- No industry or financial disclosures
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AHA Scientific Statement

Diagnosis and Treatment of Fetal Cardiac Disease
A Scientific Statement From the American Heart Association

Endorsed by the American Society of Echocardiography and Pediatric and Congenital Electrophysiology Society

The American Institute of Ultrasound in Medicine supports the value and findings of the statement.*

The Society of Maternal Fetal Medicine supports the statement's review of the subject matter and believe it is consistent with its existing clinical guidelines.†

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Circulation 2014;129:2183-2242
All Happy Hours in Short Pump, VA

0.5 miles away
- Four House
  - 11:00am - 2:00am: Half Price

1 mile away
- Kona Grill
  - 3:00pm - 7:00pm: 1/2 off appetizers $3 Bud Light and Blue Moon; $4.50 glasses of wine, margaritas and cosmopolitan; $7 sake bombs

5 miles away
- Shula's America's Steak House
  - 4:00pm - 7:00pm: discounted drinks discounted foods
- Beach House
  - 11:00am - 2:00am: $1 OFF
- Zorba's Restaurant
- Rare Olde Times Pub
  - 3:00pm - 7:00pm: $1 off domestic draft beers, well drinks.

www.thehappyhourfinder.com/us_va/short-pump/
Objectives

• Reviews ways to evaluate fetal arrhythmias
• Discuss etiologies and treatment for the different types of arrhythmias
  – Irregular HR
  – Tachycardias
  – Bradycardias
Tools to Evaluate Fetal Arrhythmia

- 2D ECHO
- M Mode
- Anatomic M Mode
- Doppler
- Tissue Doppler
- Other (Fetal EKG, Magnetocardiography)
2D ECHO

Tachycardia

Bradycardia
M Mode

Ventricle

Atrium
Anatomic M Mode
Doppler

LV Inflow/Outflow
Tissue Doppler
Other Methods: SVC/Aorta
Other Methods: Renal Vessels

S: Ventricular systole
D: Atrial Diastole
A: Atrial systole

Berg. *Ultrasound Obstet Gynecol* 2009
Other Methods: Pulmonary Vessels

- S: Ventricular systole
- D: Atrial Diastole
- A: Atrial systole
Classification of Arrhythmias

- **Irregular fetal heart rhythms**: irregular due to beat to beat variability, but in the average rate range (100 – 180 BPM)
- **Tachycardias**: > 180 BPM (may be sustained or intermittent); Sinus Tachycardia, SVT, atrial flutter, VT
- **Bradycardias**: < 100 BPM; usually complete heart block, sinus bradycardia or blocked PACs
Irregular Heart Rhythms

- Common: PACs (up to 2% of term fetuses)\(^1\); PACs most common cause of referral for fetal arrhythmia; PVCs much less common
- If PACs are very early and frequent, they may be blocked and result in low ventricular rates.
- Encourage stop smoking, excessive caffeine or use of potential cardiac stimulating drugs (cold meds)
- PACs are not a marker for CHD (1%; series of 194 fetuses 2 had CHD)\(^2\); PACs do not progress to SVT; In general do not need to be referred
- PVCs seen with CHD at a higher frequency

\(^1\) Southall et. al. *Arch Dis Child* 1980
\(^2\) Simpson et al. *Cardio Young* 1996.
PACs vs. PVCs

Partial compensatory pause

Full compensatory pause
PACs vs. PVCs

Ventricles - PAC Conducted

Atria - PAC

Ventricles - PVC

Atria - normal
Fetal PACs

AO outflow

MV inflow

Conducted PAC

Ventricle

Atria

Blocked PAC
Fetal Ventricular Ectopy
Fetal Tachycardias

• Reentry SVT (70 – 90%): 1:1 A:V conduction; HR is usually between 220 – 260 BPM
• Atrial flutter (10 – 30%): variable AV conduction; atrial rates 400-600 BPM, ventricular rates depend on degree of conduction
• Ventricular tachycardia (< 1 - 2%): ventricular rate > atrial rate with atrioventricular dissociation.
• Sinus Tachycardia
SVT 1:1 Conduction
Run of SVT
Atrial Flutter (2:1 AV conduction)
Sinus Tachycardia

1. Anemia
2. Infection/maternal fever
3. Hyperthyroid
4. Compression (mass)
5. Drug
6. Fetal Distress
Treatment Options

• Decision to treat depends on gestational age, signs of CHF/hydrops, duration of tachycardic episodes
• Treatment options can include no treatment with close observation, medical treatment, delivery of infant for failed medical treatment, if they are near term or worsening hydrops
• Pharmacology of drug treatment during pregnancy is very complex, but depend on maternal, placental and fetal drug absorption, distribution, metabolism and elimination
**Treatment Options: Digoxin**

