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During Pregnancy, Foetal Arrhythmias are Monitored and Treated Intrauterinally

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Abstract

Introduction: Fetal arrhythmias are a common phenomenon with rather complicated etiologies. Debates remain regarding prenatal diagnosis and treatment of fetal arrhythmias.

Method: The literature reporting on prenatal diagnosis and treatment of fetal arrhythmias published in the recent two decades were retrieved, collected and analyzed.

Result: Both fetal magnetocardiogram and electrocardiogram provide information of cardiac time intervals, including the QRS and QT durations. M-mode ultrasound detects the AV and VA intervals, fetal heart rate, and AV conduction. By using Doppler ultrasound, simultaneous recording of the atrial and ventricular waves can be obtained. Benign fetal arrhythmias, including premature contractions and sinus tachycardia, do not need any treatment before and after birth. Sustained fetal arrhythmias that predispose to the occurrence of hydrops fetalis, cardiac dysfunction or eventual fetal demise require active treatments. Intrauterine therapy of fetal tachyarrhythmias has been carried out by the transplacental route. If maternal transplacental treatment fails, intraumbilical, intraperitoneal, or direct fetal intramuscular injection of antiarrhythmic agents can be attempted.

Conclusion: The outcomes of intrauterine therapy of fetal tachyarrhythmias depend on the types or etiology of fetal arrhythmias and fetal conditions. Most are curable to a transplacental treatment by the first-line antiarrhythmic agents. Fetal cardiac pacings are effective methods to restore sinus rhythm in drug-resistant or hemodynamically compromised cases. Immediate postnatal pacemaker implantation is warranted in refractory cases.

Keywords: Chronic heart failure • Neprilysin • Inhibitor/Sacubitril • Valsartan • Cardiac resynchronization therapy

Introduction

Fetal arrhythmias are a common occurrence with a variety of causes. Prenatal diagnosis and management of foetal arrhythmias are still up for debate.The most recent two decades' worth of literature on prenatal diagnosis and therapy of foetal arrhythmias was downloaded, gathered, and assessed. Both a foetal magnetocardiogram and an electrocardiogram can provide information on heart time intervals, such as the QRS and QT intervals. The AV and VA intervals, foetal heart rate, and AV conduction are all detected with M-mode ultrasonography. The atrial and ventricular waves can be recorded simultaneously using Doppler ultrasound. Premature contractions and sinus tachycardia are benign foetal arrhythmias that do not require therapy before or after birth. Active therapy is required for persistent foetal arrhythmias that can lead to hydrops fetalis, cardiac dysfunction, or foetal death. The transplacental method has been used for intrauterine therapy of foetal tachyarrhythmias. If maternal transplacental treatment fails, antiarrhythmic medicines can be injected intraumbilically, intraperitoneally, or directly into the foetal muscle. The types or genesis of foetal arrhythmias, as well as foetal circumstances, influence the outcomes of intrauterine therapy for foetal tachyarrhythmias. The majority can be treated transplacentally with first-line antiarrhythmic drugs. In drug-resistant or hemodynamically compromised instances, foetal cardiac pacings are effective ways to reestablish sinus rhythm. In refractory cases, a postnatal pacemaker should be implanted right away [1].

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Definition

Fetal arrhythmias are identified in 1–3 percent of pregnancies, and 10–20 percent of foetal cardiology referrals are due to them. Premature atrial contractions (PACs) (28/45, 62.2 percent), atrial bigeminal ectopic beats (3/45, 6.7 percent), premature ventricular contractions (PVCs) (2, 4.4 percent), supraventricular tachycardia (SVT) (5/45, 11.1 percent), ventricular tachycardia (1, 2.2 percent), second-degree atrioventricular (AV) block (1, 2.2 percent) and second-degree. A 10-year study of pregnant women found 29 cases of foetal arrhythmias, with 12 (41.4%) being foetal tachycardias (10 cases with SVT, 2 cases with atrial flutter (AF)), 5 (17.2%) being foetal bradyarrhythmias (all 5 cases with AV block), and 12 (41.4%) being foetal irregular cardiac rhythms (premature atrial beats). Malignant foetal arrhythmias, such as total AV block and SVT, are quite uncommon, occurring in 1 in 5000 pregnancies [1].

Fetuses with benign arrhythmias, such as PACs under 11 beats per minute (bpm) and sinusal tachycardias, did not require therapy before or after birth; however those with postnatal arrhythmias associated with hemodynamic fluctuations did, as they can lead to preterm delivery. Furthermore, prolonged foetal arrhythmias increase the risk of hydrops fetalis, cardiac dysfunction, and even foetal death. As a result, prenatal therapy is necessary to improve foetal survival rates. The purpose of this study is to explore the complex and difficult subject of foetal arrhythmias prenatal assessment and intrauterine treatments [2].

