Inappropriate Sinus Tachycardia: The Role of Transvaginal Fetal Echocardiography - Case Report

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Abstract

Introduction: The inappropriate sinus tachycardia is rare in the general population, more frequently affects young women, and its etiology is unknown. It is characterized by a persistently elevated cardiac frequency with an exaggerated response to physical activity. Objective: Report a rare case of inappropriate sinus tachycardia in the early phase of pregnancy and emphasize the importance of transvaginal fetal echocardiography. Case report: Pregnant referred due to persistent fetal tachycardia after obstetric ultrasonography. The transvaginal echocardiogram performed at 9 weeks´ gestation showed a fetal heart rate of 240 beats/min (bpm) with normal conduction from atria to ventricles (1:1) and no signs of hydropsy. Digoxin therapy and Flecainide were used with no success. Sotatol use was chosen when the fetal heart rate (HR) reduced to tolerable levels and then the number of heartbeats normalized at thirty six weeks gestation. The baby was born well at term and developed persistent tachycardia. The electrocardiogram performed showed P-wave morphology of sinus rhythm. Possible causes of sinus tachycardia were excluded, thus confirming the diagnosis above. Comments: The author describes the importance of transvaginal fetal echocardiography for the diagnosis and early treatment of fetal arrhythmias avoiding complications.

Keywords: **Tachycardia Sinus; Fetal Heart; Echocardiography; Pregnant Women.**

Introduction

Inappropriate sinus tachycardia (IST) is a rare type of arrhythmia characterized by a persistent and exaggerated increase in heart rate (HR). Its etiology is unknown, and possibly this is a primary abnormality of the sinus node or a primary disorder of the autonomic nervous system, with increased sympathetic activity of the sinus node[1,2]. The initial diagnosis of IST often occurs in young women, being very rare in fetal life. This study presents a case whose unusual course of intrauterine sinus tachycardia drew attention to this diagnosis, which was confirmed after birth.

Objective

To report a rare case of inappropriate sinus tachycardia during the fetal life, discussing the differential diagnosis and treatment, emphasizing the importance of transvaginal fetal echocardiography in the early pregnancy to the diagnosis and treatment of fetal arrhythmias, in order to avoid complications.

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Case Report

LFSO, primigravida, 27 years old, was referred for fetal echocardiography due to persistent fetal tachycardia (210-220 beats per minute) on two obstetric ultrasonography performed at seven and nine weeks of pregnancy.

The transvaginal fetal echocardiogram showed an average fetal heart rate (HR) of 230-240 beats per minute (bpm) with 1:1 atrioventricular conduction, at regular intervals, being difficult, in this exam, the differentiation between sinus and supraventricular tachycardia (Figures 1 and 2).

After performing a normal electrocardiogram (ECG) in the pregnant women, maternal digoxin was started. The oral digitalising dose used was 2.0 mg/day, being reduced every 24 hours to 1.5 mg and 1.0 mg/day, divided in intervals of 12 hours. The patient was daily monitored with electrocardiogram and serum digoxin level in a hospital environment. As occurred persistence of fetal tachycardia (210-220 bpm), after adequate maternal digoxinemia (2.0 ng/ml), the patient was moved to a reference center in Fetal Cardiology, which had flecainide, a drug currently not yet available in the country. Digoxin was maintained and associated with flecainide. This was administered maternally at a dose of 200 mg every eight hours, and then increased to 300mg without success.

