

● Case report

FETAL ATRIAL FLUTTER AND HYDROPS SUCCESSFULLY TREATED WITH TRANSPLACENTAL AND DIRECT FETAL THERAPY



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Abstract

The hydropic fetus with atrial flutter has high risk of fetal demise. In utero treatment is not as successful as SVT with 1:1 conduction. Even after conversion to sinus rhythm, close follow-up of the pregnancy is required for several reasons.

Case Report:

A 25 year old primigravida, at 26 wks of gestation had a fetal ultrasound which showed a tachycardic hydropic fetus with AFI 49. The rhythm was atrial flutter: AR 400 bpm and VR 200 bpm. The heart was structurally normal. Transplacental antiarrhythmic treatment with sotalol was started and 24 hours later, the fetus was still primarily in flutter with rare episodes of sinus rhythm and frequent PAC. Sotalol was increased but the mother's QTc increased to > 500 ms, so the sotalol dose was reduced. On day 4th direct i.m. of digoxin was given and fetus was in sinus rhythm. Pharmacotherapy was continued. On the 16th day of sinus rhythm (at 33 wks), a marked change in FHR variability was seen. An US revealed the fetus was in sinus rhythm with a normal FHR. Because of the decreased FHR variability, the fetus was delivered by CS and the cord pH was 7.19, Apgars 1, 9 and 9. The neonate received no antiarrhythmic medications. On day 6 of postnatal life, an AV re-entrant tachycardia (AVRT) developed and sinus rhythm was successfully restored with sotalol and digoxin. The infant was treated for 18 months with no episodes of SVT or atrial flutter.

Key words: atrial flutter, fetal hydrops, transplacental therapy, direct fetal therapy, digoxin, sotalol

INTRODUCTION

The hydropic fetus with atrial flutter has high risk of fetal demise. In utero treatment of atrial flutter is not as successful as treatment of supraventricular tachycardia with 1:1 conduction¹. Even if treatment is successful, the time to conversion to sinus rhythm is longer¹. One reason it takes longer to convert any supraventricular arrhythmia in a hydropic fetus is that transplacental passage of most antiarrhythmic agents is impaired in the presence of hydrops^{2,3}. It takes an average treatment time of 10 days to convert a supraventricular arrhythmia to sinus rhythm^{1,4}.

The fetus can also be treated directly by intravenous injection into the fetal cord or intramuscular injection into the fetal thigh or buttock^{2,3,5,6}. Digoxin has safely and rapidly restored sinus rhythm when given as adjunctive therapy to several different transplacental antiarrhythmic medications⁴⁻⁶. Indications for direct fetal therapy include if the mother cannot tolerate an increased medication dose or when an abnormal fetal biophysical profile

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score necessitates a more rapid conversion to sinus rhythm.

Even after conversion to sinus rhythm, close follow-up of the pregnancy is required for several reasons. First, as hydrops resolves, there can be rupture of membranes and premature labor. Second, toxicity and

proarrhythmias of antiarrhythmic medications are difficult to monitor in the fetus because only the mechanical PR interval can be measured by the fetal echocardiography.

CASE REPORT

A 25 year old primigravida was seen for a routine obstetrical visit at 30 weeks of gestation. She had gained 20 pounds since her previous visit at 26 weeks of gestation, and was measuring size > dates. For these reasons she had a fetal ultrasound which showed a tachycardic hydropic fetus with severe polyhydramnios (amniotic fluid index 49). She was sent to our institution for diagnosis and treatment.