Diagnosis

Early detection in the first trimester, unfavourable foetal position, hydrops fetalis, foetuses with cardiac contractile dysfunction, and obese pregnant women may compromise detection qualities. M-mode ultrasound can detect the AV and ventriculoatrial (VA) intervals, foetal heart rate, AV conduction, and even ejection fraction. For the diagnosis of foetal arrhythmias, Crowley et al.

used a two-dimensional scan head with M-mode recordings. Semilunar and AV valve opening and closing points, as well as a waves and ventricular wall motion, were used to determine foetal heart rate and rhythm. Two-dimensional echo alone was used to identify arrhythmias in two foetuses in their patient context. Anatomic M-mode views provide simultaneous two-dimensional real-time images, allowing for better atria and ventricle tracings than regular M-mode views [3].

Simultaneous recordings of atrial and ventricular waves can be acquired using Doppler ultrasound. Mechanical VA intervals can be characterised as short or long VA intervals in SVT. Doppler echocardiography can help distinguish between kinds of foetal tachycardias with short and long VA intervals, such as AV nodal reentrant tachycardia and permanent junctional reciprocating tachycardia. The Doppler ultrasound captures flow velocity waveforms in the ascending aorta and superior vena cava better than the M-mode. It may show a characteristic Doppler flow velocity pattern with a 1:1 AV conduction and a tall A wave superimposed on the aortic ejection wave in foetuses with brief VA tachycardia. It was diagnosed as a fast-conducting AV accessory route reentrant tachycardia. An A wave of normal amplitude and AV time interval might be identified in advance of the aortic ejection wave in protracted VA tachycardia. Doppler waveforms obtained in the inferior vena cava and descending aorta aid in the simultaneous acquisition of atrial and ventricular systoles. However, when the foetus is in an unsuitable position for simultaneous recordings, the results may be harmed. The pulse Doppler echocardiography may detect the rhythm variations between the spectra and the arrhythmic patterns by detecting the flow imaging frequency spectrum of the pulmonary arteries and pulmonary veins. This method can easily distinguish between atrial and ventricular systoles as well as measure the PR interval [4].

By detecting the signal averaging of electrocardiographic complexes, foetal electrocardiography (ECG) does not give beat-to-beat analysis. As a result, it's useless for identifying foetal rhythm and conduction abnormalities in patients with irregular heart rhythms. Due to the more advantageous transmission qualities of magnetic signals, foetal magnetocardiography (MCG) enables for real-time detection and classification of arrhythmias with greater signal quality than electrocardiography. Complete AV block, premature contractions, paroxysmal SVT, Wolff-Parkinson-White syndrome, and long QT syndrome are among the foetal arrhythmias that can be diagnosed prenatally. The use of the magnetic counterpart of ECG, on the other hand, necessitates the usage of a magnetically protected environment. MCG and ECG can both provide information about cardiac time intervals such the QRS and QT intervals [5-7].

Prognosis

There are several forms of foetal arrhythmia, each with a different prognosis. Individualized treatment and clinical treatment should be determined based on the type of person. Premature contractions are the most prevalent kind of foetal arrhythmia, with a good short- and long-term prognosis and no effect on foetal growth and development. Rapid foetal arrhythmia, particularly SVT, is relatively common, accounting for 0.4-0.6 percent of all foetuses. The majority of fast foetal arrhythmia is caused by a nonorganic, mainly transitory lesion. Early treatment with steroids and/or plasmapheresis for foetal bradycardia has demonstrated minimal therapeutic benefit, and it is still debatable. The kind and amount of heart abnormality usually determines the patient's clinical outcome and prognosis. When foetal arrhythmia is discovered, especially foetal bradycardia, careful attention should be devoted to whether cardiac structural abnormalities are present. In terms of outcomes and prognosis, appropriate clinical measures should be taken into account [8-10].

Conclusion

Benign fetal arrhythmias, such as premature contractions and sinus tachycardia, do not need any perinatal treatments. Sustained fetal arrhythmias that predispose to the occurrence of hydrops fetalis, cardiac dysfunction, or even fetal demise require early treatments. The effect of intrauterine therapy of fetal tachyarrhythmias depends on the types or etiology of fetal arrhythmia and fetal conditions (hydrops fetalis, cardiac function, and maternal autoantiboy positivity, etc.) to the conversion rate was high with the use of the first-line antiarrhythmic agents via the transplacental route. Fetal cardiac pacings are effective methods to restore sinus rhythm in drug-resistant or hemodynamically compromised cases. Immediate postnatal pacemaker implantation is warranted in refractory cases.

Acknowledgement

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Conflict of Interest

None.

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