- First line treatment in most multi-center experience; best safety profile
- IV loading dose then bid dosing (maternal trough digoxin level 1.5 – 2.0 ng/ml); In non-hydrops fetal levels are 60 - 70% of maternal levels; Hydrops present:20 - 40%
- Digoxin as single drug with no hydrops had conversion rate of for SVT (65.4%) and AF: (51.7%)¹
- When hydrops was present, digoxin significantly lower conversion rates for SVT (24.6%) and AF (6.3%)¹

¹Krapp et.al. *Heart* 2003
Treatment Options: Flecainide

- Flecainide (Class IC); 100mg bid – tid
- Proarrhythmia 4 – 17%, increases digoxin and amiodarone levels
- Up to 60% effective (16/27) in hydropic fetuses\(^1\); 100% nonhydropic fetuses\(^2,3,4\) (smaller numbers)
- One report on 15 fetuses with SVT and hydrops who had initial failure with digoxin. After addition of flecainide 14/15 had conversion to sinus rhythm and ultimate resolution of hydrops.\(^5\)

\(^1\)Simpson et.al. *Heart* 1998.
\(^2\)Hansmann et.al. Ultras Obstet Gynecol 1991
\(^3\)Van Engelen et al. J Am Coll Cardiol 1994
\(^4\)Frohn – Mulder et.al. Prenat Diag 1995
\(^5\)Krapp et.al. Ultras Obstet Gynecol 2002
Treatment Options: Sotolol

- Sotolol (Class III antiarrhythmic); 80 – 160 mg bid
- QTc prolongation (4 – 5%), bradycardia, hypotension
- Prospective study on 18 fetuses (9 SVT/9 AF; 3 hydrops) where 12/14 tx with sotolol and 2/4 tx with sotolol/digoxin converted to sinus rhythm.¹
  - Maternal and fetal blood concentrations showed good correlation, but did not predict success
  - Sotolol not associated with growth retardation.
- Used as first line treatment for atrial flutter in some centers.²

¹ Oudijk et. al. JACC; 2003
² Jaeggi et. al. Sem. Fetal and Neonatal Med; 2005
Treatment Options: Amiodarone

- Amiodarone (Class III antirrhythmic); load 800-1200mg/d; maint. 400-800 mg/d
- QTc prolongation, proarrhythmic ~ 1%; bradycardia, hypotension, fetal hypothyroidism, ↑ digoxin levels, liver dysfunction, corneal deposition
- Poor placental transfer (10-40%).
- Last resort; rarely needed to be used (when delivery of preterm infant is not acceptable and other medications have failed)
Treatment Options: Direct Fetal Therapy

• Direct injection of drugs into fetal circulation (umbilical vein, fetal heart, fetal peritoneum and muscle)
• Usually used as last resort in severely hydropic fetuses with tachycardia resistant to transplacental therapy and delivery is not a reasonable option.
• Drugs used amiodarone, digoxin, verapamil and adenosine
Comparison of Treatments: Digoxin, Flecainide, Sotalol

- 159 consecutive pts SVT (114) & AF (45)
- Randomized 75 (SVT), 36 (AF) to Tx with Digoxin (24), Flecainide (35), Sotalol (52)

Jaeggi et. al. *Circulation* 2011
Tx Summary for Fetal Tachycardia at CHKD/EVMS

• Digoxin first line for reentry SVT (1:1) without hydrops

• Use other medications (Flecainide, Sotalol) for failure of digoxin, or as primary treatment if fetal hydrops is present or arrhythmia is atrial flutter.

• For sinus tachycardia look for other causes
Bradycardia

- PAC’s not conducted (discussed)
- Sinus Bradycardia
- Complete heart block
Sinus Bradycardia
Sinus Bradycardia

- Variation on normal
- Fetal distress
- Long QT syndrome
- Cardiomyopathy
- Myocarditis
- Maternal hypothyroidism
- Maternal meds
- Fetal CNS malformations
Complete Heart Block: 2D and Color
Complete Heart Block: MMode

Ventricular

Atrial
Complete Heart Block: MMode
Complete Heart Block: Pulse Doppler

Ventricular

Atrial
Fetal Complete Heart Block Outcomes

- Multicenter study of 55 fetuses with CHB
- 29 (53%) with CHD (heterotaxy, L atrial isomerization), 19 (35%) structurally nl hearts (+ antibody screen) 7 (13%) idiopathic
- Survival to neonatal period: 14% in CHD group; 85% in children with structurally normal hearts.

