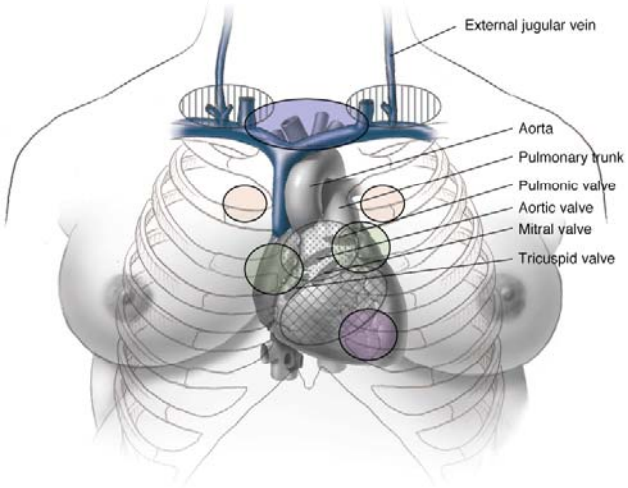
Risk assessment and management for the pregnant ACHD woman



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SUNG KYUN KWAN UNIVERSITY

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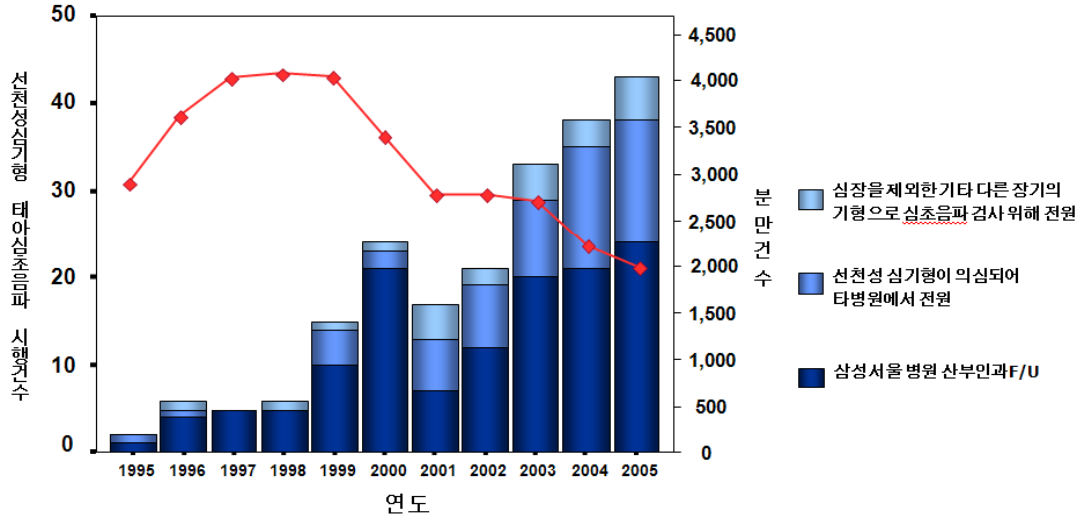
Cardiac diseases in pregnancy

- **Cardiac disease profile in obstetric population**
  : congenital, rheumatic, ischemic, etc.
- **Congenital heart disease ↑**
  : d/t advanced prenatal diagnosis and postnatal medical & surgical management
- **Rate of CHD at birth: 4~12/1,000**



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Cardiac diseases in pregnancy

➢ Problems

1) High risk of maternal morbidity and mortality

2) High risk of fetal and neonatal complications

3) Recurrence of cardiac disease in offspring

4) The effects of CV drugs on fetus/neonate

Table 44-3. Approximated Risks for Cardiac Complications during 1712 Pregnancies in Women with Preexisting Heart Disease

	Complication No. (%)				
Type of Cardiac Lesion	**No.**	**Heart Failure**	**Arrhythmia**	**Thrombosis**	**Death**
Congenital	804	52 (6.5)	26 (3.2)	2 (0.3)	11 (1.4)
Acquired	820	116 (14)	35 (4.3)	18 (2.2)	11 (1.3)
Arrhythmia	88	2 (23)	22 (25)	0	0

Data from Avila (2003), Ford (2008), Madazli (2009), Siu (2001), Stangl (2008), and all their co-workers.

Neonatal outcome with CHD

	LIVEBORN INFANT (%)	TERMINATION (%)
Noncyanotic	86	5
Cyanotic	85	26
Corrected	95	17
Palliative	87	17
Uncorrected	71	42

	SAB (%)	SGA (%)	PRETERM (%)	BIRTH WEIGHT
Noncyanotic	12	6	9	3,300 ± 600
Cyanotic	21	52	35	2,400 ± 800
Corrected	11	25	0	
Uncorrected/palliative	25	67	53	

Preterm, preterm birth; SAB, spontaneous abortion; SGA, small for gestational age.

