

## Assessment and Treatments for Fetal Arrhythmias During Pregnancy: A Mini Review

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### ABSTRACT

The diagnosis and management of fetal arrhythmias, a common occurrence during pregnancy. This concise review delves into the latest literature spanning two decades, focusing on prenatal diagnosis techniques such as fetal magnetocardiograms and electrocardiograms. Additionally, the review discusses various treatment methods, including transplacental therapy and administration of antiarrhythmic medications. The outcomes of intrauterine therapy are examined concerning different types and origins of fetal arrhythmias, emphasizing the importance of tailored interventions based on specific fetal conditions. The review underscores the significance of timely and appropriate interventions, including fetal cardiac pacing and postnatal pacemaker implantation, in managing persistent or severe cases of fetal arrhythmias.

**Keywords:** Fetal Arrhythmias; Pregnancy; Prenatal Diagnosis; Fetal Magnetocardiogram; Antiarrhythmic Medications.

### INTRODUCTION

Fetal arrhythmias are a common occurrence, stemming from various causes. The diagnosis and management of these conditions during pregnancy remain topics of ongoing discussion. Recent literature spanning two decades has been extensively examined regarding the prenatal diagnosis and treatment of fetal arrhythmias. Both fetal magnetocardiograms and electrocardiograms are instrumental in providing insights into heart intervals, including QRS and QT intervals. M-mode ultrasonography detects AV and VA intervals, fetal heart rate, and AV conduction, while Doppler ultrasound can record atrial and ventricular waves simultaneously.

Benign fetal arrhythmias such as premature contractions and sinus tachycardia do not necessitate intervention

before or after birth. However, active intervention becomes crucial for persistent fetal arrhythmias, which can lead to serious complications like hydrops fetalis, cardiac dysfunction, or fetal demise. In cases of fetal tachyarrhythmias, intrauterine therapy has been administered through the transplacental method. If this maternal treatment approach proves ineffective, antiarrhythmic medications can be injected either intraumbilically, intraperitoneally, or directly into the fetal muscle.

The specific type and origin of fetal arrhythmias, as well as the overall fetal condition, significantly influence the outcomes of intrauterine therapy for fetal tachyarrhythmias. In most cases, first-line antiarrhythmic drugs can effectively manage fetal arrhythmias through transplacental administration. For instances resistant to medication or cases where there is hemodynamic compromise, fetal cardiac pacing serves as an effective method to restore normal sinus rhythm. In refractory situations, immediate postnatal pacemaker implantation becomes necessary [1].

## DESCRIPTION

Fetal arrhythmias, identified in 1-3% of pregnancies, account for 10-20% of fetal cardiology referrals. Various types of arrhythmias, including premature atrial contractions (PACs), atrial bigeminal ectopic beats, premature ventricular contractions (PVCs), supraventricular tachycardia (SVT), ventricular tachycardia, second-degree atrioventricular (AV) block, and second-degree AV block, were observed in a 10-year study involving 45 cases. Among these cases, 41.4% were fetal tachycardias (10 SVT, 2 atrial flutter), 17.2% were fetal bradyarrhythmias (all with AV block), and 41.4% displayed irregular cardiac rhythms (premature atrial beats). Malignant fetal arrhythmias like total AV block and SVT are rare, occurring in 1 in 5000 pregnancies [1].

Benign arrhythmias, such as PACs below 11 beats per minute (bpm) and sinus tachycardias, require no prenatal or postnatal therapy. However, postnatal arrhythmias linked to hemodynamic fluctuations necessitate intervention due to their association with preterm delivery. Prolonged fetal arrhythmias heighten the risks of conditions like hydrops fetalis, cardiac dysfunction, and fetal death, underscoring the importance of prenatal therapy to enhance fetal survival rates. This study aims to delve into the intricate realm of prenatal assessment and intrauterine treatments for fetal arrhythmias [2].

In the early stages of pregnancy, challenges such as an unfavorable fetal position, hydrops fetalis, fetal cardiac contractile dysfunction, and maternal obesity can hinder the detection of fetal arrhythmias. M-mode ultrasound proves valuable, detecting atrioventricular (AV) and ventriculoatrial (VA) intervals, fetal heart rate, AV conduction, and even ejection fraction. Researchers like Crowley et al. utilized a two-dimensional scan head with M-mode recordings, relying on semilunar and AV valve points, A waves, and ventricular wall motion to assess fetal heart rate and rhythm. For certain cases, two-dimensional echo sufficed to identify arrhythmias, providing superior real-time images of atria and ventricles compared to standard M-mode views [3].

Doppler ultrasound allows simultaneous recordings of atrial and ventricular waves. Doppler echocardiography aids in distinguishing between different fetal tachycardias, using short and long VA intervals to identify conditions like AV nodal reentrant tachycardia and permanent junctional reciprocating tachycardia. Doppler ultrasound excels in capturing flow velocity waveforms in the ascending aorta and superior vena cava, displaying characteristic patterns indicating 1:1 AV conduction and specific wave configurations in cases of VA tachycardia. However, unfavorable fetal positioning during recording may affect results. Pulse Doppler echocardiography, by analyzing flow imaging frequency spectra of pulmonary arteries and veins, differentiates atrial and ventricular systoles and measures the PR interval [1].

Conventional fetal electrocardiography (ECG) provides signal averages of electrocardiographic complexes, lacking beat-to-beat analysis and accuracy in irregular heart rhythm cases. In contrast, fetal magnetocardiography (MCG) excels due to superior signal transmission qualities, offering real-time detection and classification of arrhythmias. MCG aids in prenatal diagnosis of various fetal arrhythmias, including complete AV block, premature contractions, paroxysmal supraventricular tachycardia (SVT), Wolff-Parkinson-

White syndrome, and long QT syndrome. However, it requires a magnetically protected environment for optimal results. Both MCG and ECG offer insights into cardiac intervals such as QRS and QT intervals [4].

Fetal arrhythmias manifest in diverse forms, each carrying a distinct prognosis. Tailored and individualized treatments must be determined based on the specific condition of the patient. Premature contractions stand as the most common fetal arrhythmia, often exhibiting a favorable short- and long-term prognosis without adverse effects on fetal growth and development. Rapid fetal arrhythmias, particularly supraventricular tachycardia (SVT), are relatively common, occurring in 0.4-0.6% of all fetuses. The majority of these cases arise from nonorganic, predominantly transient causes.

Early interventions like steroids and/or plasmapheresis for fetal bradycardia have shown limited therapeutic benefits, sparking ongoing debates within the medical community. The clinical outcome and prognosis of patients are primarily determined by the type and severity of the heart abnormality present. When fetal arrhythmia, especially bradycardia, is detected, meticulous attention is crucial to assess the presence of underlying cardiac structural abnormalities. Appropriate clinical measures must be promptly implemented, considering both short- and long-term outcomes for the patient [5].

## CONCLUSION

Premature contractions and sinus tachycardia represent non-threatening fetal arrhythmias that do not necessitate immediate perinatal intervention. Conversely, sustained fetal arrhythmias, which can lead to severe complications such as hydrops fetalis, cardiac dysfunction, or fetal mortality, require prompt and decisive treatment. The success of intrauterine therapy for fetal tachyarrhythmias hinges on the specific type of arrhythmia, its underlying causes, and the overall fetal condition, including the presence of hydrops fetalis, cardiac functionality, and maternal autoantibody status. Utilizing first-line antiarrhythmic medications administered through the transplacental route has demonstrated a high rate of converting abnormal rhythms to a normal state.

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