Schmidt et. al, *J Am Coll Cardiol* 1991
Fetal Complete Heart Block Outcomes

CHB and Structurally Normal Hearts

100% (20/20) survival for FHR > 55 BPM
33% (2/6) survival for FHR < 55 BPM

CHB and CHD

38% (3/8) survival for FHR > 55 BPM
7% (1/15) survival for FHR < 55 BPM

Figure 2. Atrial and ventricular rates in 49 fetuses with complete AV block. Top, In the 26 fetuses without an associated structural heart defect the atrial rates are well above 120 beats/min. Most surviving fetuses (open circles) have a ventricular rate >55 beats/min, whereas the four nonsurviving fetuses (closed circles) have a ventricular rate ≤55 beats/min. Bottom, Among the 23 fetuses with an associated structural heart defect there are only a few survivors (open circles). Many of the nonsurvivors (closed symbols) have an atrial rate ≤120 beats/min, but almost all of them have left atrial isomerism (closed triangles). As in the top panel, the ventricular rate is <55 beats/min in most of the nonsurviving fetuses with an associated heart defect.

Schmidt et. al, *J Am Coll Cardiol* 1991
Predicting Fetal CHB - AV Interval
PRIDE Study

- 98 pregnancies anti-SSA positive
- 3 fetuses developed CHB; none showed prolongation of AV interval prior, none improved with dexamethasone
- 2 fetuses developed AV interval > 150 ms; both reversed within 1 wk with Tx dexamethasone

Mechanical AV interval:
Beginning of A wave – upstroke of Ventricular flow >150 ms (3 SD)

Conclusion: CHB can develop within 1 wk of normal ECHO with normal PR interval. Perform intense monitoring 16-24 wks EGA

Friedman et.al; Circulation, 2008
Predicting Fetal CHB – AV Interval

• 165 pregnancies anti-SSA positive prospectively studied 2003-2009

• 1 fetus developed CHB (28 wks); 3 nl ECHO (19 – 24 wks)

• 11 (7%) fetuses: transient prolongation of AV interval (≤ 3 z-scores)
  – No treatment 10/11 had normal ECG at 56 (range 43-87) DOL
  – No treatment 1/11 had ECG with 1° AVB that has persisted (now 6yo)

• 3 (2%) fetuses: persistent prolonged AV interval (> 3 z-scores)
  – No treatment given; one Nl ECG at birth, one 1° AVB at birth that resolved, one 1° AVB that has persisted (now 3 yo)

Conclusions: Prolonged AV interval is a benign condition and in not predictive of development of CHB.

Jaeggi et.al; JACC, 2011
Predicting Fetal CHB:
Past Pregnancy Hx, Antibody Level

- PRIDE study: CHB developed in 19% of pregnancies with previously effective child, 4% in no prior effective child. (P=0.067) \(^1\)
- Anti-Ro/SSA antibody level as predictor of development of CHB:
  - 8 yr study comparing 146 SSA positive fetuses with no CHB compared to 40 SSA positive fetuses with CHB
  - All CHB were associated with moderate (>50 U/ml) and high (>100 U/ml)
  - Event rate of CHB was 5% in prospectively screened fetuses with SSA levels >50 U/ml (odds ratio: 7.8) and 0% for fetuses with lower titers (p < 0.0001)

\(^1\)Friedman et.al; *Circulation*, 2008
\(^2\)Jaeggi et.al; *JACC* 2010
Fetal CHB Treatment

• Treatment depends on etiology of CHB, gestational age, fetal heart rate and presence of fetal hydrops

• Treatment options are often institution specific and can include steroids, sympathomimetics, IVIG, and premature delivery
Fetal CHB Treatment

Steroids

• Fluorinated steroids (Dexamethasone/betamethasone) cross placenta well and is commonly used when etiology of maternal autoantibody is suspected

• Use is supported by small cases series and case reports (no large prospective studies)

• Complications can include growth restriction, oligohydramnios, ductal constriction, maternal DM, CNS effect
Fetal CHB Treatment