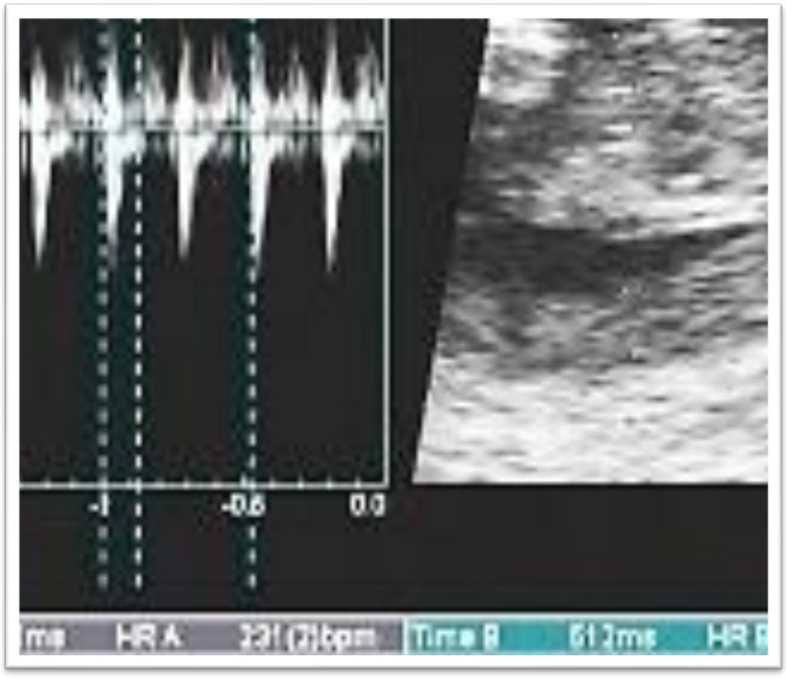

Figura 1- *Transvaginal echocardiogram performed after nine weeks of pregnancy. Outlet Doppler of the left ventricle indicating a HR of 231 bpm. HR = heart rate.*

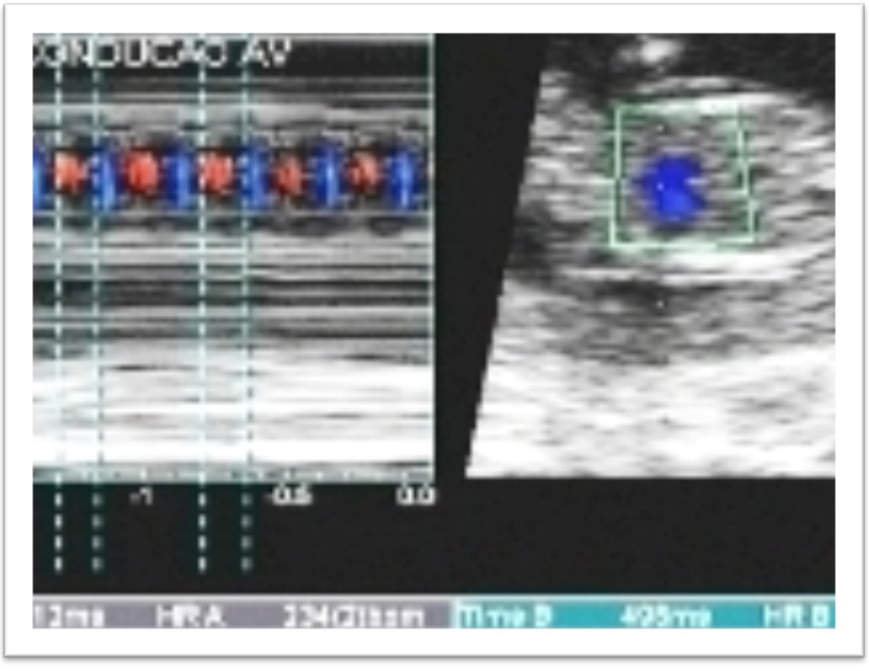

Figura 2 - *Fetal echocardiography M-Mode indicating sinus rhythm with HR between 234-240 bpm. Each atrial contraction is followed by a ventricular one (1:1 A-V conduction), with pauses Similar A-V and V-A.*

Figura 3 - *Nuchal translucency (arrow) of 11 weeks near the upper limit of normal (2.3mm).*

The patient underwent daily electrocardiographic assessment for controlling the QT interval. After 72 hours of use of these drugs, the pregnant woman showed signs of digitalis intoxication, being suspended the digoxin. Morphological ultrasonography was performed in the first quarter, the examination showed nuchal translucency near the upper limit (2.3 mm; Normal: less than 2.5 mm), with no other ultrasonographic markers for trisomy (Figure 3).

In this examination, it was observed that fetal HR, despite persistently high, varied in an exacerbated manner with fetal movements. Due to the failure of flecainide, the pregnant woman returned to the original care service and a third regimen was started. It was chosen to use sotatol maternally at 320 mg/day (orally) at intervals of 12 hours, with gradual reduction of fetal heart rate to tolerable levels (180 bpm) in the eighteenth week of pregnancy. The dose of sotalol was reduced to 160 mg/day, and the pregnant woman was monitored by weekly electrocardiographic control.

The fetal echocardiograms were performed weekly. The fetus, during the follow-up, showed no fetal hydrops and no anatomic cardiac malformation. The second morphological ultrasonography detected the presence of renal malformation with mild left hydronephrosis. At thirty-six weeks of gestation, fetal HR normalized (140 bpm). The patient was kept in use of sotalol until the term. The unusual course of this case drew attention to the diagnosis of a possible inappropriate sinus tachycardia. The delivery occurred at term (38 weeks), via Caesarean section, resulting in a female fetus, weighing 3050 g and showing Apgar 9/9.

