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PRENATAL ELECTRO- AND ECHOCARDIOGRAPHIC DIAGNOSIS OF FETAL SUPRAVENTRICULAR PREMATURE BEAT: A CASE REPORT

(fetal echocardiography/fetal electrocardiogram/supraventricular premature beat)

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In a fetus with dysrhythmia, the prenatal diagnosis of supraventricular premature beat was made in utero, using fetal M-mode echocardiography and electrocardiogram. Fetal two-dimensional echocardiography in the antenatal period revealed no evidence of structural anomalies of the fetal heart. Postnatally, the supraventricular premature beat disappeared within one week.

M-mode echocardiography makes feasible identification in utero of fetal heart structures (1,2), various cardiac dimensions (3-7) and fetal cardiac dysrhythmias (8-13). We also obtain data on the fetus in utero using simultaneous application of M-mode echocardiography and electrocardiogram (14). We now report the prenatal in utero diagnosis of supraventricular premature beat, using fetal M-mode echocardiography and electrocardiogram.

CASE REPORT

A 28-year-old Japanese nulliparous woman, in her thirty-first week of pregnancy, was admitted to Shimane Medical University Hospital with labor pains. The course of the pregnancy had been normal. At 33 weeks of gestation, fetal dysrhythmia was detected on routine examination. On the fetal M-mode echocardiogram on the four-chamber plane, the M-mode beam

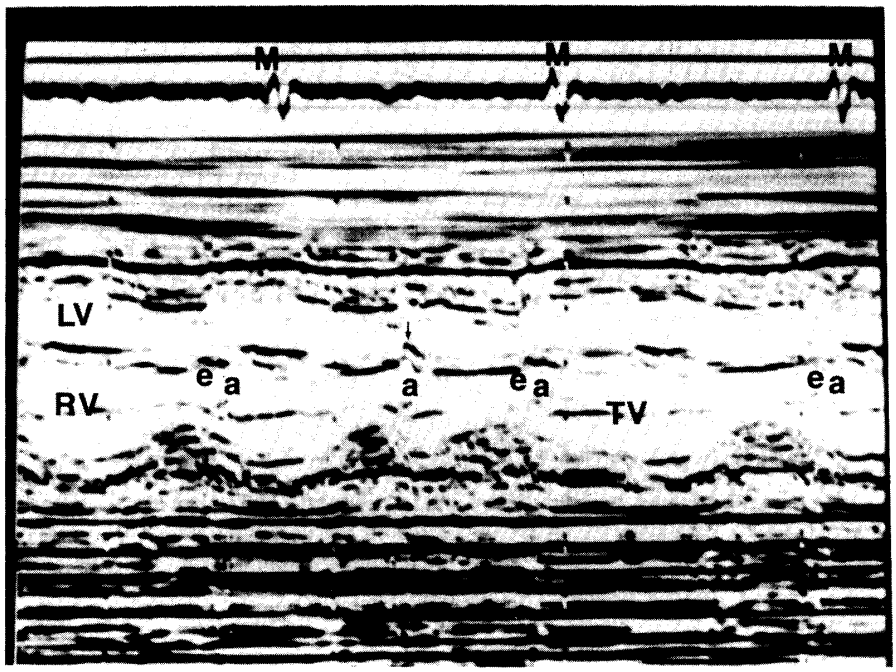

Fig.1a. On the fetal M-mode echocardiogram on the four-chamber plane, "a" wave due to atrial contraction preceded the premature contraction in the tricuspid valve, and a corresponding motion of the interventricular septum (arrow) was noted. LV: Left ventricle, RV: right ventricle, TV: tricuspid valve, M: QRS complex of the mother.

was placed at right angles to the interventricular septum at the level of the mitral and tricuspid valve leaflets, "a" wave due to atrial contraction preceded the premature contraction in the tricuspid valve (Fig.1a). In the fetal electrocardiogram, the QRS complex of the premature contraction was similar to that of the sinus rhythm (Fig.1b). On the fetal M-mode echocardiogram on the short-axis plane of the aortic root, ventricular contraction followed the premature atrial contraction (Fig.1b). Therefore, supraventricular premature beat was diagnosed antenatally. There was no evidence of structural heart anomalies of the fetus on the two-dimensional echocardiography.