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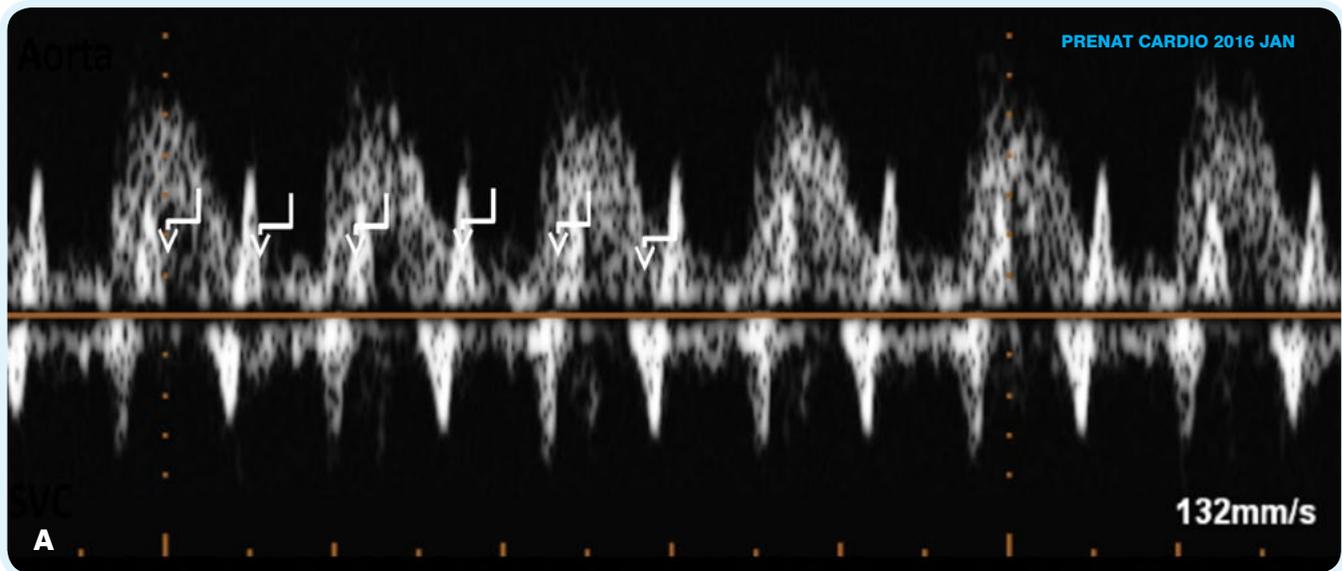
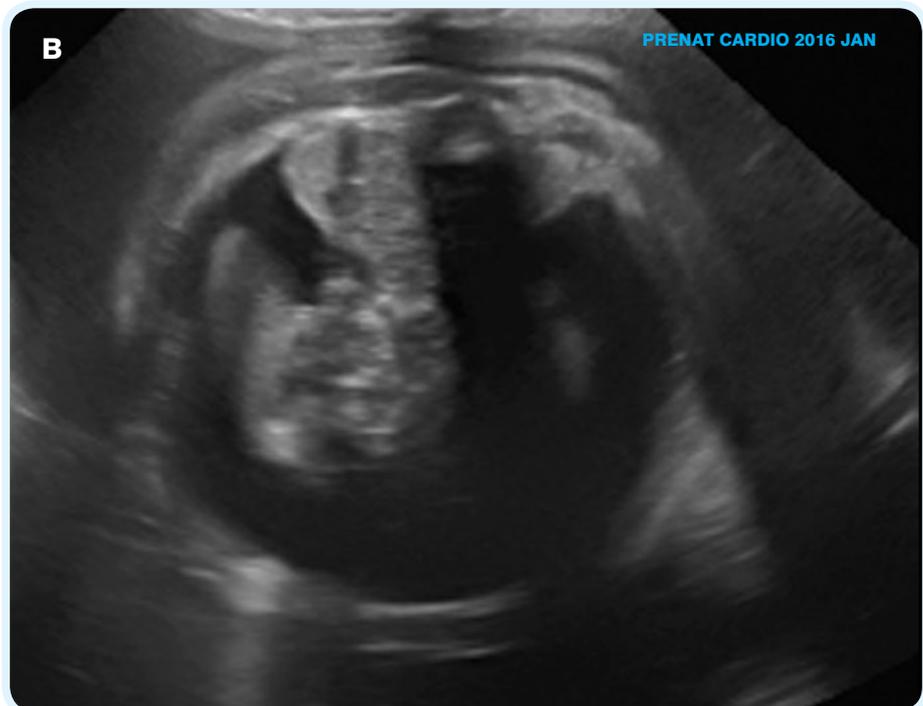


