FETAL ARRHYTHMIA OUTLINE

- Overview
- Echocardiographic Evaluation
- Mechanism of Arrhythmias
- Extrasystoles
- Fetal Tachycardia
- Fetal Bradycardia
  - Heart block
FETAL ARRHYTHMIAS OVERVIEW

• 1-3% of pregnancies
• 10-20% of cardiac referrals
• Challenges with fetal EKG
  • Low p wave amplitudes
  • Signal acquisition from 27-34 weeks
• Early recognition is important
  • M-mode and Doppler Techniques
Overview
Echocardiographic Evaluation
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ECHOCARDIOGRAPHIC ANALYSIS OF FETAL CARDIAC RHYTHM: M-MODE ECHO
ECHOCARDIOGRAPHIC ANALYSIS OF FETAL CARDIAC RHYTHM: PULSED DOPPLER
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FETAL ARRHYTHMIA MECHANISMS

Extrasystoles
- Atrial*, junctional, ventricular

Tachycardia
- Sinus Tachycardia
- Supraventricular tachycardia
  - Reentrant
    - Atrioventricular (AV) reentrant tachycardia *
    - Atrial flutter *
    - AV nodal reentrant tachycardia
    - Paroxysmal junctional reciprocating tachycardia (PJRT)
  - Ectopic
    - Ectopic Atrial tachycardia
    - Junctional ectopic tachycardia

Ventricular
- Ventricular Tachycardia

Bradycardia
- Sinus Bradycardia
- Sinoatrial block
- Atrioventricular * block
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EXTRASYSTOLES

• Atrial extrasystoles
• Ventricular extrasystoles
PACS: CONDUCTED AND NON-CONDUCTED
VENTRICULAR ECTOPY: BIGEMINY
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FETAL TACHYCARDIA

HR > 160 bpm
Sinus (160-200 bpm)
Pathologic mechanisms (180-280 bpm)
70-90% AV reentry tachycardia
Evaluate for congenital heart disease
Fetal tachycardia

Assess AV relation

1:1

Assess VA/AV intervals

VA > AV
AET/PJRT/ST

VA < AV
AVRT

VA << AV
JET/VT

<1:1

VT

>1:1

Fast atrial rates

Regular

Variable
Aflutter
CAT, AFib
SINUS TACHYCARDIA

Fetal distress

- Hypoxemia, anemia, infection

Maternal use of medications

Fetal or maternal thyrotoxicosis

Maternal electrolyte abnormalities

Maternal fever
PATHOLOGIC FETAL TACHYCARDIA: AV 1:1

Short VA tachycardias
- AV reentrant tachycardia
  - Preexcitation about 30% of the time
- AVN reentrant tachycardia, typical
- Junctional ectopic tachycardia (JET)

Long VA tachycardias
- Ectopic atrial tachycardia (EAT)
- Paroxysmal junctional reciprocating tachycardia (PJRT)
SHORT VA TACHYCARDIA: ACCESSORY PATHWAY
LONG-VA TACHYCARDIA: SINUS TACHYCARDIA, EAT, PJRT
PATHOLOGIC FETAL TACHYCARDIA: AV > 1:1

Atrial Flutter
- 30% of cases of fetal tachycardia
- More As than Vs
- Atrial rate 300-500 bpm
- Regular
ATRIAL FLUTTER
FETAL TACHYCARDIA: VENTRICULAR AV<1:1

Relatively rare

HR 180-300 bpm

AV dissociation, can be 1:1

Usually automatic, non-sustained

Rare underlying etiology: Long QT, LV non-compaction, rhabdomyoma, fibroma, LV aneurysm
FETAL TACHYCARDIA: VENTRICULAR

Long QT syndrome
- Possible cause of intrauterine death
- High suspicion if:
  - Constant bradycardia (110-120 bpm), low HR variability
  - 2nd degree AV block (functional)
  - Torsade des pointes
- Diagnosis: Fetal magnetocardiography
Fetal Arrhythmia Monitoring Guideline: ectopy & tachycardia

Ectopy or tachycardia noted on OB scan → Refer for fetal echocardiogram

If ectopy noted on fetal echocardiogram:
- Follow-up with OB weekly for FHR checks and possible fetal echo in 4 weeks
- If not ectopy noted, to see OB in 1 week for FHR check

If fetal tachycardia noted on fetal echo
- Follow-up with OB weekly for FHR checks and possible fetal echo in 4 weeks
  - If FHR > 200 bpm or < 100 bpm, call OB
  - OB to admit for observation for 4-6 hrs
  - Obtain maternal baseline labs of a renal panel, calcium, phosphorus, magnesium & ECG*
  - May need US to check for hydrops and/or fetal echo to assess function/AVVR

If fetal tachycardia noted > 50% of the monitoring time, maternal admission for treatment

Please see fetal tachycardia treatment guideline - will include involvement of pediatric cardiology, pediatric EP, MFM and possibly adult EP

If fetal tachycardia not frequent/<50% of monitored time, then discharge w/o treatment with close follow-up.
- FHR with OB twice weekly
- Fetal echo every other week for AVVR & hydrops check

*If admitted recently for previous observation, no need to repeat lab work/ECG again
FETAL TACHYCARDIA: TREATMENT

In the final stages of pregnancy: Brief therapeutic attempt, if unsuccessful, delivery (preferably with CS), direct neonatal therapy.

