

Congenital Heart Disease Patient and Pregnancy

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Cardiac Disease in Pregnancy

- Normal physiology of pregnancy
- Pre-pregnancy risk assessment: mum and baby
- Special issues encountered during pregnancy
- Obstetrics consideration
- Contraception

Pregnancy and the heart

- 1-4% of pregnancies
- CV diseases rarely preclude pregnancy, but pose increased risk to mother and fetus

Risk of transmission to offspring

- 6% if mom is affected
- 3% if dad is affected

Fetal echo for screening

Heart diseases and pregnancy

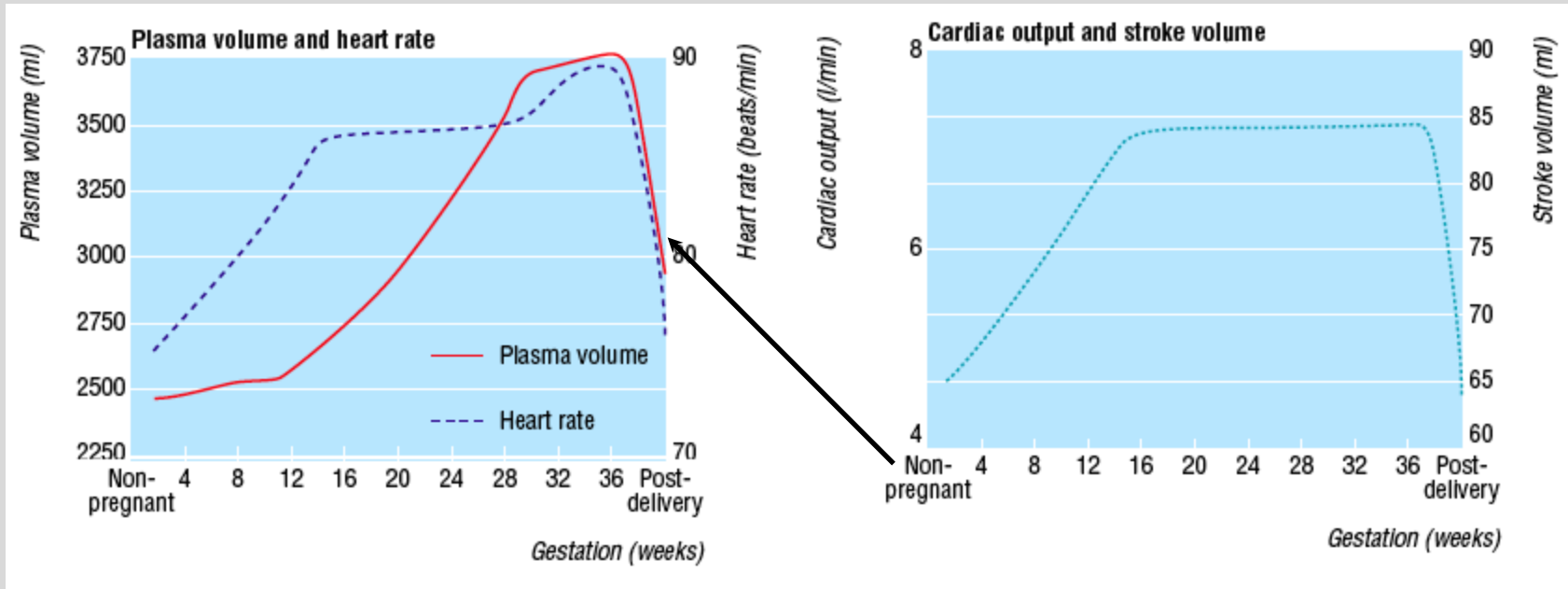
- CV physiological changes with pregnancy
- Pre-pregnancy counseling
- Peripartum management



Physiological Changes During Pregnancy

- 40-70% decrease in total peripheral vascular resistance
- 30-50% increase in blood volume
- 10-20 bpm increase in mean heart rate
- 30-50% increase in cardiac output
- Physiologic anemia (secondary to increase in plasma volume in excess of red cell mass)

