

## 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 (eg. 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 chamber motion

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

- 1) Reed KL, Anderson CF and Shenker LA (1988) Fetal Echocardiography: An Atlas. Alan R. Liss Inc., New York.
- 2) Kleinman CS, Hobbins JC, et al (1980) Echocardiographic studies of the human fetus: Prenatal diagnosis of congenital heart disease and cardiac dysrhythmias. Pediatrics 65 (6):1059
- 3) Copel JA, Pilu G, et al (1987) Fetal echocardiographic screening for congenital heart disease: The importance of the four-chamber view. Am J Obstet Gynecol 157:648.
- 4) Copel JA, Pilu G, et al (1986) Congenital heart disease and extracardiac anomalies: Associations and indications for fetal echocardiography. Am J Obstet Gynecol 154:1121.

- 5) Veille JC, Mahowald MD, et al (1989) Ethical dilemmas in fetal echocardiography. *Obstetrics & Gynecology* 73:710.
- 6) Allan LD, Crawford DC, et al (1986) Familial recurrence of congenital heart disease in a prospective series of mothers referred for fetal echocardiography. *Am J Cardiology* 58:334.
- 7) Reed KR, Sahn DJ, et al (1987) Cardiac Doppler flows during fetal arrhythmias: physiologic consequences. *Obstetrics & Gynecology* 70:1.
- 8) Bical O, Gallix P, et al (1987) Intrauterine creation and repair of pulmonary artery stenosis in the fetal lamb. *J of Thoracic & Cardiovascular Surgery* 93(5):761-6.
- 9) Maxwell D, Allan L and Tynan MJ (1991 May) Balloon dilatation of the aortic valve in the fetus: a report of two cases. *British Heart Journal* 65(5):256-8.
- 10) Harrison MR, Adzick NS (1991 Apr.) The fetus as a patient, surgical considerations. *Annals of Surgery* 213(4):279-91.
- 11) Crombleholme TM, Harrison MR, et al (1990 June) Complete heart block in fetal lambs. I. Technique and acute physiological response. *Journal of Pediatric Surgery* 25(6):587-93.