

Management of Fetal Arrhythmias



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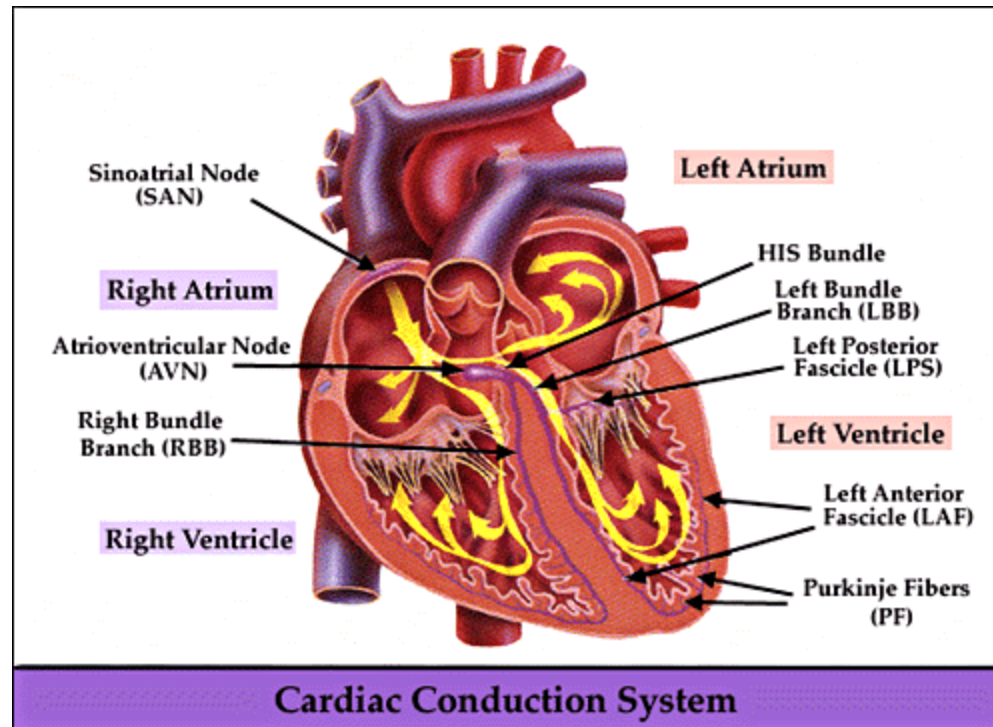


Objectives

- 1. List the types of common fetal arrhythmias
- 2. Describe the treatment strategies for fetal arrhythmias
- 3. Identify side effects of the medical therapies for fetal arrhythmias



Cardiac Conduction





Types of Fetal Arrhythmias

- Nonsustained (e.g. PACs or PVCs)
- Sustained Tachycardia (e.g. SVT, atrial flutter)
- Sustained Bradycardia (e.g. congenital heart block, congenital long QTS)