Physiological Changes During Pregnancy



40% ↑ blood volume

30-50% ↑ cardiac output

Physiological Changes During Labor and Peripartum

- Additional increase in cardiac output
- 300-500 mL additional blood into venous system with each uterine contraction
- Increase in HR and BP during the second stage of labor secondary to pain
- Autotransfusion of 500 mL of blood from uteroplacental bed back into the maternal circulation immediately after delivery of placenta and splanchnic vasoconstriction

Physiological Changes During Postpartum

- Diuresis and natriuresis after 48 hrs of delivery
- 4-12 weeks after delivery- normalization of blood volume, PVR and CO

Normal pregnancy vs heart failure

Maybe normal in pregnancy

- Fatigue
- Exertional dyspnea
- Palpitation (PVC, PAC)
- Elevated JVP
- Sinus tachycardia, 10-15%
- S3
- Systolic flow murmur
- Pedal edema

Suggests cardiac pathology

- Chest pain
- PND, severe breathlessness
- AF, VT
- Hypotension
- Sinus tachycardia > 15%
- S4
- Pulmonary edema
- Pleural effusion

Maternal Cardiac Adverse Events in Pregnancy

- Pulmonary edema
- Arrhythmia
- Stroke
- Death

Risk Factors for Maternal Cardiac Events in Pregnancy

- Poor functional class (NYHA class III or IV) or cyanosis
- Systemic ventricular ejection fraction $<40\%$
- Left heart obstruction (mitral valve area $<2\text{ cm}^2$, aortic valve area $<1.5\text{ cm}^2$, peak left ventricular outflow tract gradient $>30\text{ mm Hg}$)
- Cardiac event (arrhythmia, stroke, pulmonary edema) prior to pregnancy
- Known lesion-specific risk

Adverse Neonatal Event in Maternal CHD

- Premature birth
- Small-for-gestational age birth weight
- Respiratory distress syndrome
- Intraventricular hemorrhage
- Fetal or neonatal death

Risk Factors for Perinatal Adverse Events in Maternal CHD

- Poor maternal functional class (NYHA class III or IV) or cyanosis
- Maternal left heart obstruction
- Maternal age <20 or >35 years
- Obstetric risk factors
- Multiple gestation
- Smoking during pregnancy
- Anticoagulant therapy

Cyanotic heart disease

- Maternal mortality 2%, morbidity 30% (endocarditis, arrhythmia, CHF)
- Fetal risk: high risk for abortion, premature delivery (50%), low birth weight

Pregnancy Risk WHO Classification

Class 1 → No higher than general population

Class 2 → Small increased risk of maternal
mortality and morbidity

Class 3 → Significant increased risk

Class 4 → Pregnancy contraindicated

Pregnancy Risk Class 1: No Risk

- Uncomplicated, small or mild
 - PS
 - VSD
 - PDA
 - MVP with trivial MR
- Successfully repaired simple lesions
 - Secundum ASD
 - VSD
 - PDA
 - TAPVR/PAPVR
- Isolated PACs or PVCs

Pregnancy Risk

Class 2: Small Risk

- If otherwise well and uncomplicated
 - Unoperated ASD
 - Repaired TOF
 - Most arrhythmias

Pregnancy Risk

Class 2-3: Variable Risk

- Depending on individual
 - Mild LV impairment
 - Marfan syndrome without aortic dilatation
 - Native or tissue valvular heart disease not considered class 4

Pregnancy Risk

Class 3: Significant Risk

- Mechanical valve
- Systemic RV (CTGA; D-TGA s/p Mustard/Senning)
- Post Fontan
- Cyanotic heart disease
- Other complex heart lesions

Pregnancy Risk

Class 4: Extremely High Risk

Pregnancy Contraindicated:

- PHTN of any cause
- Severe systemic ventricular dysfunction
 - NYHA III-IV or LVEF <30%
- Severe left heart obstruction
- Marfan syndrome with aortic dilation >40mm
- Peripartum cardiomyopathy with residual LV impairment

Pregnancy CONTRAINDICATED

Significant stenosis: Why?