Fig 1: Echo findings upon presentation. (A). Simultaneous superior vena cava (SVC) and aortic (AO) pulsed Doppler tracing demonstrating 2:1 atrial flutter. Reverse flow in the SVC during atrial contraction is shown by the arrows above baseline. (B). Moderate ascites and skin edema consistent with hydrops fetalis.

Upon admission, the fetus had a biophysical profile score of 6/8 (normal amniotic fluid, tone and movement). The rhythm was atrial flutter (Figure 1) with an atrial rate of 400 bpm and a ventricular rate of 200 bpm. Atrial and ventricular function were subjectively reduced and the heart was enlarged (CT circumference ratio 60%, normal = $\leq 50\%$). The heart was structurally normal. We began transplacental antiarrhythmic treatment with sotalol, 80 mg orally every 8 hours, after we obtained a normal maternal ECG and electrolyte levels (including magnesium and calcium).

Twenty-four hours later, the fetus was still primarily in flutter with rare episodes of sinus rhythm and frequent premature atrial contractions occurring in a quadrageminal pattern (Figure 2). Sotalol was increased to 120 mg every 8 hours, but the mother's QTc increased to >500 ms. The sotalol dose was reduced to 80 mg alternating with 120 mg every 8 hours; the QTc interval did not increase. There was no change in the fetal rhythm from day 2-4. On day 4, the fetal biophysical profile score dropped from 6/8 to 4/8 (+2 for amniotic fluid and tone). Because the mother's QTc was still >500 msec, we elected to give the fetus a direct intramuscular injection of digoxin, 88 $\mu\text{g}/\text{kg}$ (based on the 50th weight for a 31 week fetus)⁷. Fifteen minutes after the ultrasound guided injection of digoxin into the fetal thigh, the fetus was in sinus rhythm



and remained so for the duration of the pregnancy. Sotalol was continued at 80 mg orally every 8 hours and digoxin was added: (loading dose 500 μg IV every 8 hours for 6 doses followed by maintenance dose 375 μg orally every 8 hours x 2 days, then 375 μg orally every day). The mother's ECG showed only digoxin effect, a mildly prolonged PR interval (170 ms), and a QTc of 450 ms. After 11 days of sinus rhythm, less ascites was seen and the fetal skin edema had resolved. The fetal mechanical PR interval was 150 ms (Figure 3) suggesting drug effect on the fetal AV node.

On the 16th day of sinus rhythm (at 33 weeks of gestation), a marked change in fetal heart rate variability was seen between the afternoon and evening monitoring periods (Figure 4). An ultrasound revealed the fetus was