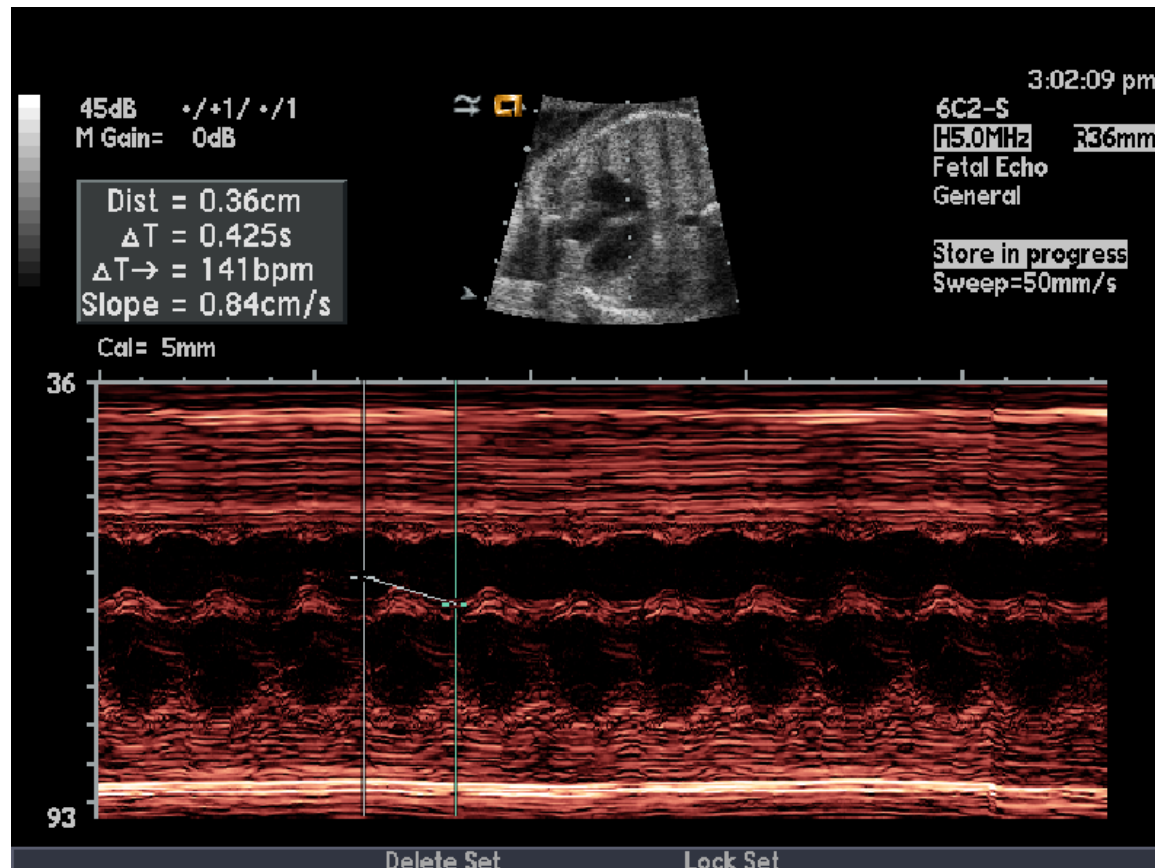


Diagnosis

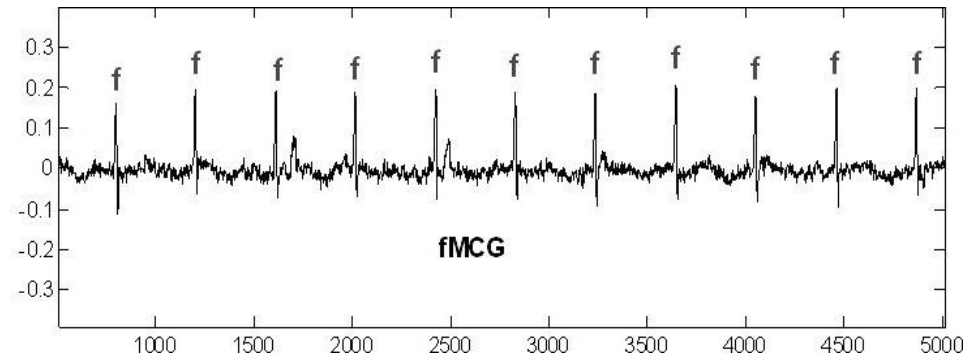
- Normal fetal heart rate: 110-160 bpm
- Doppler auscultation: allows determination of ventricular rate, but not AV relationship or origin of arrhythmia
- M-Mode echocardiography: allows visualization of atrial and ventricular contraction simultaneously