- Placenta has very low SVR
- Lowering afterload (downstream pressure) increases gradient
- Increases symptoms of valve stenosis

Pregnancy CONTRAINDICATED

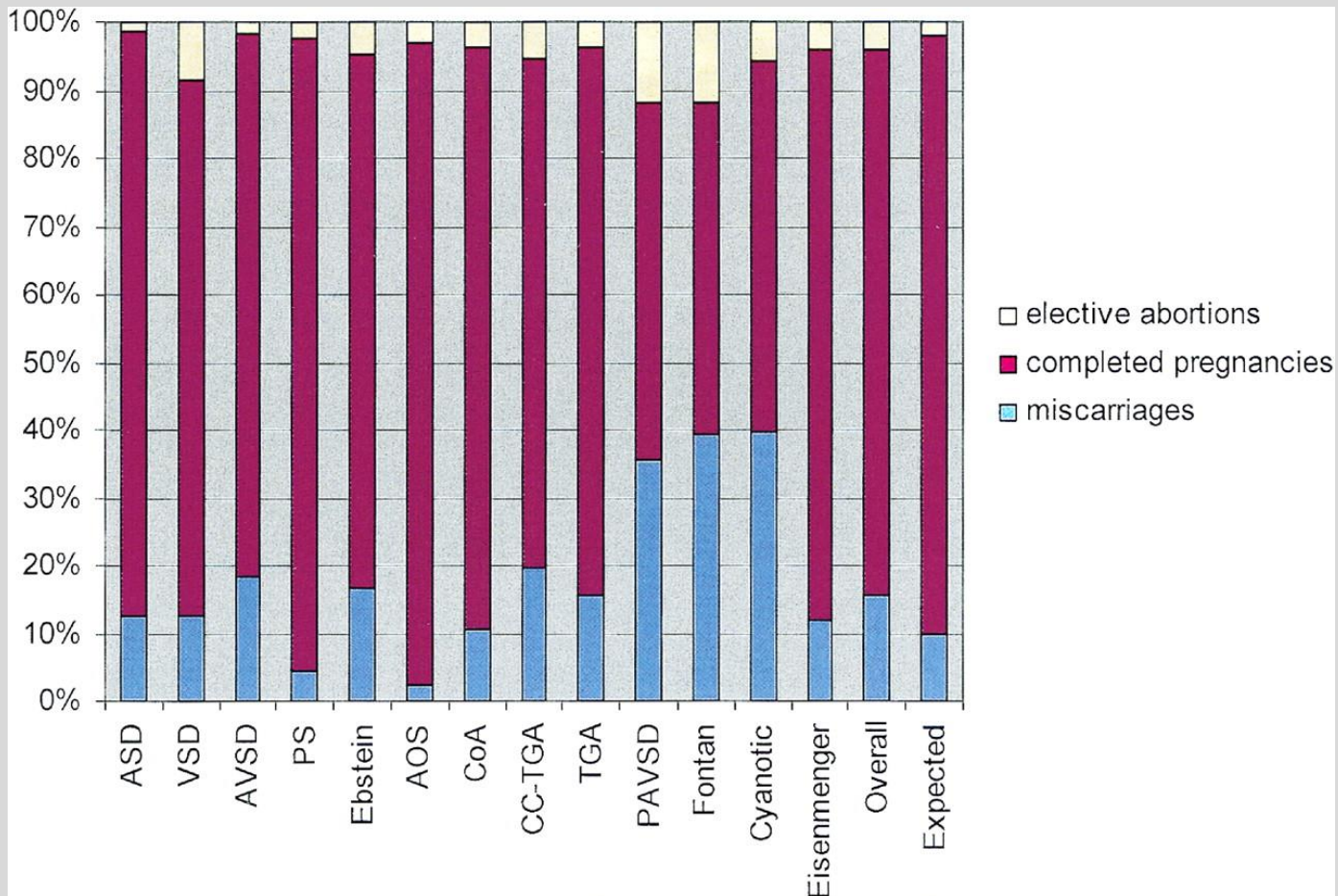
Cyanosis

- Risk of thrombosis
- Lowering SVR / lowering BP decreases perfusion to lungs via collateral vessels or systemic to pulmonary shunts

Pregnancy CONTRAINDICATED

- Eisenmenger Syndrome
 - 30-50% maternal mortality
 - Lowering SVR
 - Decreases perfusion to lungs
 - Increases R to L shunting
 - Increases cyanosis