Contents

1. Physiology
2. Preconceptional care and risk assessment
3. Antepartum care
4. Labor and delivery
5. Postpartum care

Physiology

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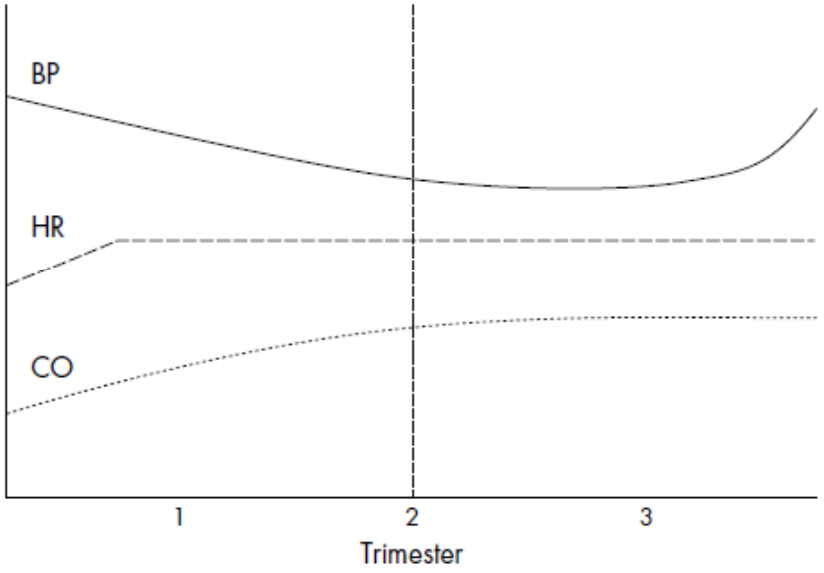
Hemodynamic change in pregnancy



- ↓ systemic and pulmonary vascular resistance
- ↑ heart rate
- ↑ plasma volume, ↓ colloid osmotic pressure
- ↑ end diastolic volume and cardiac output
- Third heart sound and ejection systolic murmur
- Hypercoagulable state

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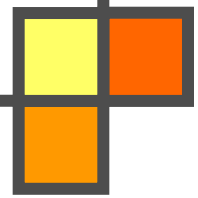
Changes in diagnostic studies

- EKG: Average 15° left axis deviation (LAD),
  Mild ST change in inferior leads,
  Atrial and ventricular premature contractions
- CXR: Mild cardiomegaly
- Echocardiography (most useful)
  : Tricuspid regurgitation
  Increased LA and LV outflow size

"Major cardiovascular changes may be poorly tolerated and precipitate heart failure and clinical decompensation, in women with CHD."

Preconceptional care



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Preconceptional counseling

1. Planning a pregnancy with a cardiologist & an obstetrician
2. Maternal risk from pregnancy including impact on long-term survival
3. Potential effects of cardiac dysfunction and treatment on fetus
4. Risk for transmitting the disease to offspring

Maternal cardiac lesion	Risk of recurrence in fetus (%)		
	One sibling	Father	Mother
Marfan SD	NA	50	50
AS	2	3	15-18
VSD	3	2	10-16
PS	2	2	6-7
ASD	2.5	1.5	5-11
CoA	2	2	14
PDA	3	2.5	4.1
TOF	2.5	1.5	2-3

Preconceptional counseling

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모자보건법 제14조

(1) 의사는 다음 각 호의 1에 해당되는 경우에 한하여 본인과 배우자(사실상의 혼인 관계에 있는 자를 포함한다. 이하 같다.)의 동의를 얻어 인공임신 중절 수술을 할 수 있다.

① 본인 또는 배우자가 대통령령이 정하는 우생학적 또는 유전학적 정신장애나 신체질환이 있는 경우

② 본인 또는 배우자가 대통령령이 정하는 전염성 질환이 있는 경우

③ 강간 또는 준강간에 의하여 임신이 된 경우

④ 법률상 혼인 할 수 없는 혈족 또는 인척간에 임신된 경우

⑤ 임신의 지속이 보건 의학적 이유로 모체의 건강을 심히 해하고 있거나 해할 우려가 있는 경우

태아측 사유로 인공임신중절은 불법!!

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Preconceptional counseling

Maternal risk associated with cardiac disease in pregnancy

(ACOG technical bulletin 1992;168:1-8)

Group I: minimal risk of complications (<1%)
- ASD, VSD, PDA, Pulmonary/Tricuspid disease, corrected TOF, Biprosthetic valve, MS (NYHA I,II), Marfan SD with normal aorta

Group II : moderate risk of complications (5~15%)
- MS with AF, Artificial valve, MS (NYHA III,IV), AS, CoA (uncomplicated), Uncorrected TOF, Previous MI

Group III : Major risk of complications or death (25-50%)
- Pulmonary HTN, Eisenmenger's SD, CoA (complicated), Marfan SD with aortic involvement, peripartum cardiomyopathy

Risk scoring system

Prediction of adverse maternal event

(pulmonary edema, sustained arrhythmia, stroke, cardiac arrest or death)

- **Cyanosis (SaO_2 <90% in air) or NYHA class III or IV**
- **Left heart obstruction**
- **Systemic ventricular dysfunction (EF<40%)**
- **Prior cardiac event (pulmonary edema, arrhythmia, CVA/TIA)**

Adverse event rate: 5% (0), 30% (1), 60% (>1)

Siu et al. Circulation 2001

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Pregnant or not?