Fetal M-Mode



Fetal Magnetocardiography: valuable for monitoring the fetal heart



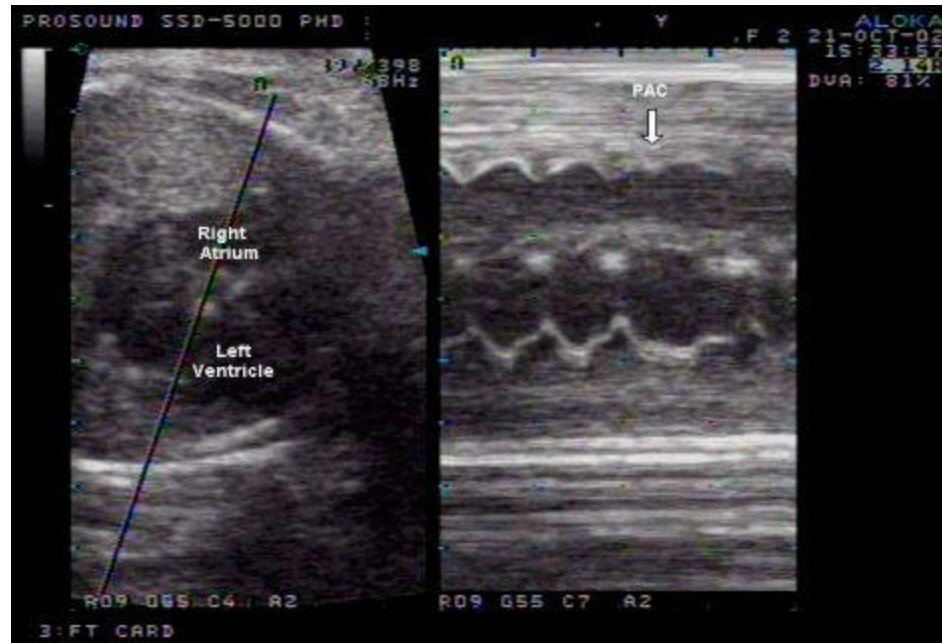


Premature Atrial Contractions (PACs)

- Most common fetal arrhythmia
- Usually clinically insignificant
- However, 1% fetuses with PACs may have structural heart disease and 0.5% may develop SVT
- May also present with bradycardia (atrial bigeminy with nonconducted PACs)
- Recommend weekly doppler auscultation to evaluate for tachycardia or bradycardia



Premature atrial contraction





Case Scenario

- A 36 year old G1P0 with an intrauterine pregnancy at 24 weeks gestation presented to her obstetrician for a routine visit. On presentation, she had no complaints. In clinic, fetal heart rate by Doppler was 260 beats per minute. Bedside ultrasound was then performed and tachycardia was confirmed.



Case Scenario

You would advise the mother of all of the following except:

A. This arrhythmia is usually originating from the upper chamber (atrium)

B. The baby will need to be monitored periodically for fluid collection (hydrops).

C. C section is safer than NSVD for the baby.

D. The mother will need to take medications to control the baby's heart rate for the rest of her pregnancy.



Fetal Tachycardia

- Fetal heart rate > 170 or 180 bpm
- Atrial tachyarrhythmias much more common than ventricular tachyarrhythmias
- Most common atrial tachyarrhythmia usually reentry pathway (within atrium for atrial flutter or between atrium and ventricle via accessory pathway in SVT)