Sympathomimetics

- Salbutamol (Canada): 20% increase in HR from baseline (N=3; 2 w/hydrops)\(^1\)
- Terbutaline: 7 infants with FHR < 60 treated, 6/7 showed initial increase HR; 4 maintained HR > 60, 2 returned to HR < 60 and 1 fetal death\(^2\)
- Terbutaline: 17 fetuses (8 isoimmune, 9 heterotaxy) treated for HR < 55. All survived to delivery. Greater ↑ atrial rates in isimmune vs ↑ ventricular rate for heterotaxy\(^3\)

\(^1\) Groves et. al. *Circulation* 1995
\(^2\) Robinson et. al. *Cardiol Young* 2001
\(^3\) Cuneo et.al. *Am J Cardio*, 2007
Fetal CHB Treatment

- IVIG: Small case series in severely affected fetuses (EFE or cardiomyopathy) used in conjunction with Dexamethasone showed some improvement in outcomes\(^1\)
- Direct fetal pacing through has been reported as single case reports; short–lived improvement
- Plasmapheresis is theorized to decrease maternal antibody delivery; not supported with literature, significant maternal risk

\(^1\) Trucco et. al. *JACC*, 2010
Fetal CHB Treatment:
Toronto Children’s Management of CHB since 1997

AT DIAGNOSIS OF FETAL ISOLATED ATRIO-VENTRICULAR BLOCK:
- HR > 55 beats/minute + normal ventricular function: DXMT
- or
- HR < 55 beats/minute or abnormal ventricular function: DXMT + beta-sympathomimetic

PREGNANCY FOLLOW-UP:
- weekly/bi-weekly: obstetrical assessment
- weekly/bi-weekly: fetal echocardiogram

DELIVERY AT TERTIARY CARE CENTER:
- Uneventful course: C-section (or vaginal delivery) at about 37 weeks
- Progressive hydrops: (Paracentesis) + C-section + immediate pacing

NEONATAL CRITICAL CARE MANAGEMENT:
- Low output: isoprenaline, pacing, etc
- Neonatal lupus: oral prednisone
- Endocardial fibroelastosis: iv. immunoglobulin

Figure 2. A, Era of diagnosis of fetal isolated CAVB and freedom from death. B, Transplacental fetal treatment with (Steroid) and without (No Steroid) dexamethasone and freedom from death. Survival was best with protocol-guided approach (Tx Protocol).

Jaeggi et. al. Circulation, 2004
Fetal Arrhythmias: Summary

- Fetal arrhythmias are common, often due to premature atrial ectopic beats and usually benign.
- Some arrhythmias are more important and life threatening resulting in fetal tachycardia and bradycardia.
- Treatment modalities are variable and depends on etiology, gestational age and signs of CHF/hydrops.
- Team approach with MFM, pediatric cardiology, delivery at tertiary care hospital will result in best outcomes.
Extra Slides
Fetal Complete Heart Block Outcomes

- 37 fetuses identified over 8 years with CHB
- 21 (57%) with CHD; 17 Heterotaxy (L atrial isom)
- 16 (43%) with isolated CHB (all + anti-Ro; SSA)
- Hydrops: 11/21 w/CHD 4/16 w/ isolated CHB
- Survival though pregnancy and newborn period: 15% in CHD group; 69% in isolated CHB group.

Machado et al. Br Heart J, 1988
Doppler
Fetal PACs
Fetal PACs
Fetal PACs
Fetal PACs
Doppler

SVC and Aorta
SVT
Atrial Flutter
Tachy/Brady Syndrome
Fetal Bradycardia
(Complete Heart Block)
PACs vs. PVCs
Premature ventricular contractions (PVCs)

LV diverticulum/aneurysm

False tendon
Conducted vs. Blocked PACs

“Extra beat”

“Skipped beat”
Single conducted PAC
Single conducted PAC
Single blocked PAC
Single blocked PAC
Frequent vs. Infrequent
Random vs. Rhythmic patterns

- Bigeminy
- Chaotic
- Trigeminy
Premature contractions

Progression $\sim 3-5\%$

30 weeks
Slow ventricular rate

32 weeks
Warm-up phenomenon

34 weeks
fast ventricular rate
Irregular fetal heart rhythm

Management options

- Isolated
- Infrequent
- Random
- Intermittent
- PACs or PVCs

- Combined with CHD
- Frequent
- Bi-/trigeminy
- Sustained
- PACs or PVCs

- Follow up at MFM in 2 weeks

- No arrhythmia

- Persistence
- Progression

No Follow up at MFM

Treatment

Delivery
Tachyarrythmias Classification

1. Sinus tachycardia
2. Supraventricular tachycardia
   - Paroxysmal
   - Sustained
3. Ventricular tachycardia
4. Atrial Flatter
5. Atrial fibrillation
Sinus tachycardia