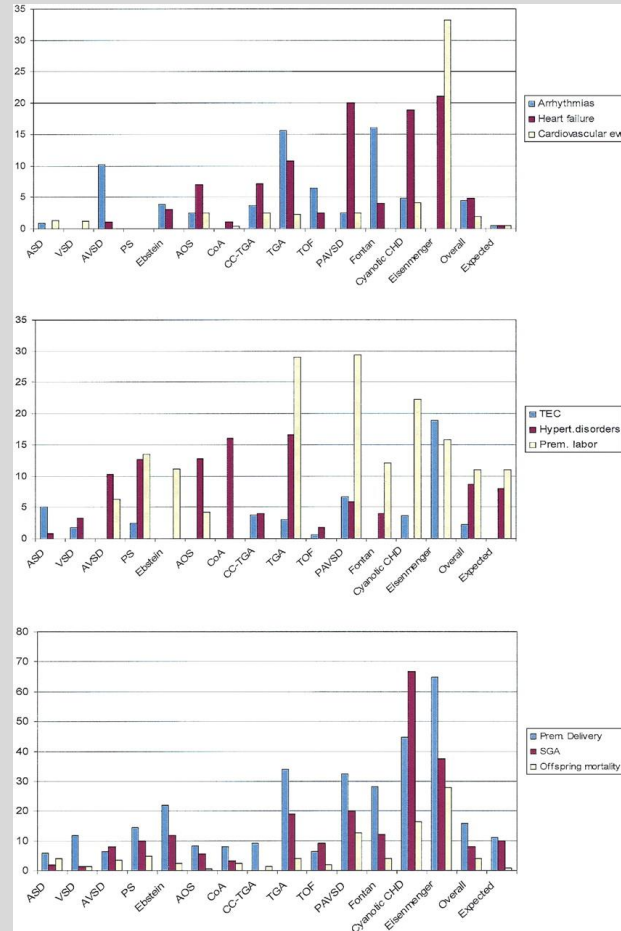
Pregnancy Outcome in Women With Congenital Heart Disease



Drenthen, W. et al. J Am Coll Cardiol 2007;0;jacc.2007.03.027v1-12938



Distribution of Complications During Pregnancy in Women With CHD



Drenthen, W. et al. J Am Coll Cardiol 2007;0:jacc.2007.03.027v1-12938



Pregnancy Management

- High-risk center unless lesion is mild
- Begin when contemplating pregnancy
- Cardiology f/u depends on lesions severity
 - Physiology changes peak at 28-34 WGA
- Involve cardiology, OB, anesthesia
- Fetal echo at 18-20 weeks

Pregnancy Management

- Continue most cardiac meds
 - Except coumadin (controversial), ACEI
- Judicious use of diuretics in select patients
 - Avoid rapid volume changes
- Facilitated second stage labor
- Vaginal delivery preferred; C/S for OB reasons
- SBE prophylaxis

Prospective Multicenter study of Pregnancy Outcomes in Women with heart disease

Siu et al. Circulation 2001; 104: 515

Pregnancy outcome in women with heart diseases

- 562 pregnant patients with heart disease
- 599 pregnancies
- 13% pregnancies complicated by arrhythmia, pulmonary edema, stroke, cardiac death

**TABLE I. Cardiac Disease in Pregnancy (CARPREG)
Risk Score***

One point for each:

History of prior cardiac event or arrhythmias

New York Heart Association functional class >II or cyanosis

Left heart obstruction (mitral valve area <2 cm², aortic valve area <1.5 cm², or left ventricular outflow tract gradient >30 mmHg)

Left ventricular ejection fraction <0.40

Chance of cardiac complication:

0 points = 5%

1 point = 27%

≥2 points = 75%

*Developed by Siu et al, 2001⁶

Pregnancy outcome in women with congenital heart disease

Landzberg et al. Circulation 2006

Pregnancy outcome in women with congenital heart disease

- 54 women followed over 6 years
- 90 pregnancies
- 19% maternal cardiac events
- 28% adverse neonatal events