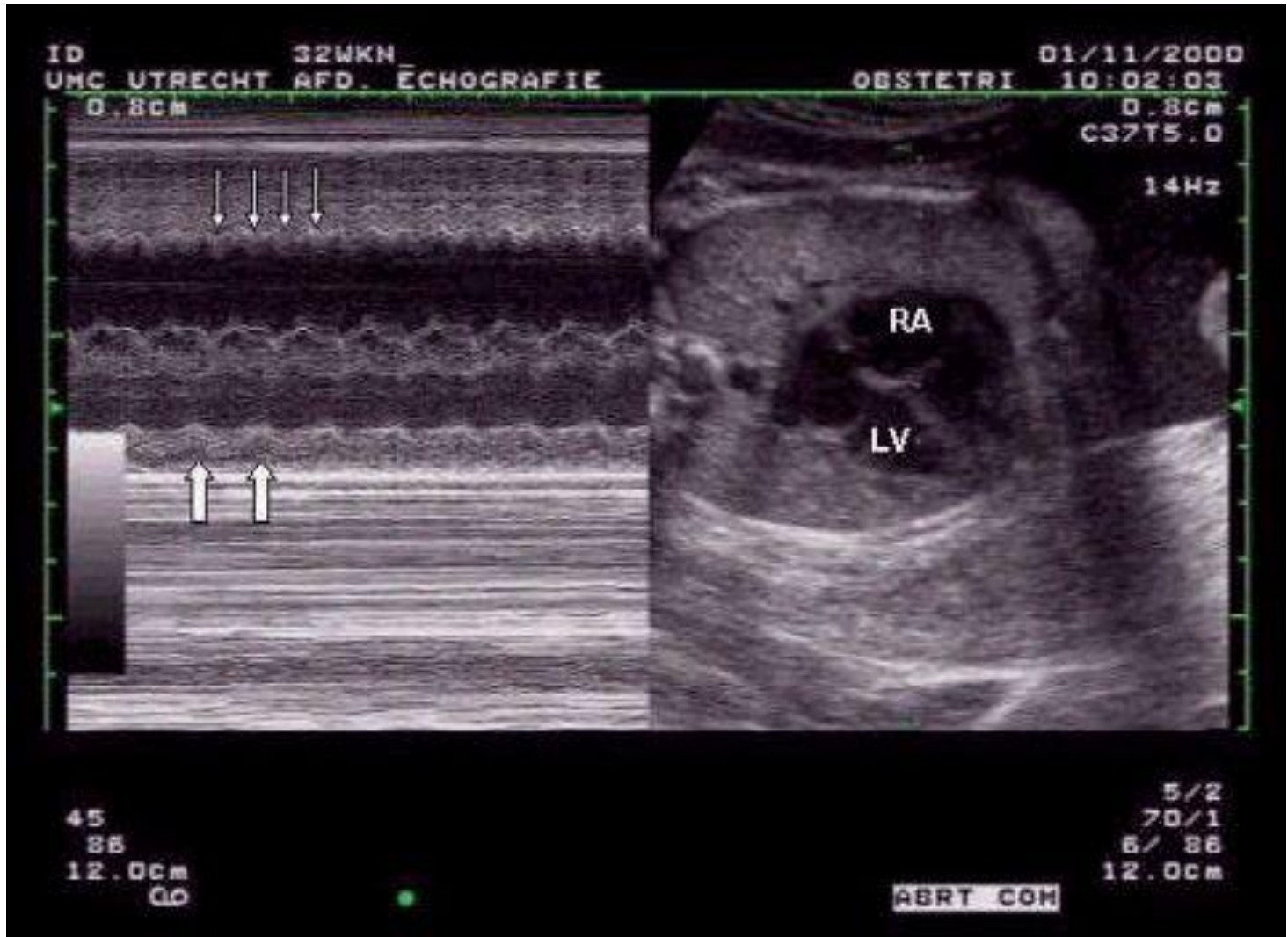


Atrial Flutter

- Atrial rate 250 to 500 bpm with fixed or variable conduction to ventricle -> 2:1 or 3:1 conduction to ventricles
- May be paraxosymal or incessant
- Associated with hydrops in 7-43% of cases¹

¹Oudijk MA et al. Fetal tachyarrhythmia. Indian Pacing and Electrophysiology Journal, 4(3): 2004

