10. **CARDIAC ANOMALIES**

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I. **FETAL CIRCULATION - MAJOR FEATURES**

Placenta - Organ of gas exchange

Shunt Pathways: Ductus venosus  
Ductus arteriosus  
Foramen Ovale

II. **FETAL ECHOCARDIOGRAPHY**

A. Historical Perspectives

B. Indications

1. Fetal Factors
   - Abnormal level 1 scan
   - Intrauterine growth retardation
     - Twin-twin transfusion syndrome
   - Dysrhythmia
   - Extracardiac anomalies
   - Non-immune hydrops fetalis
   - Abnormal genetic screen
   - Decreased fetal movement

2. Maternal Factors
   - Congenital heart disease
   - Polyhydramnios
   - Rh sensitization
   - Diabetes mellitus
   - Collagen vascular disease
   - Teratogen exposure (e.g., alcohol, lithium, anti-convulsants, etc.)
   - Pre-eclampsia
   - Advanced maternal age

3. Familial Factors
   - Congenital heart disease
Syndromes (eg Marfan, Noonan etc.)

C. Timing - Optimal 14-22 weeks

D. Structural Heart Disease

1. Two dimensional; M-mode
   Four chamber view
   Segmental approach
   Abnormal anatomy
   Lesions **unable or difficult to exclude** by fetal echo:
   - Patent ductus arteriosus
   - Atrial septal defect; patent foramen ovale
   - Small ventricular septal defects
   - Minor valvar abnormalities
   - Pulmonary venous abnormalities

2. Doppler evaluation (pulsed and color)
   - Placental flow
   - Ductus arteriosus
   - Foramen ovale
   - A-V valves
   - Semilunar valves
   - Inferior Vena Cava

E. Arrhythmias
   Definition - any irregularity of fetal cardiac rhythm
   Unassociated with uterine contraction, or a sustained regular rhythm outside the range of 100-160 beats per minute.

   **Tachy** - Supraventricular tachycardia
      - Atrial flutter/fibrillation
      - Ventricular tachycardia
      - Junctional tachycardia

   **Brady** - High degree AV block

M-mode - presumptive diagnosis based on evaluation of individual chambermotion

2-D, Doppler - presence of fetal hydrops, valvar insufficiency

**III. THERAPEUTICS**

Intervention should only proceed with adequate knowledge of the *in utero* natural history of the fetal anomaly, along with risk/benefit analysis for **both mother and fetus**.

A. Structural Heart Disease
Obstetric decisions - i.e. amniocentesis, genetic counseling; time, place and mode of delivery; frequency of follow-up
Experimental models - feasibility
Obstructive lesions - premature closure of FO, DA
  - aortic / pulmonic stenosis
Risk to future pregnancies

B. Arrhythmias - Intelligent therapy requires an understanding of the most likely underlying electrophysiologic principles.

1. Tachy - maternal intravenous administration of medications that break the A-V re-entrant circuit:

   - Digoxin
   - Type IA agents - procainamide, quinidine
   - Type II agents - B blockers
   - Type IC agents - flecainide
   - Type IV agents - calcium channel blockers
   - Type III agents - amiodarone

Trans-umbilical - direct administration (via PUBS) of all of the above anti-arrhythmics plus adenosine, which may be diagnostic as well as therapeutic.

2. Brady - ? steroids
   - ? pacemaker

IV. ETHICAL CONSIDERATIONS

   Certainty of diagnosis
   Parental (maternal) autonomy
   Prognosis (both pre and postnatal)
   Welfare of the fetus / infant
   Option of termination

V. SUGGESTED READING