Maternal cardiac events

- Pulmonary edema 17%
- symptomatic arrhythmias 2%

Neonatal adverse events

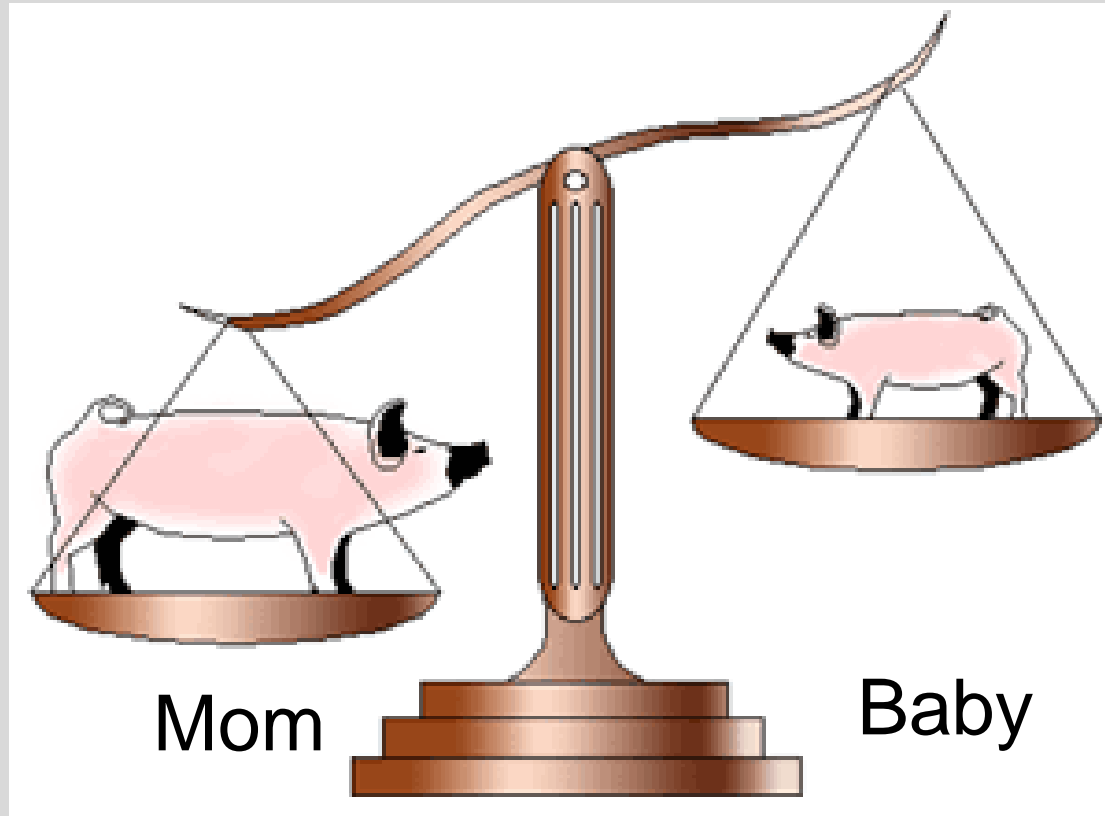
- Preterm delivery 20%
- Small for gestational age 8%
- Respiratory distress 8%
- Intraventricular hemorrhage 1.5%
- Death 3%

Predictors of maternal cardiac events

	OR
Smoking	16
Prior CHF	16
Low subpulmonary EF	8
Baseline NYHA > 2	5
Severe PR	4.6

Mechanical prosthesis

Anticoagulation during pregnancy



Warfarin during pregnancy

- Coumadin crosses placenta: fetal loss, prematurity, stillbirth, fetal intracranial hemorrhage
- Retroplacental hemorrhage
- Embryopathy risk
- Package insert- class C in pregnancy

Warfarin embryopathy

- Bone and cartilaginous abnormality
- Chondrodysplasia, nasal hypoplasia, optic atrophy, developmental delay

Warfarin embryopathy

- Exposure during 6-12 weeks gestation
- Past reported 30%
- Incidence 4-10% (Br Heart J 1995)
- Dose related: low risk < 5 mg/day

Warfarin embryopathy



UF heparin during pregnancy

- Increased risk of valve thrombosis
- Long-term use not recommended: osteoporosis, sterile abscesses
- Increased risk of maternal hemorrhage: bleeding at uteroplacental junction
- Treatment of choice: late pregnancy, delivery

LMWH in pregnancy

- Does not cross placenta
- Antithrombotic protection
- Potential advantages: increased bioavailability, administration ease, decrease osteoporosis and thrombocytopenia