Atrial Flutter – 2:1 Conduction





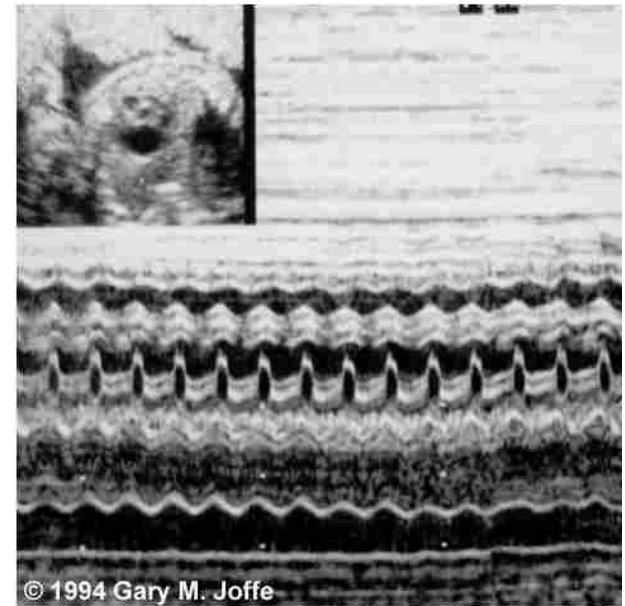
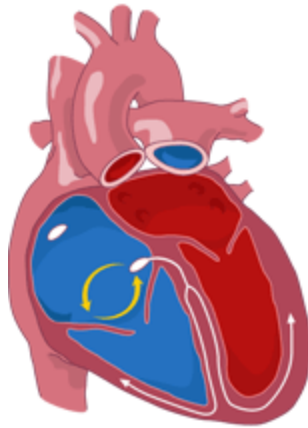
Fetal Supraventricular Tachycardia

- 1:1 atrioventricular conduction
- Heart rates in SVT most commonly 200-300 bpm
- May be paroxysmal or incessant
- Associated with hydrops in 30-60% of pts¹
- Usually reentry mechanism

¹Oudijk MA et al. Fetal tachyarrhythmia. Indian Pacing and Electrophysiology Journal, 4(3): 2004



Mechanism of SVT



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Treatment: Tachyarrhythmias

- Treatment recommended for sustained arrhythmia or evidence of hydrops
- Digoxin is usually first-line agent if no hydrops present; case series report 60-80% positive responders
- Other agents include flecainide, sotalol, or amiodarone



Treatment: Tachyarrhythmias

- Fetal drug concentration depends on variety of factors: transplacental transfer, fluid status of fetus, gestational age, half-life of drug
- Check 12-lead EKG in mother prior to initiating meds and serial maternal EKG monitoring after starting meds.
- Check maternal drug levels



Patient Case (Part 2)

- Plan of care was discussed with a pediatric cardiologist, and it was decided to proceed with attempted conversion of SVT using digoxin. Baseline EKG was performed and was within normal limits. The patient was then loaded with 0.5 mg IV digoxin and then started on oral digoxin 0.25 mg three times a day with a plan to check digoxin level in 24 hours. The patient remained on continuous monitoring.



Patient Case (Part 2)

- The following morning a fetal echocardiogram revealed fetal heart rates in the 240' s, fetal hydrops with ascites and pleural effusion, and decreased cardiac function. After the echocardiogram was completed the Pediatric Cardiologist recommended adding flecainide 100 mg twice a day.



Patient Case (Part 2)

After starting Flecainide, all of the following will need to be monitored except:

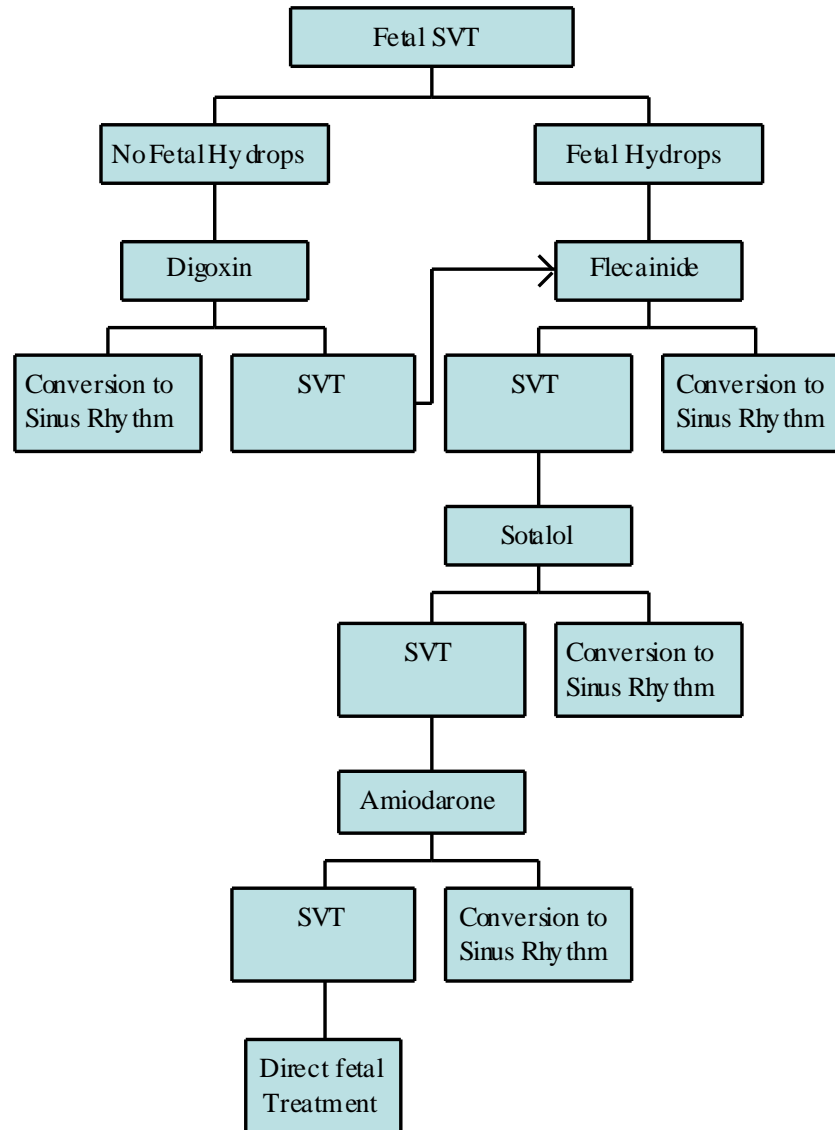
- A. The mother's ECG.
- B. The baby's heart.
- C. Serum drug levels on the mother
- D. Serum drug levels on the fetus.



Patient Case (Part 2)

- On the third day after starting flecainide, the fetal heart rates were in the 140' s. The patient was maintained on digoxin and flecainide as an outpatient, and by the following week, the fetal echocardiogram returned to normal. At 40 weeks gestation, a newborn was delivered by normal spontaneous vaginal delivery in no distress.

Protocol: Fetal SVT



Drug	Class	Use	Dose	Metabolism	Half life	Therap range	Side effects, maternal	Side effects, fetal
<i>Flecainide</i>	IC	SVT AF VT	PO: 100-400 mg bid	Hepatic excretion 67%, renal excretion 33%	13-19 hr	< 1 µg/ml	proarrhythmia, vertigo, nausea, headache, disturbed vision, parasthesia	negative inotrope, proarrhythmia
<i>Amiodarone</i>	III	SVT AF VT	IV: 5 mg/kg over 20 min; 500-1000 mg over 24 hr, PO: 1200-1600 mg/d for 7- 14 days (loading), then 200- 400 mg/day (maint)	hepatic metabolism; renal excretion	25-110 days	1.0-2.5 µg/mL	proarrhythmia risk	proarrhythmic, hypothyroid
<i>Sotalol</i>	III	SVT AF VT	PO: 80-160 mg q 12h; increase to 160 mg q 8h	renal excretion	15-17 hr	1.5-2.5 µg/mL	proarrhythmia risk	negative inotrope, proarrhythmia
<i>Adenosine</i>	IV	SVT	IV: 100-200 Ug/kg (into umbilical vein)	throughout body	10-30 sec	NA	useful for acute termination of SVT	proarrhythmia
<i>Digoxin</i>	cardiac glyco- side	SVT AF	IV: 1 mg divided over 24 hrs, PO: 0.5-1.0 mg daily in 2 divided doses.	renal excretion	36 hr	1-2 ng/mL	proarrhythmia, AV block, nausea, anorexia, vomiting	