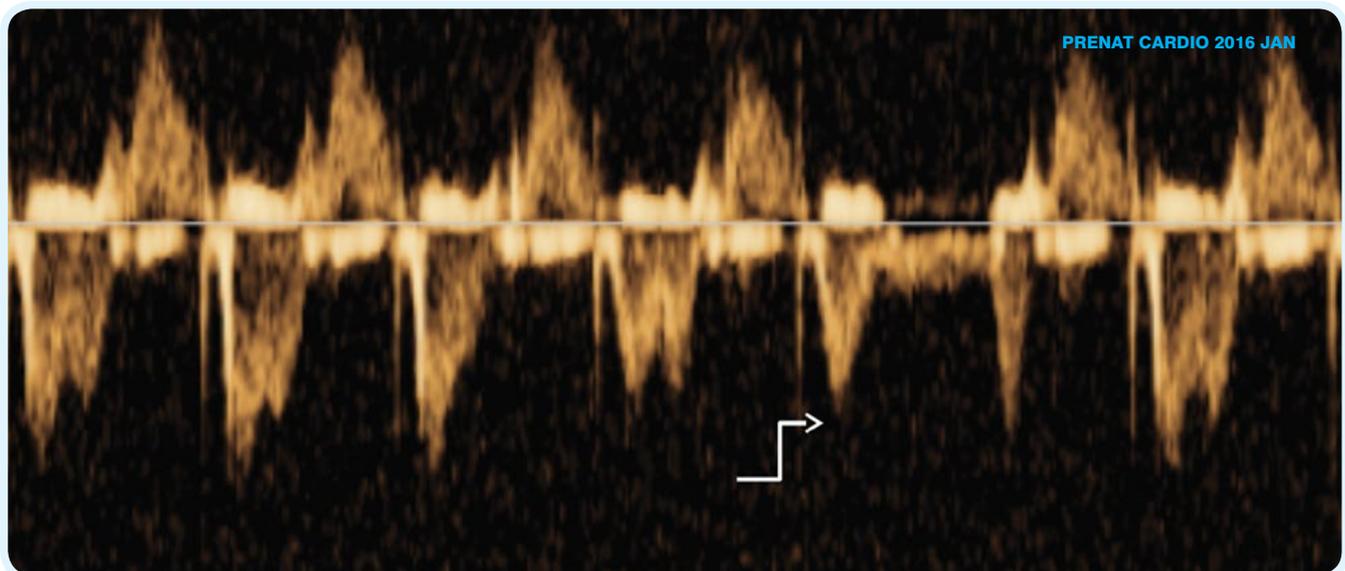


Fig. 2: Rhythm after 24 hours of sotalol treatment. Mitral inflow (below baseline) and aortic outflow (above baseline) shows 1:1 atrioventricular (AV) conduction. A premature atrial beat (fusion of the mitral E and A waves) is shown by the arrow.

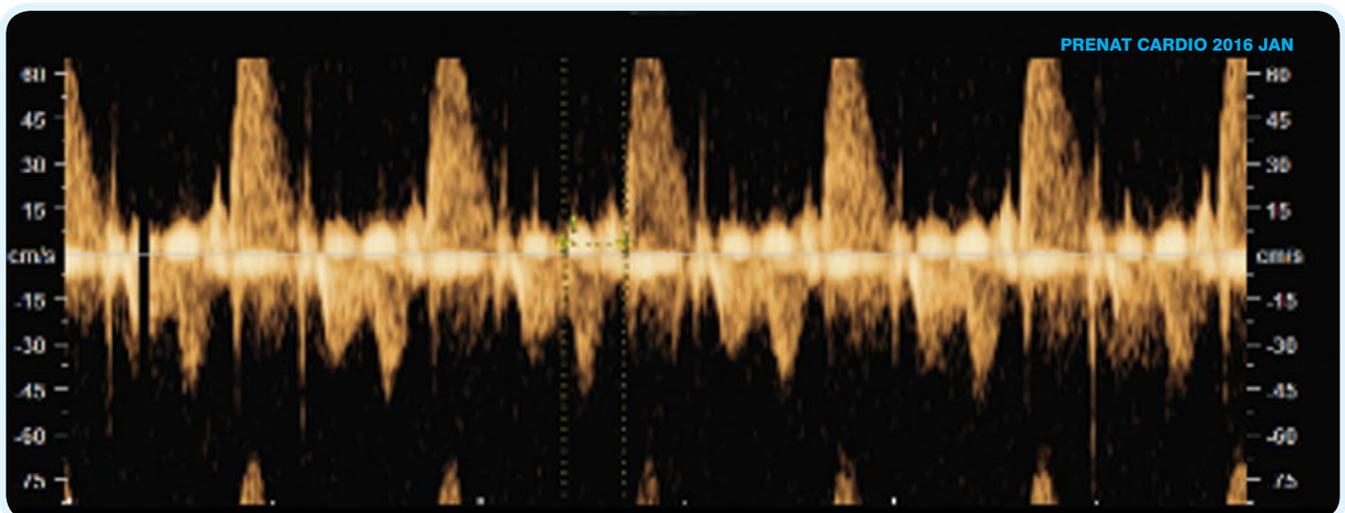


Fig. 3: Rhythm after 11 days of successful treatment. Mitral inflow (below baseline) and aortic outflow (above baseline) show 1:1 AV conduction. The mechanical PR interval is 150 ms indicating drug effect.