Reported cases of valve thrombosis during pregnancy

Higher Risk

First generation PHV (e.g., Starr-Edwards, Bjork Shiley) in the mitral position, atrial fibrillation, history of TE on anticoagulation
Warfarin (INR 2.5–3.5) for 35 weeks, followed by UFH (mid-interval aPTT >2.5) or LMWH (pre-dose anti-Xa ~0.7) + ASA 80–100 mg q.d.
OR
UFH (aPTT 2.5–3.5) or LMWH (pre-dose anti-Xa ~0.7) for 12 weeks, followed by warfarin (INR 2.5–3.5) to 35th week, then UFH (aPTT >2.5) or LMWH (pre-dose anti-Xa ~0.7) + ASA 80–100 mg q.d.

Lower Risk

Second generation PHV (e.g., St. Jude Medical, Medtronic-Hall) and any mechanical PHV in the aortic position
SC UFH (mid-interval aPTT 2.0–3.0) or LMWH (pre-dose anti-Xa ~0.6) for 12 weeks, followed by warfarin (INR 2.5–3.0) for 35 weeks, then SC UFH (mid-interval aPTT 2.0–3.0) or LMWH (pre-dose anti-Xa level ~0.6)
OR
SC UFH (mid-interval aPTT 2.0–3.0) or LMWH (pre-dose anti-Xa ~0.6) throughout pregnancy

Elkayam et al. J Cardiovasc Pharmacol Ther 2004

Anticoagulation during pregnancy

- Decision regarding choice of anticoagulation requires detailed discussion
- Insufficient data to reliably predict efficacy and safety of any regimen
- Meticulous monitoring is necessary

Anticoagulation during pregnancy

1. LMW heparin SC BID
2. UF heparin SC BID
3. UF or LMWH SC BID until 13 WGA, Warfarin 13-35 WGA,
UF of LMW heparin SC BID until delivery

Arrhythmias during pregnancy

- PACs, PVCs common and benign
- SVT, ventricular arrhythmias less common
- Pregnancy worsens pre-existing arrhythmias, can cause de novo arrhythmias
- Treatments

Peripartum Cardiomyopathy

- Rare: 1/3000- 1/15000
- Last month of pregnancy to 5 months post-delivery
- Increased incidence: twin pregnancy, age > 30, black women, multiparity

Peripartum Cardiomyopathy

- Etiology unknown
- Prognosis variable
- Recurrent risk in future pregnancy
- Management: standard CHF

Contraception for women with congenital heart disease

- Natural or barrier methods
- Combined oral contraceptives
- Progesterone-only pills
- IUD
- Sterilization

Obstetrical considerations

- Peripartum care
 - mode of delivery
 - maternal monitoring
- Antibiotic prophylaxis?

Vaginal delivery

- Feasible and preferable in most cases
- Facilitate second stage of labor

C-section indications

- Obstetric reasons
- Coumadin anticoagulation
- Severe pulmonary hypertension
- Fixed obstructive lesions
- Unstable aorta

Endocarditis prophylaxis

AHA guidelines

- prophylaxis not required during uncomplicated delivery
- reasonable to administer prophylaxis in high risk patients

Endocarditis prophylaxis

GI/GU regimen

- ampicillin and gentamycin im/iv 30 min before procedure
- 6 hrs later, ampicillin im/iv or amoxicillin po
- PCN allergic: vancomycin iv and gentamycin within 30 minutes of procedure

Cardiac drugs in pregnancy

- Most CV drugs cross placenta and secreted in breast milk
- Weigh risk/benefit ratio
- Use drugs with long safety record- prescribe lowest dose for shortest duration

Cardiac drugs in pregnancy

FDA Classification

- A- no disclosed fetal effects
- B-animal studies suggest risk
- C-animal studies suggest adverse fetal effects
- D-evidence of human fetal risk
- X-documented fetal abnormalities

Drugs- not safe

- ACE inhibitors/ ARB
- Warfarin- esp first trimester
- Amiodarone- may be used in special cases
- Spironolactone

Drugs- safe

- digoxin
- β blockers- need close monitoring
- calcium channel blockers
- heparin
- quinidine
- flecainide
- adenosine
- amiloride

Thank you