SVT = supraventricular tachycardia, AF = atrial flutter, VT = ventricular tachycardia, AV = atrio-ventricular



Sustained Bradycardia

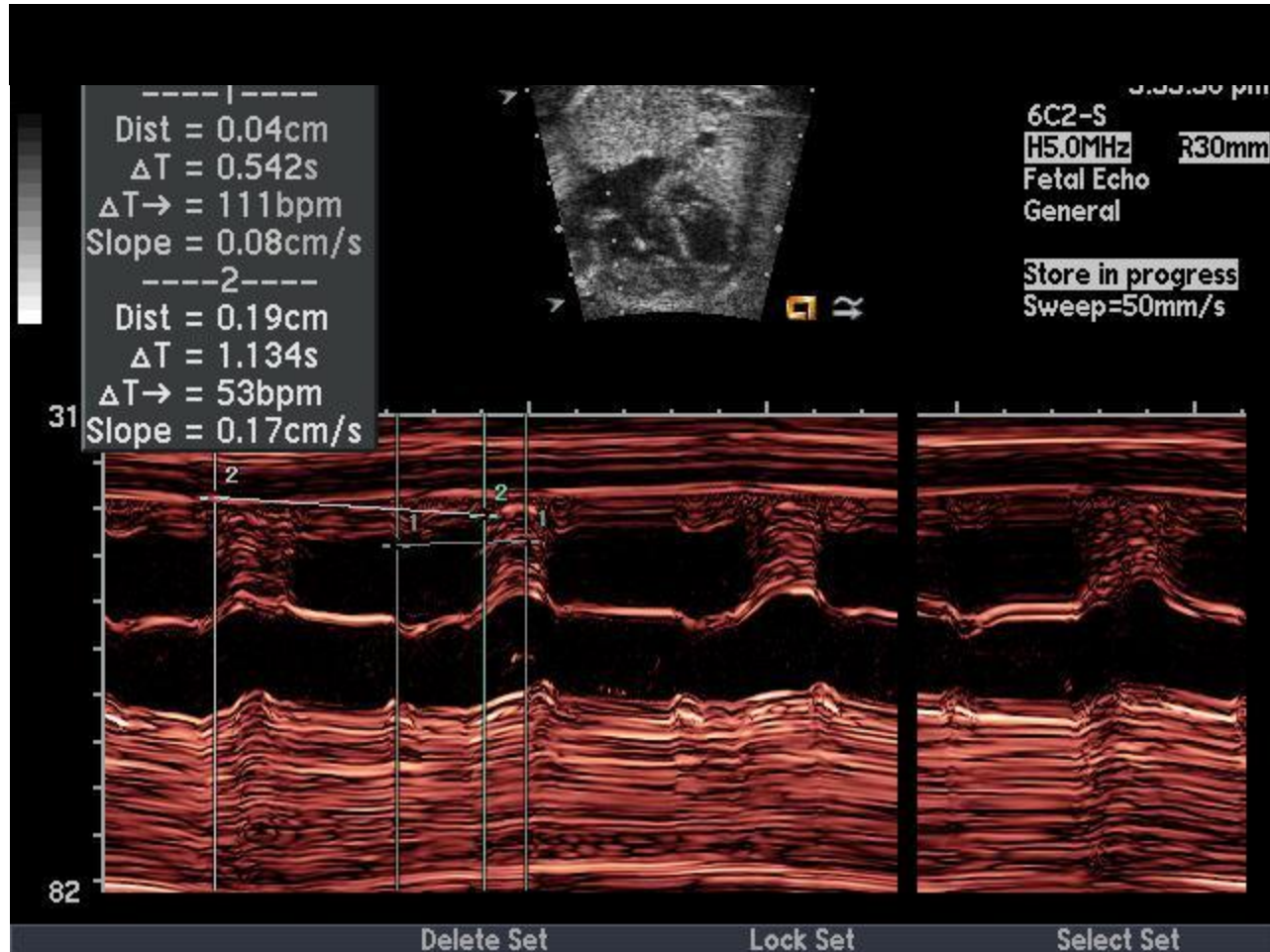
- Fetal heart rate < 110 beats/min
- Most commonly related to congenital complete heart block (CHB)
- Incidence of CHB 1:20,000
- Complex cardiac structural defects present in 50% of pts
- Combination of complex heart disease and bradycardia = very poor prognosis