At 37 weeks of gestation, labor was induced with prostaglandin F2α as the membranes had ruptured. During labor, fetal scalp electrocardiogram revealed supraventricular premature beats (Fig.2). A female child weighing 2950g was delivered vaginally, with Apgar scores of 6 and 9 at 1 and 5 minutes, respectively. The supraventricular premature beat was confirmed

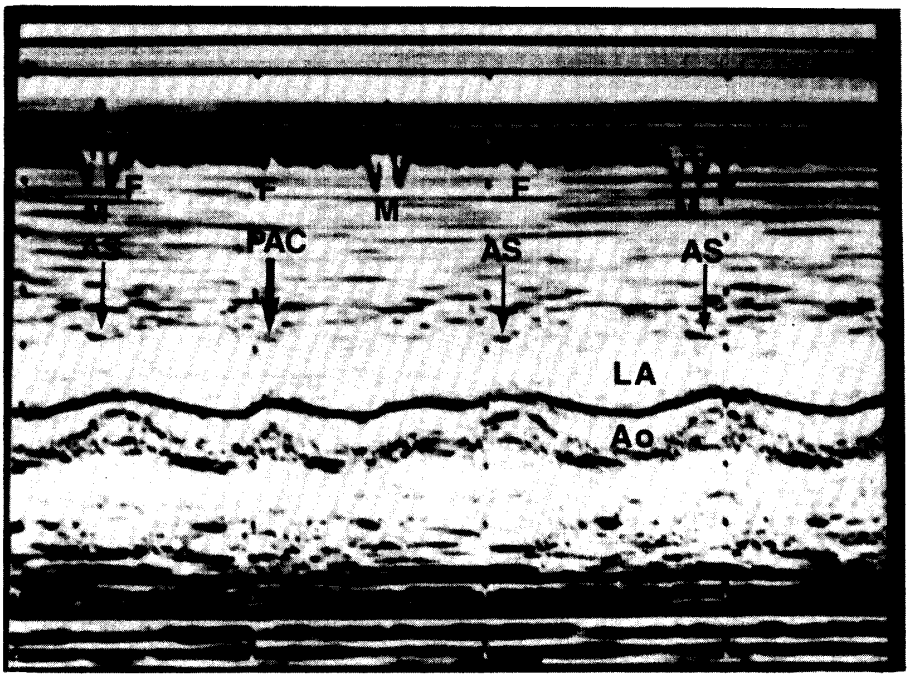

Fig.1b. Fetal M-mode echocardiogram on the short-axis plane of the aortic root. The left atrial contraction was recognized in extrasystole (PAC: premature atrial contraction), and the QRS complex of the premature contraction was similar to that of the sinus rhythm. LA: left atrium, Ao: aorta, AS: atrial systole, F: QRS complex of the fetus, M: QRS complex of the mother.

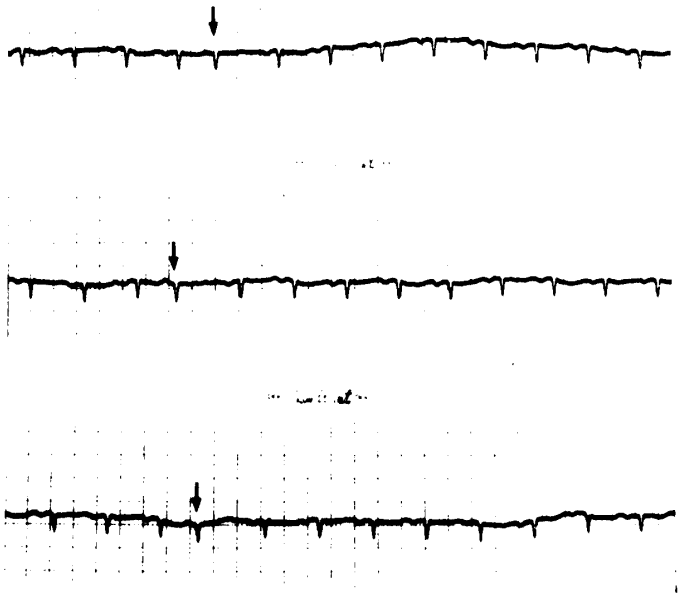

Fig.2. The diagnosis of supraventricular premature beat (arrow) was based on findings on the ECG taken during labor by means of a fetal scalp electrode.