still in sinus rhythm with a normal heart rate. Because of the decreased fetal heart rate variability, the fetus was delivered by caesarian section. The cord pH was 7.19 and appgars were 1, 9 and 9. The neonate was intubated for apnea in the delivery room and extubated 12 hours later. There was no pre-excitation on the postnatal ECG: the QTc was mildly prolonged (468 ms) and the PR interval was normal (128 ms) (Figure 5). The neonate received no antiarrhythmic medications. On day 6 of life, an AV re-entrant tachycardia (AVRT) developed (Figure 6). Sinus rhythm was successfully restored with sotalol and digoxin.

The infant was treated for 18 months. There were no episodes of SVT or atrial flutter seen on requent Holter monitoring. The child is now 2 years of age, on no medication, and has had no recurrence of AVRT or atrial flutter.

DISCUSSION

There are several important observations in this report. First, postnatal SVT following prenatal atrial flutter is an unusual occurrence and suggests a reentrant mechanism and an accessor connection. Second, direct fetal antiarrhythmic therapy has an important role in restoring sinus rhythm quickly when increasing the transplacental medication puts the mother at risk. Finally, fetal distress can occur unrelated to arrhythmia or antiarrhythmic treatment, thus even after conversion to sinus rhythm and improving hydrops, close pregnancy surveillance is prudent.

Postnatal AVRT is generally uncommon in patients with prenatal atrial flutter. The association between atrial flutter and accessory pathways was first highlighted by Till and Wren in 1992⁸. Of 9 subjects with fetal or