Isolated Congenital Heart Block

- No structural heart disease
- High association with maternal autoimmune disease
- Maternal testing: anti SS-A/Ro and anti SS-B/La antibodies increased risk of CHB
- In these pts, consider frequent monitoring between 16-24 weeks¹

¹ Friedman DM et al. Utility of cardiac monitoring in fetuses at risk for congenital heart block. *Circulation*. Jan 2008.





Treatment: Bradyarrhythmia

- Fetuses with HR > 60 generally do well
- Sustained HR 55 bpm or less particularly in association with complex heart disease or hydrops may require early delivery and immediate neonatal intervention
- Postnatal interventions include pacing or chronotropic drugs such as isoproterenol



Treatment: Bradyarrhythmia

- Treatment with maternal corticosteroids in CHB reported, will not reverse CHB once present
- Maternal tx with terbutaline also reported
- Generally good prognosis in absence of hydrops or structural heart disease



Fetal arrhythmias in review ...

For the fetus with arrhythmia:

- Is the arrhythmia sustained or nonsustained?
- Is the heart rate fast or slow?
- Is there hydrops or cardiovascular compromise?
- For sustained fetal tachycardia, consider maternal agents such as digoxin or flecainide
- For fetal bradycardia <55 bpm, consider maternal terbutaline, early delivery if feasible for postnatal intervention



Fetal arrhythmias in review ...

- 1. The normal fetal heart rate ranges between:
 - a. 110 to 160 beats per minute.
 - b. 80 to 150 beats per minute.
 - c. 150 to 250 beats per minute.
 - d. 120 to 200 beats per minute



Fetal arrhythmias in review ...

2. The most common arrhythmia in fetuses that leads to a referral for an arrhythmia is:

- a. Premature atrial contractions (PACs)
- b. Premature ventricular contractions (PVCs)
- c. Supraventricular tachycardia (SVT)
- d. Atrial Flutter (AF)



Fetal arrhythmias in review ...

The drug of first choice for treatment of non-hydropic fetal supraventricular tachycardia is:

- a. Sotalol
- b. Amiodarone
- c. Flecainide
- d. Digoxin



Fetal arrhythmias in review ...

The presence of maternal anti SS-A/Ro or anti SS-B/La antibodies has been associated with an increased risk in the fetus for

- a. supraventricular tachycardia
- b. complete heart block
- c. ventricular tachycardia
- d. premature atrial contractions



Fetal arrhythmias in review ...

The level of drug in the fetus is influenced by all of the following except:

- a. transplacental transfer
- b. dosage of drug
- c. maternal serum levels
- d. type of arrhythmia



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