1:1 AV conduction

1. Anaemia
2. Infection/maternal fever
3. Fetal thyrotoxicosis
4. Compression (mass)
5. Drugs
6. Fetal distress
Paroxysmal SVT

1:1 AV conduction
**Tachyarrhythmias: treatment**

Table 30.2. Therapeutic protocol for the antiarrhythmic therapy of fetal tachyarrhythmia currently used in our hospital based on data from the literature and our own experience.\(^9\)

<table>
<thead>
<tr>
<th>Tachyarrhythmia</th>
<th>First choice</th>
<th>Second choice</th>
<th>Third choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSVT (short-term and without hydrops)</td>
<td>control twice a week</td>
<td>digoxin + flecainide</td>
<td>digoxin + sotalol</td>
</tr>
<tr>
<td>PSVT (long-term and/or with hydrops, especially below 30 weeks of gestation)</td>
<td>digoxin</td>
<td>digoxin + flecainide</td>
<td>digoxin + sotalol; alternatively: digoxin + amiodarone (directly and transplacentally)</td>
</tr>
<tr>
<td>SVT without hydrops</td>
<td>digoxin</td>
<td>digoxin + flecainide</td>
<td>digoxin + sotalol; alternatively: digoxin + amiodarone (directly and transplacentally)</td>
</tr>
<tr>
<td>SVT with hydrops, without AV valve regurgitation</td>
<td>digoxin</td>
<td>digoxin + flecainide</td>
<td>digoxin + sotalol; alternatively: digoxin + amiodarone (directly and transplacentally)</td>
</tr>
<tr>
<td>SVT with hydrops, without AV valve regurgitation</td>
<td>digoxin</td>
<td>control twice a week; digoxin + flecainide</td>
<td>digoxin + sotalol; alternatively: digoxin + amiodarone (directly and transplacentally)</td>
</tr>
<tr>
<td>AF without hydrops</td>
<td>digoxin</td>
<td>digoxin + flecainide</td>
<td>digoxin + sotalol; alternatively: digoxin + amiodarone (directly and transplacentally)</td>
</tr>
<tr>
<td>AF with hydrops</td>
<td>digoxin</td>
<td>control twice a week; digoxin + flecainide</td>
<td>digoxin + sotalol; alternatively: digoxin + amiodarone (directly and transplacentally)</td>
</tr>
<tr>
<td>VT without hydrops</td>
<td>control twice a week</td>
<td>flecainide</td>
<td>digoxin + sotalol</td>
</tr>
<tr>
<td>VT with hydrops</td>
<td>control twice a week</td>
<td>amiodarone</td>
<td></td>
</tr>
</tbody>
</table>

1. If the frequency of tachycardia can be reduced under flecainide and other antiarrhythmic therapy below 210 beats/minute and the pulsatile monophasic blood flow in the precordial veins is replaced by the normal biphasic antegrade blood flow pattern, we can expect a significant reduction of fetal venous pressure and the medication should be continued even if complete cardioversion is not obtained.
2. After the 34 weeks of gestation, fetuses with supraventricular tachycardia may be delivered, in particular if hydrops progresses despite antiarrhythmic therapy.
PSVT, paroxysmal supraventricular tachyarrhythmia; SVT, supraventricular tachycardia; AV, atrioventricular; AF, atrial flutter; VT, ventricular tachyarrhythmia.
## Tachyarrhythmias: treatment