The electrocardiogram performed after birth showed P-wave morphology in sinus rhythm and normal PR and QT intervals. The newborn showed good clinical conditions and normal HR (140 bpm) in the nursery and was discharged without medication. However, in return visits after ten days of life, the patient showed tachycardia (HR = 180 bpm), with an exaggerated increase in HR at minimum stress. Laboratory tests were collected and other causes of arrhythmia were ruled out. The diagnosis of IST was confirmed and beta-blocker drug was restarted with proper HR control.

Subsequently, renal malformation was confirmed (presence of double ureter). Currently, the child is five years old, showing normal psychomotor development and stable HR, in use of atenolol.

Discussion

The fetal tachyarrhythmia is a rare condition that occurs in 0.4 to 0.6% of pregnancies. The prenatal diagnosis of these tachycardias can be performed accurately by fetal echocardiography[3,4] and generally responds well to prenatal therapy. It is important to emphasize that the fetal

myocardium is less compliant, making changes in cardiac output predominantly dependent on HR variations. Thus, the antiarrhythmic treatment must be immediately started to avoid complications such as heart failure, fetal hydrops, intrauterine death, and postnatal changes in fetal brain blood flow or neurological[5]. In this case, fetal echocardiography allowed evidencing and early treating the tachycardia, preventing complications that worsen the prognosis.

The fetal echocardiogram allows the measurement of atrioventricular (AV) and ventriculoatrial (VA) intervals by simultaneous recording of Doppler of the Vena Cava and Aorta, and the recording of atrial and ventricular walls in M-mode[6,7]. Both in sinus tachycardia (ST) and in sustained supraventricular (PSVT) the rhythm of atrioventricular conduction is one to one (1:1), but HR is usually lower (160-180 bpm) in ST than in supraventricular tachycardia (above 200 bpm).

In this case, as the HR was high (220-240 bpm), this differentiation was initially difficult. Measures of AV and VA intervals aided the diagnosis. In PSVT by reentry mechanism, it is possible to identify that the VA interval is shorter than the AV, and by ectopic atrial focus the VA interval is longer. In the case described, there was sinus tachycardia and these intervals did not show differences. Some unusual aspects for this type of tachycardia, such as the early onset and difficult therapeutic success, suggested the diagnosis of intrauterine inappropriate sinus tachycardia (IST), which was confirmed after birth.

The sustained fetal tachycardia should be considered emergencies in fetal cardiology and the treatment with antiarrhythmic drugs should be immediately started. Currently, the first therapeutic regimen most commonly used to treat fetal supraventricular tachycardia (PSVT) is still that using monotherapy with digoxin[8]. Subsequently, other drugs used are amiodarone, sotalol or flecainide[9,10]. The latter is an important treatment option in the first quarter of gestation, when the use of amiodarone would be contraindicated because of the risk of fetal and neonatal hypothyroidism[11,12].

In this case, due to the initial difficulty in differential diagnosis of PSVT, the early tachycardia, and the possibility of transference of the pregnant women to a Fetal Cardiology Unit, which had medication, it was decided to use flecainide[13] (13%). Generally, in case of sinus tachycardia the treatment is limited to the resolution of the root cause (fetal hypoxia, maternal intake of certain substances, infections, and other causes). However, in our case report, this was an inappropriate sinus tachycardia.

The IST is a rare arrhythmia, difficult to control, with an initial diagnosis after adolescence or, more often, from the second decade of life, predominant in women[14]. Generally, it is not associated with cardiac or extracardiac anatomical malformations[15]. In the literature, there are few records of IST in fetal life and its association with renal malformation has never been described. The nuchal translucency, near the upper limit of normality, has been described by Zielinsky et al. in fetuses with interventricular communication; however, there are no studies on its association with tachyarrhythmias[16]. The transient accumulation of fluid in the neck of the fetus would probably be associated with hemodynamic changes in fetal heart failure. The most widely used drugs for the treatment of IST are selective beta-blockers (atenolol, metoprolol or propranolol), and, as second option, calcium channel blockers[17]. Recent studies have shown favorable response to the use of ivabradine in some patients, and in those refractory to drug therapy, radiofrequency ablation may be attempted[18,19]. In this case, as the treatment of IST was prenatal, sotalol was chosen because it is a selective beta-blocker, with good placental penetration.