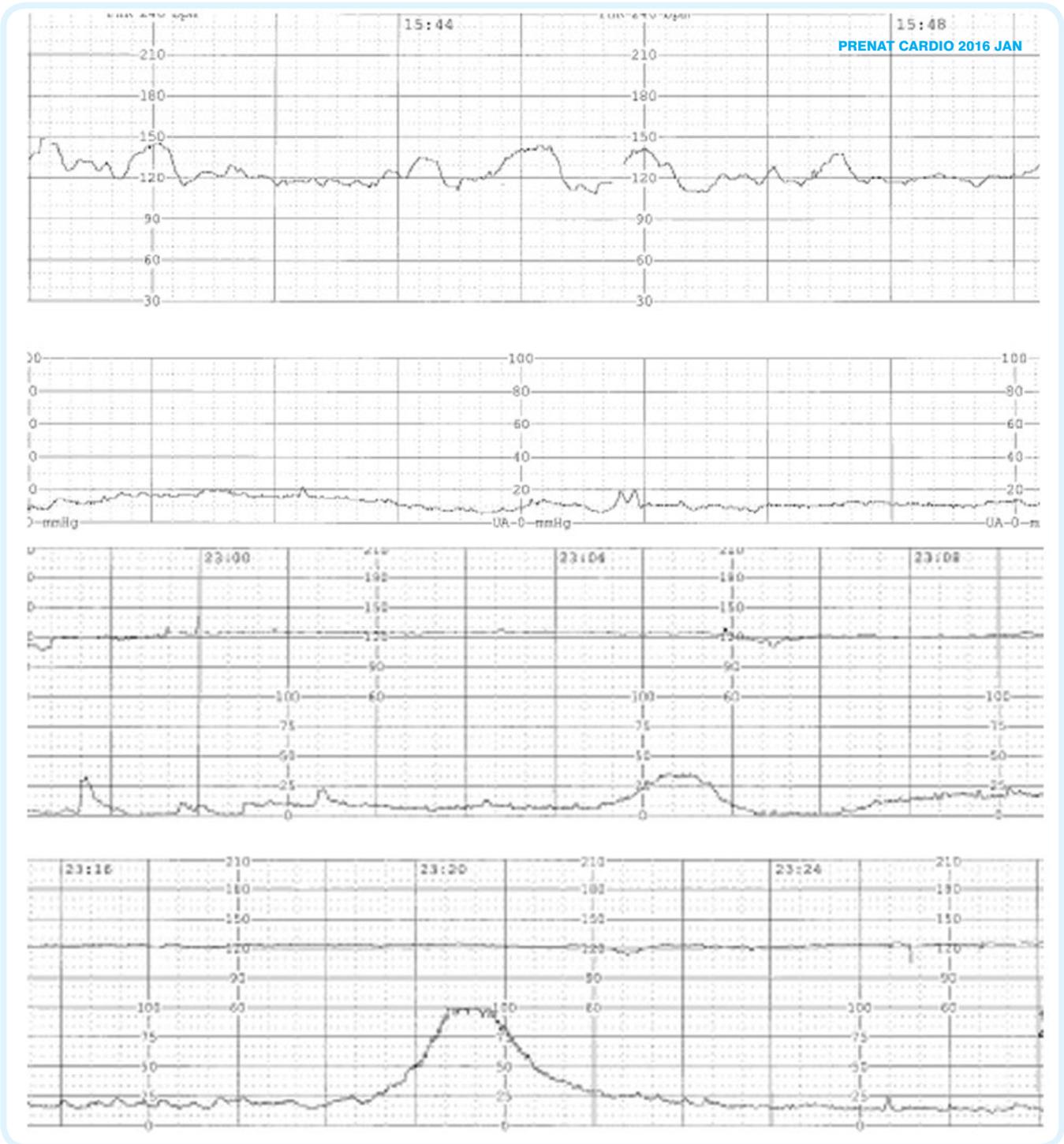


Fig. 4: Fetal heart rate and uterine activity monitoring on day 16 of sinus rhythm. (A). In the morning, there is normal fetal heart rate reactivity, and no contractions. (B). In the evening, fetal heart rate activity is markedly decreased and there is some uterine activity.

neonatal atrial flutter, 1/3 had postnatal AVRT. In a postnatal transesophageal electrophysiologic study of 8 neonates with fetal atrial flutter, 5 (62.5%) had inducible AVRT⁹. None, however, were noted to have spontaneous AVRT. The association between atrial flutter and accessory connections may explain why digoxin, which slows conduction in the AV node, may be effective therapy in some cases of atrial flutter, and supports use of direct fetal therapy with digoxin not only in cases of AVRT, but also in cases of atrial flutter.

Adding a second antiarrhythmic medication is generally recommended if sinus rhythm has not been restored after about 5 days of treatment with an appropriate dose of the first anti-arrhythmic agent. In our case, the mother developed a prolonged QT interval at a very low dose of sotalol, precluding increasing the sotalol dose. We could have added a second transplacental medication, but a rapid conversion was necessary due to the abnormal biophysical profile score. Directly treating the fetus circumvents both the mother and the hydropic