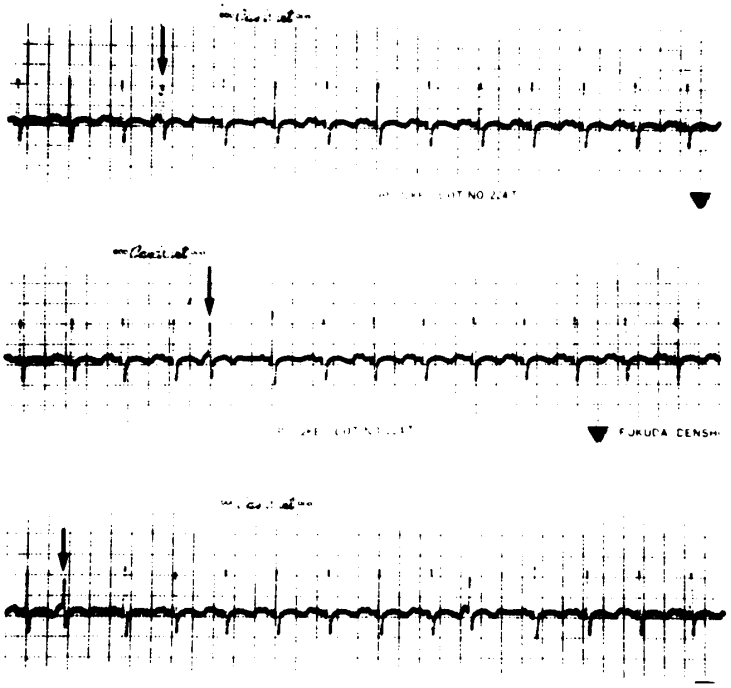

Fig.3. Electrocardiographic records of a supraventricular premature beat (arrow) during the first postnatal week.

by electrocardiogram (Fig.3) and the premature beat disappeared during the first postnatal week.

DISCUSSION

The sinus node is discernible by the sixth week of gestation, the A-V node is formed by the tenth week, and the conductive system of the fetal heart is functionally mature by the sixteenth week of gestation (15). James (16) reported that the postnatal closure of the foramen ovale established the final form of the atrial septal route of interatrial and internodal pathways, and with abnormal development of the atrial septum or primitive venous valves, the pathways for internodal conduction might be altered. We detected fetal dysrhythmia, in utero, at the 33rd week of gestation, and diagnosed antenatally the supraventricular premature beat, using fetal M-mode echocardiography and electrocardiogram.

De Vore et al. (12) reported that a normal sequence of atrioventricular systole occurred prior to the premature atrial contraction, premature ventricular systole followed the premature atrial contraction on M-mode echocardiogram of the short-axis

view of the aortic root, and normal atrial systole was reflected by an outward excursion of the valve leaflets and the corresponding motion of the interventricular septum. Kleinman et al. (13) stated that presystolic atrial activity was reflected by the presence of "a" waves of the atrioventricular valve, and these preceded the premature ventricular responses represented by the premature movement of the ventricular wall on the M-mode echocardiogram performed at the mid-ventricular level. With this same technique, we diagnosed the supraventricular premature beat of the fetus in utero.

Shenker (15) stated that premature systoles of the fetus arise in the atria when the following criteria were present; premature P wave, often with a different configuration from the sinus P wave, and identical or similar QRS morphology to sinus complex. In the present case, the QRS morphology of the premature beat was similar to that of the sinus rhythm and a prenatal diagnosis of supraventricular premature beat was suspected in utero. However, transabdominal fetal electrocardiogram is unfortunately of limited value in the analysis of cardiac rhythm disturbances, due to the inability of this technique (13). In this case, the supraventricular premature beat was picked up by the scalp electrode in the electrocardiogram taken during labor (15).

Supraventricular premature beats are not due to hypoxia and the prognosis is excellent (17). Arrhythmias in the immediate neonatal period usually disappear during the first week of life (15). In our neonate, the supraventricular premature beat disappeared during the first postnatal week and the baby is well. Although the supraventricular tachyarrhythmia is one of causes for developing hydrops of the fetus, the development of supraventricular tachyarrhythmia can be triggered by premature atrial contractions (2). Therefore, detection of dysrhythmias in the antenatal fetus enables the obstetrician to better handle the pregnancy and carry out appropriate procedures. Simultaneous records of M-mode echocardiography and electrocardiogram are most useful to detect fetal dysrhythmias, and make for a differential diagnosis in utero.

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