Fetal Cardiac Arrhythmia: Diagnosis and Management

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Objectives

- Evaluation of fetal heart rate and rhythm
- Recognize abnormal heart rhythm
- Indications for referral
- Differential diagnosis of fetal tachycardia and management
- Differential diagnosis of fetal bradycardia and management
Fetal Cardiac Arrhythmia

- Occur in 1-3% of pregnancies
- 10-20% fetal cardiology referrals
- Majority are benign
- Can cause fetal morbidity (hydrops) and demise
- Potential to alter course with therapy
Fetal Cardiac Arrhythmia

- Fetal heart rate and rhythm assessment mandatory component of fetal echocardiogram per recent published guidelines
  - AHA 2014
  - AIUM 2013
  - ASE 2004
Normal Cardiac Conduction

Surface EKG

Wang P J , and Estes N A M Circulation. 2002;106:e206-e208 AHA .org
Normal fetal heart rate and rhythm

- Rhythmic contractions begin at 22 days post conception
- Atrio-ventricular synchrony by 6 weeks (110bpm)
- Average HR 170 bpm at 10 weeks, 150 bpm at 16 weeks, 140 bpm at 20 weeks, 130 bpm at term
- Normal range: 110-180 bpm
- Beat to beat variability of 5-15 bpm
Assessment of Fetal Rhythm

- Echocardiography is the mainstay
  Pulse Doppler, M-mode, Tissue Doppler

- Direct electrocardiographic assessment of rhythm (fetal electrocardiography)-limited use due to poor quality

- Magnetocardiography- higher quality, limited availability
Echocardiographic analysis of fetal cardiac rhythm

- Heart rate
- Demonstrate sequential atrioventricular contraction
- Mechanism of tachycardia / bradycardia
- Measurements - ex. mechanical PR interval
Echocardiographic analysis of fetal cardiac rhythm: M-Mode echo

Simultaneous M-mode recording of atrium and ventricle
Echocardiographic analysis of fetal cardiac rhythm: Doppler

Simultaneous Doppler tracing of left ventricular inflow and outflow.
Echocardiographic analysis of fetal cardiac rhythm: Doppler

Simultaneous Doppler tracing of pulmonary vein (below) and pulmonary artery (above)
Echocardiographic analysis of fetal cardiac rhythm: Doppler

Simultaneous Doppler tracing of ascending aorta (below baseline) and SVC (above)
Abnormal Fetal Rhythm

- Irregular
- Tachycardia
- Bradycardia
Irregular cardiac rhythm

- Premature atrial contractions (PAC’s)
- Premature ventricular contractions (PVC’s)
- 2nd degree atrioventricular block (AVB)
Irregular cardiac rhythm

- Premature beats occur in 1-3% pregnancies
- Benign
- Rare - myocarditis, tumors, aneurysm, diverticulum, maternal stimulants
- Atrial ectopy 10-fold more common
- Frequent or persistent ectopy (more than 2 weeks) needs further evaluation
Premature atrial contractions
Premature atrial contractions
PACs: Conducted and non-conducted
Ventricular bigeminy
2\textsuperscript{nd} degree AV block

Parthiban, Swaminathan   Cardiol in the Young Vol 14, Issue 4: 432- 34
Ectopy- Management

- Pharmacotherapy not recommended
- 0.5 to 1% risk of supraventricular tachycardia with PAC’s
- Unknown risk of ventricular tachycardia with PVC’s
- Differentiate from 2nd degree AV block
- Observation with weekly heart rate assessment, function assessment if myocarditis or other structural disease
- Referral for fetal echocardiogram
Fetal tachycardia

- HR > 160 bpm
- Sinus (160-200 bpm)
- Pathologic mechanisms (180-280 bpm)
Pathologic fetal tachycardia

- Accessory pathway mediated supraventricular tachycardia (SVT)
- Atrial flutter
- Ventricular tachycardia – tumor, aneurysm, myocarditis, Long QT syndrome
Fetal tachycardia
SVT: Accessory pathway
Atrial flutter

Atrial rate usually 300-500 bpm. Panel above shows 2:1 atrioventricular conduction
Fetal Tachycardia- Management

- Sustained tachycardia can result in hydrops fetalis
- In utero pharmacotherapy is usually successful
- Management depends on gestational age, fetal compromise, maternal and fetal risk factors, type of tachycardia
- Referral for fetal echocardiogram and cardiac evaluation – assess mechanism and therapy
Fetal Tachycardia - Management

- Digoxin, flecainide, sotalol, amiodarone, IV magnesium, lidocaine
- Direct fetal therapy (Intramuscular or intracordal) digoxin, amiodarone
- Risks to mother and fetus
- Little data to support specific treatment protocols for maximal efficiency and least risk
Fetal Bradycardia

- Heart rate <100 bpm
- Sinus bradycardia
- Atrial or junctional bigeminy with non-conducted extrasystoles
- AV block (high grade or complete)
Persistent bradycardia: Differential diagnosis

Sinus bradycardia

Atrial bigeminy with block
Complete (3rd degree) AV block
3d Degree AV block

A rate 140 bpm
V rate 60 bpm
3rd Degree AV block

- Autoimmune: Maternal collagen vascular disease (SLE, Sjögren’s)
- Associated with congenital heart disease
- Indices of poor prognosis: Ventricular rate < 55 bpm, endocardial fibroelastosis, myocardial dysfunction, hydrops fetalis
- Worse prognosis when associated with CHD
Fetal bradycardia - Management

- Referral for fetal cardiac evaluation and echocardiogram
- Sinus bradycardia - treat mechanism (maternal hypothyroidism, medications, autoimmune, long QT syndrome)
- Atrial bigeminy with block - observation, rule out complete/high grade AV block, risk of SVT 10%
- Immune mediated AV block - dexamethasone, IVIg, terbutaline, fetal pacing
Summary

- Assessment of fetal heart rate and rhythm is an important part of evaluation of the fetus.
- Though uncommon, fetal arrhythmia can cause significant fetal morbidity and mortality.
- Pharmacotherapy is often successful in managing most common forms of tachycardia.
- Early cardiac referral is important in management.