### Table 28.1. Guide to fetal arrhythmia treatment

<table>
<thead>
<tr>
<th>Drug</th>
<th>Loading dose</th>
<th>Maintenance dose</th>
<th>Plasma level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digoxin</td>
<td>0.5–1.0 mg i.v.</td>
<td>0.25 mg t.i.d.</td>
<td>1–2.5 ng/ml</td>
</tr>
<tr>
<td>Verapamil</td>
<td>40–80 mg t.i.d.</td>
<td>80–300 ng/ml</td>
<td></td>
</tr>
<tr>
<td>Propranolol</td>
<td>10–40 mg t.i.d.</td>
<td>20–1000 ng/ml</td>
<td></td>
</tr>
<tr>
<td>Procainamide</td>
<td>15 mg/kg i.v. &lt;sup&gt;c&lt;/sup&gt; (max. 1 g)</td>
<td>0.5–1.0 g p.o. q.4h.</td>
<td>3–6 µg/ml</td>
</tr>
<tr>
<td>Quinidine</td>
<td>200–400 mg t.i.d/q.d.s</td>
<td>2–6 µg/ml</td>
<td></td>
</tr>
<tr>
<td>Flecaïnide</td>
<td>100 mg t.i.d</td>
<td>0.4–0.8 µg/ml&lt;sup&gt;d&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Amiodarone</td>
<td>800–1600 mg/day p.o/i.v</td>
<td>400–800 mg/day</td>
<td>0.5–2.5 µg/ml</td>
</tr>
<tr>
<td>Sotalol</td>
<td>80–160 mg b.i.d</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drug</th>
<th>Direct i.v. therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amiodarone</td>
<td>2.5 mg/kg estimated fetal weight i.v. over &gt; 30 mins</td>
</tr>
<tr>
<td>Adenosine</td>
<td>50–200 µg/kg&lt;sup&gt;35&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup>Do not use verapamil and beta blockers at the same time.

<sup>b</sup>Atropine 0.5–1.0 mg should be available for managing the side effect of bradycardia due to atroventricular block. Verapamil should not be administered directly to the fetus.

<sup>c</sup>As infusion, at about 50 mg/min.

<sup>d</sup>Regular ECG monitoring indicated, QRS widening >25% indicated toxicity.

<sup>35</sup>Regular ECG monitoring to ensure maternal QTc remains less than 500 ms.
Bradyarrhythmias: Classification

1. Sinus bradycardia
   - Intermittent
   - Sustained

2. Frequent blocked PACs

3. Second-degree heart block

4. Third-degree heart block (complete)
Sinus Bradycardia

1:1 AV conduction

- Sinus node dysfunction
- Long QT syndrome
- Fetal distress
Sinus Bradycardia
Frequent blocked PACs - bigenimy
Frequent blocked PACs - trigeminy
Second-degree Heart Block
Complete Heart Block
Complete heart block: M-mode at 4-chamber view
Complete heart block: Doppler at LVOT
<table>
<thead>
<tr>
<th>Condition</th>
<th>With CHD ~ 40%</th>
<th>Without CHD ~ 60%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heterotaxy</td>
<td>left isomerism</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ventricular inversion</td>
<td></td>
</tr>
<tr>
<td>Fetal Hydrops</td>
<td>63%</td>
<td>Fetal Hydrops 20%</td>
</tr>
<tr>
<td>Survival rate</td>
<td>13%</td>
<td>Survival rate 78%</td>
</tr>
<tr>
<td>Anti-SSA/Ro</td>
<td>&gt; 100 U/ml</td>
<td>Anti-SSA/Ro negative</td>
</tr>
</tbody>
</table>
Bradyarrhythmias:
Differential diagnosis

HR <100 bpm:

- regular
  - check atrial and ventricular activity
    - atrial & ventricular activity associated, slow atrial and slow ventricular rate
    - atrial & ventricular activity associated, every 2nd atrial contraction premature, blocked at AV-node
    - atrial & ventricular activity dissociated, normal atrial and slow ventricular rate
    - atrial & ventricular activity associated, every 3rd atrial contraction premature, blocked at AV-node

- irregular
  - atrioventricular delay increasing, atrial contraction repeatedly blocked at AV-node
  - atrial & ventricular activity dissociated, frequent premature ventricular contractions

- sinus bradycardia (LQTS?)
- bigeminal PACs
- complete AV-block
- arrhythmic (2:1) PACs
- 2° AV-block (Wenckebach)
- complete AV-block & PVCs

From "Fetal Cardiology" by Yagel; 2003
Complete Heart Block
Management options

Referrals at 20-22 weeks

Ventricular rate < 50bpm

Endocardial fibroelastosis

Basic treatment

US follow up every 1-2 weeks

Delivery: 37-38 weeks, CS

Late referrals > 32 weeks

No treatment

Basic treatment

US follow up every 1-2 weeks

Delivery: 37-38 weeks, CS

DEXAMETHASONE:
8mg/d – 2 weeks
4mg/d – 2 weeks
2mg/d – 2 weeks
+ SALBUTAMOL

+ Ig 70g every 2-3 weeks

Arrhythmias and CHD

Myocardial diverticulum
Myocardial non-compaction
PACs are not a marker for CHD

Ebstein Anomaly

Left isomerism

Rhabdomyomas

Ectopic beats
Tachyarrythmias

Ventricular inversion
Bradycarrythmias