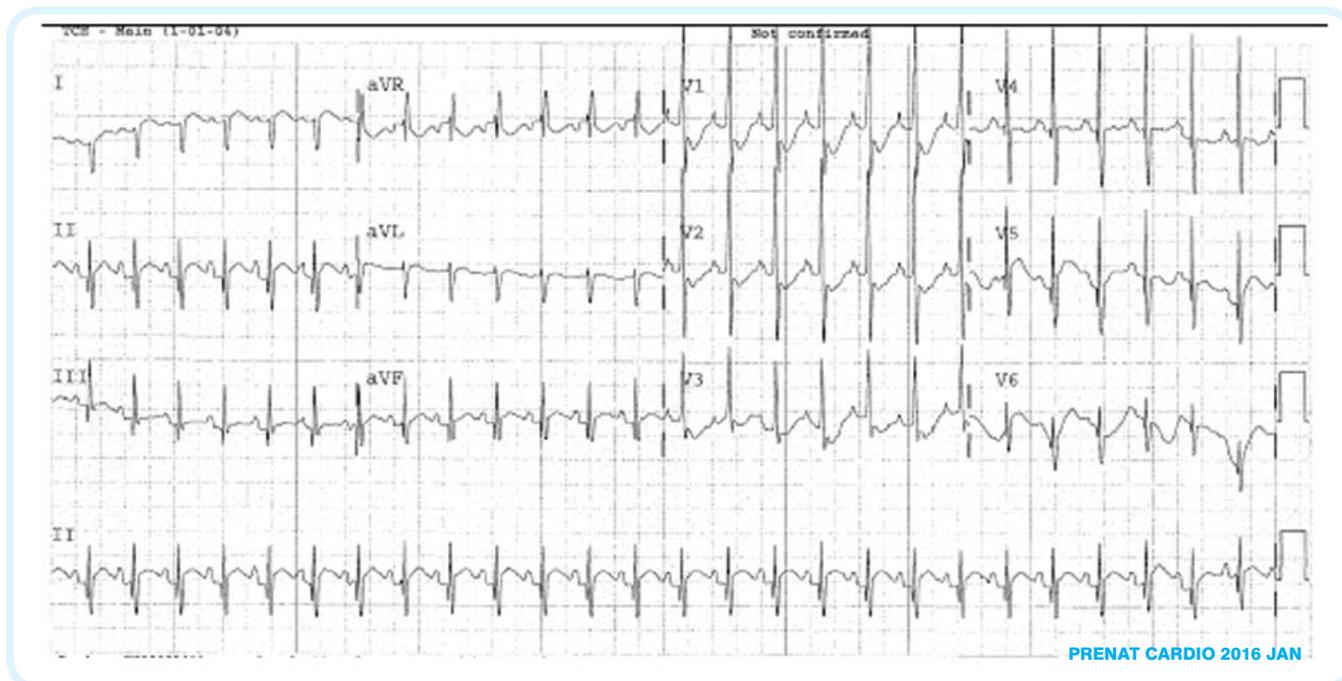


Fig. 5: 12-lead ECG immediately after birth. The rhythm is sinus. There is no ventricular preexcitation. The QTc interval is prolonged (468 ms) but the PR and QRS durations are normal.