In this case, although the confirmation of the diagnosis was only possible after delivery, the transvaginal fetal echocardiography, indicated in the first weeks of gestation, allowed the suspicion of diagnosis, and the prenatal treatment of arrhythmia. The early therapy prevented complications such as heart failure, and fetal death, and allowed the term birth without the presence of postnatal complications.

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References

1. Morillo CA, Klein G; Thakur RK, Li H, Zardini M, Yee R Mechanism of inappropriate . sinus tachycardia role of sympathovagal balance. Circulation. 1994;90(2): 873-7.
2. Krahn AD, Yee K, Klein GJ, Morillo CA. Inappropriate Sinus Tachycardia: Evaluation and Therapy. J Cardiovasc Electriphysiol.1995;6(12):1124-8.
3. Kleinman CS, Copel JA. Fetal cardiac arrhythmias: diagnosis and therapy. In: Creasy RK, Resnik R (eds). Maternal-fetal: medicine: principles and practice, 3rd .d. Philadelphia: WB Saunders. 1994.p.286-97.
4. Simpson JM, Sharland GK. Fetal tachycardia: management and outcome of 127 consecutive cases. Heart. 1998;79(6):576-81.
5. Oudijk MA, Gooskens RHJM, Stoutenbeek P, de Vries LD, Visser GHA, Meijboom EJ. Neurological outcome of children who were treated for fetal tachycardia complicated by hydrops. In: Fetal tachycardia diagnosis and treatment. Martijn Oudijk 2003
6. Simpson JM. Fetal arrhythmias. Ultrasound Obstet Gynecol 2006 ;27(6):599–606.
7. Strasburger JF. Prenatal diagnosis of fetal arrhythmias. Clin Perinatol 2005; 32(4):891–912.
8. McElhinney DB, Tworetzky W, Lock JE. Current Status of Fetal Cardiac Intervention. Circulation 2010;121(10):1256-63.
9. Strasburger JF, Cuneo BFm, Michon MM, Gotteiner NL, Deal BJ, McGregor SN, et al., Clinical Investigation and Reports: Amiodarone therapy for drug-refractory fetal tachycardia. Circulation 2004; 109(3): 375-9.
10. Zielinsky P, Dillenburg FD, de Lima CG, Zimmer LP. Taquiarritmias Supraventriculares no Feto. Experiência de uma Unidade de Referência em Cardiologia Fetal. Arq Bras Cardiol 1998;70 (5):337-40.
11. Schmolling J, Renke K, Richter O, Pfeiffer K, Schlebusch H, Höller T. Digoxin, flecainide, and amiodarone transfer across the placenta and the effects of an elevated umbilical venous pressure on the transfer rate. Ther Drug Monit 2000; 22(5): 582–8.
12. Lopes LM, Zugaib M. Arritmias fetais. In: Lopes LM, Zugaib M, eds. Atlas comentado de cardiologia fetal. São Paulo:RR Donnelley;2003,p.366-7.
13. Jaeggi ET, Carvalho JS, De Groot E, Api O, Clur S-AB, Rammeloo L, et al. Comparison of transplacental treatment of fetal supraventricular tachyarrhythmias with digoxin, flecainide, and sotalol: results of a nonrandomized center study. Circulation. 2011;124(16):1474-84.
14. Bauernfeind RA, Amat-Y-Leon F, Dhingra RC, Kehol R, Wyndham C, Rosen KM. Chronic nonparoxysmal sinus tachycardia in otherwise healthy persons. Ann Inten Med 1979; 91(5):702-10.
15. Zielinsky P, Nicoloso LH, Piccoli AL,.Borderline or increased first trimester nuchal translucency: a marker for isolated ventricular septal defect? [abstract]. Ultrasound Obstetr Gynecol.2009;34(Suppl1):275-6.
16. Femenía F, Baranchuk A, Morillo CA. Inappropriate sinus tachycardia: current therapeutic options. Cardiol Rev 2012;20(1):8-14.
17. Rormeo E, Grimaldi N, Sarubbi B, DÁlto M, Santarpia G, Scognamiglio G, et al. A pediatric case of cardiomyopathy induced by inappropriate sinus tachycardia: efficacy of ivabradine. Pediatr Cardiol.2011; 32(6):842-5.
18. Ho RT,Ortman M, Mather PJ, Rubin S. Inappropriate sinus tachycardia in a transplanted heart— Further insights into pathogenesis. Heart Rhythm .2011; 8: (5):781-3.