Fetuses <34 weeks with sustained tachycardia need medical therapy to avoid complications of prematurity.
Fetal tachycardia treatment guideline:

Without hydrops:

SVT:
- First line:
  - Digoxin IV load (1200-1500 micrograms/day divided every 8 hours) for goal maternal Digoxin level 1.5 – 2
  - Then switch to oral Digoxin (375-750 micrograms/day divided every 12 hours); level ≤ 1.5-2
  - Flecainide can be considered first line (100-300 mg/day divided every 8 hours orally); levels 0.2-1
- Second line (in addition to the above):
  - Amiodarone oral load (1800-2400 mg/d divided every 6 hours for 48 hours)
  - Then switch to maintenance dose of 200-600 mg/day orally

Atrial Flutter:
- Sotalol (160-480 mg/day divided every 8 hours orally)

Ventricular tachycardia:
- Maternal IV Magnesium (loading dose 2-6 g IV over 20 min, followed by 1-2 g/hr for < 48 hours; can treat again if maternal Magnesium level < 6 mEq/L)

After Magnesium, consider one of the following with unclear QTc interval:
- Lidocaine load 1-1.5 mg/kg IV followed by 1-4 mg/min infusion (esp if hydrops)
- Propranolol 60-320 mg/day divided every 6 hrs oral
- Mexiletine 600-900 mg/day divided every 8 hrs oral

After Magnesium, if normal QTc interval (DO NOT give if LQTS suspected or confirmed):
- Sotalol
- Flecainide
- Amiodarone (for short term)

With hydrops:

SVT:
- First line consider direct intramuscular fetal tx (Digoxin IM dose 88 micrograms/kg every 12hrs, repeat 2 times) + transplacental tx

***All treatment requires***:
- Daily maternal ECGs
- Inpatient monitoring until fetal rhythm is <50% SVT

Outpatient monitoring with:
- Fetal echo once weekly at first, then every other week until delivery
- Discontinue anti-arrhythmic therapy at 37 weeks gestation if heart rate control achieved

***AVOID PRETERM DELIVERY UNLESS IN DIRE SITUATION***
POSTNATAL OUTCOME OF FETAL TACHYCARDIA

2/3 of newborns with fetal tachycardia present with recurrence postnatally

Predicting factors: Presence of hydrops, lack of response to intrauterine therapy and female sex

Most patients free of tachycardia after first 6 months
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FETAL BRADYCARDIA

Heart rate <100 bpm
• Sinus bradycardia
• Atrial or junctional bigeminy with non-conducted extrasystoles
• AV block (high grade or complete)
**SINUS BRADYCARDIA**

Transient (vagal, e.g. from transducer pressure)

Persistent

- Fetal distress
- Maternal hypothermia
- Sinus node disease
  - Primary (genetic etiology)
  - In the context of heterotaxy syndrome (left atrial isomerism / polysplenia syndrome)
- Long QT syndrome
PERSISTENT BRADYCARDIA: DIFFERENTIAL DIAGNOSIS

Sinus bradycardia

Atrial bigeminy
ISOLATED CONGENITAL AV BLOCK

1:20,000 births

Age of diagnosis: 18-24 weeks

Usually autoimmune mediated

- Maternal collagen vascular disease (SLE, Sjögren’s)
- Transplacental passage of Anti-Ro (SSA), anti-La (SSB) antibodies
- Possibility of AV block in the presence of maternal antibodies: 2-5%
- Possibility of appearance in subsequent pregnancies: 15-20%
- Occasionally progressive

Survival: 75% in isolated Complete Congenital AV block (CCAVB)

Indices of poor prognosis: Ventricular rate<55 bpm, endocardial fibroelastosis, myocardial dysfunction, hydrops fetalis
THIRD DEGREE AV BLOCK
CONGENITAL AV BLOCK IN THE CONTEXT OF CONGENITAL HEART DISEASE (CHD)

AV discordance (L-TGA, isolated ventricular discordance)

Heterotaxy syndrome (Left atrial isomerism)

LV non-compaction
CONGENITAL AV BLOCK IN THE CONTEXT OF CHD: PROGNOSIS

Much worse than isolated CCAVB

29-40% mortality

Poor prognosis

- Hydropic fetus with CCAVB and CHD
- Heart rate <55 bpm
Fetal Arrhythmia Monitoring Guideline: bradycardia, maternal autoimmune history + or history of previous pregnancy/child with complete heart block

Fetal bradycardia noted by OB → Refer for fetal echocardiogram

Maternal history of autoimmune disease, antibody positive and/or previous pregnancy/child with CHB

MFM involvement if not already involved

Fetal echo once weekly for fetal PR interval checks bw 16-28 weeks gestation:

If fetal heart block noted:
- Maternal testing of thyroid fan, sea, ssB antibodies if not previous performed
- Fetal magnetocardiography if Long QT suspected

If isoimmune disease positive with CHB:
MFM involvement if not already involved
Treatment with dexamethasone 4-8 mg/day* +/- IVIG (not early in gestation)
While receiving treatment, daily fetal echo for rhythm check

If isoimmune disease 1° AVB (PR >150 ms) or 2° AVB, + other signs of inflammation (AVVR, ventricular dysfunction, effusion), consider treatment with steroids

*extensive counseling before the use of steroids re: side effects of fetal growth restriction, oligo, ductal constriction, maternal DM and CNS effects
CONCLUSIONS

Fetal arrhythmia can be diagnosed with high degree of accuracy with fetal echocardiographic methods.

Treatment, depending on etiology, severity, can be delivered either transplacentally or intraumbilically, or directly after emergent delivery.
REFERENCES


ASL, draft, 6.2.2014

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