifications and clinical urgency.

a. Supraventricular Tachycardia (SVT)

- **Vagal maneuvers**: First-line, including modified Valsalva technique.
- **Adenosine**: 6 mg IV bolus followed by 12 mg if needed. First-line pharmacologic agent, with excellent safety profile due to its ultra-short half-life.
- **Beta-blockers**: Metoprolol or labetalol may be used if SVT recurs or adenosine is ineffective. Atenolol is contraindicated due to fetal growth restriction.
- **Verapamil or digoxin**: Alternatives if beta-blockers are contraindicated, particularly in asthmatic patients (Regitz-Zagrosek et al., 2018; Tamirisa et al., 2022).

b. Atrial Fibrillation (AF) / Atrial Flutter

- **Rate control**: Use beta-blockers (metoprolol) or calcium channel blockers (verapamil, diltiazem). Avoid atenolol.
- **Rhythm control**: Indicated in unstable or highly symptomatic patients. Use electrical cardioversion or sotalol cautiously if required.
- **Anticoagulation**: LMWH is preferred for stroke prevention in high-risk cases. Use with fetal monitoring and obstetric collaboration.

c. Ventricular Arrhythmias (VT/VF)

- **Unstable VT/VF**: Initiate Advanced Cardiac Life Support (ACLS) with modifications for pregnancy:
  - Immediate electrical cardioversion/defibrillation
  - Left uterine displacement
  - Intubation if necessary

- **Stable monomorphic VT**: Consider lidocaine or sotalol. Avoid amiodarone unless life-threatening arrhythmia persists.

- **Frequent PVCs or nonsustained VT**: Use beta-blockers and correct any underlying electrolyte abnormalities.

5.3 Electrical Cardioversion

- **Indications**: Hemodynamic instability, refractory arrhythmias, or poor drug response.

- **Safety**: Electrical cardioversion is safe in all trimesters and has no known teratogenic effects (Williams et al., 2021; Tamirisa et al., 2022).

- **Monitoring**: Should be performed with continuous fetal monitoring and readiness for emergency delivery if fetal compromise occurs post-shock.

- **Sedation**: Use short-acting agents such as midazolam or etomidate under anesthesiology supervision.

5.4 Delivery Considerations in Arrhythmic Patients

- **Timing**: For women with recurrent, drug-resistant arrhythmias or structural heart disease, early delivery (37–38 weeks) may be considered.

- **Mode of delivery**: Vaginal delivery is usually preferred if rhythm is controlled and there are no obstetric contraindications. Cesarean section is reserved for:
  - Uncontrolled arrhythmias
  - Decompensated heart failure
  - Indications unrelated to arrhythmia (e.g., fetal distress)

- **Intrapartum care**: Continuous cardiac and fetal monitoring, access to emergency cardioversion, and tailored anesthesia planning are essential.

6. Conclusion

The third trimester of pregnancy represents a physiologically dynamic period in which the cardiovascular system undergoes significant changes to support fetal development. These adaptations—while normal—can provoke new-onset arrhythmias or exacerbate existing conditions, placing both maternal and fetal health at risk. Supraventricular tachycardia (SVT), atrial fibrillation (AF), and ventricular arrhythmias (VAs) are among the most clinically relevant presentations in late pregnancy. Although some arrhythmias are benign and self-limiting, others may lead to hemodynamic instability, fetal compromise, or life-threatening maternal events if left unmanaged.

A careful and timely diagnostic process is essential, beginning with hemodynamic assessment and fetal monitoring. Treatment must be guided by the arrhythmia type, symptom severity, and maternal-fetal safety. First-line therapies such as vagal maneuvers, adenosine, and beta-blockers (excluding atenolol) have established roles in SVT management. Rate and rhythm control strategies, as well as anticoagulation when indicated, are central to managing AF, while prompt cardioversion and advanced life support protocols are lifesaving in cases of ventricular arrhythmias. As shown by recent guidelines and studies, including those by Regitz-Zagrosek et al. (2018), Tamirisa et al. (2022), Williams et al. (2021), and Yuldasheva (2024), most arrhythmias in pregnancy can be managed effectively with evidence-based interventions and interdisciplinary care. Emergency management protocols tailored to pregnant women—such as positioning to avoid aortocaval compression and integrating fetal heart rate monitoring—should be standard practice in obstetric and emergency settings.

Equally important is preparation for potential early delivery, especially in patients with refractory arrhythmias or compromised fetal well-being.

Ultimately, optimizing outcomes for both mother and fetus requires a multidisciplinary approach, including cardiologists, obstetricians, anesthesiologists, and neonatologists. Continued research, clinician education, and institutional preparedness are vital in refining protocols and improving maternal cardiovascular care. With vigilant monitoring and appropriate intervention, the majority of arrhythmias in the third trimester can be managed safely, ensuring a healthy transition into delivery and the postpartum period.

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