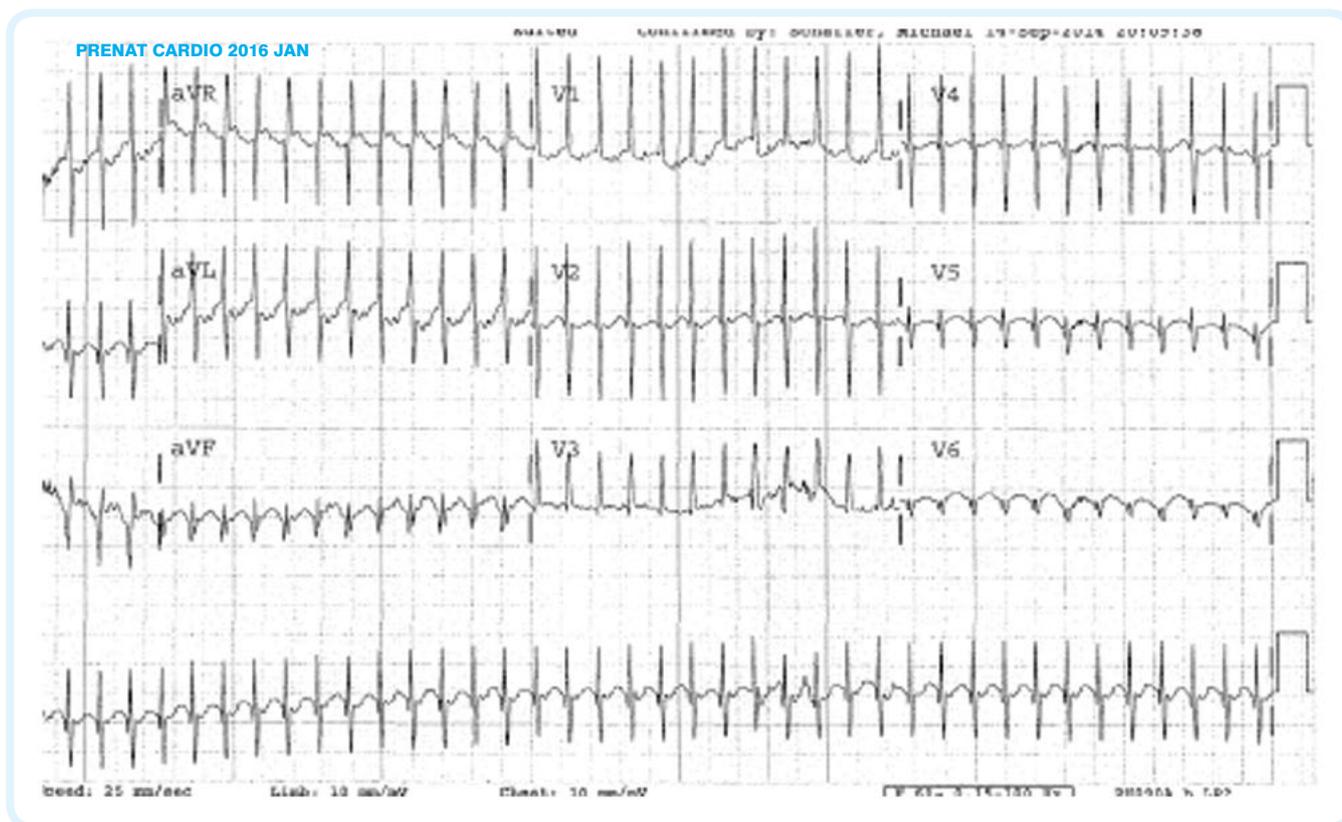


Fig. 6: 12 lead ECG in tachycardia. This is SVT with a short RP interval suggesting a reentrant mechanism through a concealed bypass tract.

placenta, eliminates the risk of maternal side effects and ensures full drug delivery to the fetus. Following direct fetal treatment, we added transplacental digoxin to maintain the fetal digoxin levels. Historically, rapid and sustained cardioversion results from this combined approach not only in atrial flutter, but also in AVRT⁵.

Direct fetal therapy could have also been given in the umbilical cord (IV), but there is an inherent risk of complications both from cordocentesis, and also from bradycardia that can occur when the antiarrhythmic medication is given IV. Fetal demise has been reported from direct IV fetal treatment², but to our knowledge,

not with direct IM fetal treatment, even with recurrent injections⁵⁻⁷.

The reasons for fetal distress after 16 days of sinus rhythm are not known. When fetal heart rate variability decreases in a fetus with a history of arrhythmia, it is necessary to show the arrhythmia has not recurred. During incessant tachycardia, some fetal heart rate monitors will half the rate, and since the rhythm is abnormal, there will be no variability. In our case the atrial flutter had not recurred, nor was there AVRT. The fetal rhythm was normal. Nor was the fetal distress as a result of antiarrhythmic drug toxicity or proarrhythmia, as the QTc was only mildly prolonged on the postnatal ECG. Thus, even after conversion to sinus rhythm, the pregnancy needs to be monitored closely. If possible, the dose of antiarrhythmic medications can be decreased to reduce the incidence of proarrhythmias, especially when treating with sotalol, since it concentrates in the amniotic fluid.

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