High risk lesions, advise against pregnancy

1) Pulmonary hypertension
2) Aortopathy with root >4 cm or aneurysm, advise surgery first
3) Severe aortic stenosis (peak gradient >80 mm Hg or symptoms), advise surgery first
4) Systemic ventricular dysfunction NYHA III or IV symptoms

Head et al. Postgrad Med J 2005

After a detailed informative counseling, mother should decide...

목숨을 걸고서라도 내 아이를 안고 싶었어요 2005-08-12

- 아이젠맹거증후군 여성 제왕절개로 딸 출산
- 삼성서울병원, 순환기내과·산부인과·마취통증의학과 협진의 승리

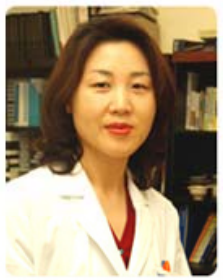
생존율 10% 미만인 선천성심장병 환자의 제왕절개 수술이 실시됐다. 아이젠맹거증후군을 앓고 있던 20대 여성이 지난달 9일 삼성서울병원에서 제왕절개 수술로 딸 아이를 출산했다.

지난달 9일 토요일 오전 10시, 아이젠맹거증후군으로 삼성서울병원 순환기내과 박승우교수에게 정기적으로 진료를 받던 김경선(강원도 화천, 28세)씨가 하복부 통증으로 응급실로 내원했다. 당시 임신 32주차, 응급실 담당의사는 박교수에게 연락했고, 박승우교수는 토요 당직의사가 아님에도 불구하고 응급실로 나와 환자 상태를 살펴보니 조산 징후가 보였다.

아이젠맹거증후군 환자의 출산은 박교수도 경험해 보지 못한 낯선 사례이고 더군다나 아이는 거꾸로 서 있어서 자연분만이 힘든 상황이었다. 먼저, 학회 참석차 지방에 내려가 있던 산부인과 노정래교수에게 연락했고 노교수도 산모 출산을 위해 서울로 상경했다. 다음으로 심장 마취 전문가인 마취통증의학과 이상민교수에게 전화를 했다. 당시 이 교수는 학교에서 고1 아들의 기말고사 시험감독을 하고 있었다.

순환기내과 박승우교수

산부인과 노정래교수



마취통증의학과 이상민교수

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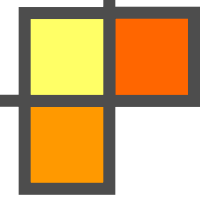
Antepartum care



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Maternal antepartum care

"A team approach with an obstetrician, cardiologist, anesthesiologist, and other specialists"

1. Physical activity
   - In cyanotic disease, resting is important to maintain SaO_2
   - Anxiety should be prevented
   - Sexual activity is not contraindicated in NYHA I, II
2. Diet
   - High-protein, low-salt diet (2 g/day)
   - Avoid junk food or snacks
   - LSD: Not helpful except in severe CHF
3. Vitamin and iron supplementation
4. Pneumococcal & influenza vaccination

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Warfarin vs. Heparin

Warfarin

- Crosses the placenta.
- ↑ early abortion and embryopathy when used in 1st trimester
- CNS & eye abnormalities (2nd & 3rd trimester).
- Bleeding in the fetus (especially at delivery)
- >5mg/d: higher risk for fetal ICH
- Should be stopped before delivery

Heparin

- Does not cross the placenta
- No teratogenicity
- No fetal bleeding
- Twice daily SC injection
- Risk of osteoporosis
  <2% symptomatic fractures, but 30% decrease in BMD
- Risk for thrombocytopenia
- ↑↑ Risk of thrombosis (10%)

"Warfarin embryopathy": Nasal hypoplasia, bone epiphysis, optic atrophy, blindness, seizures, mental impairment. Overall risk around 15-25%. Decreases with the use of UFH in the first 3 months

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Maternal antepartum care

5. Anticoagulation

1) Up to 35 week

- **Decision to use heparin or warfarin during 1st trimester (risk of thrombosis vs. fetal complication)**
- **High risk for thromboembolism**

  1st T: heparin ⇨ 2nd T: warfarin
- **Low risk for thromboembolism: Heparin**

2) Beyond 36 week

- **Warfarin should be stopped: substituted by heparin**
- **If labor begin during Tx with warfarin, ⇨ C/S!!**
- **In absence of bleeding, heparin can be resumed 4 to 6 hours after delivery and warfarin begun orally.**

Maternal antepartum care

6. Clinical follow-up

1) Uncomplicated cardiac disease

- until 28~30 week: once a month
- then ~ 36 week: every 2 week
- thereafter: weekly

2) At each appointment, systemic review by cardiologist & obstetrician

7. Hospital admission

1) Whenever sign and symptoms of decompensation, infection, anemia

2) Pulmonary HTN: prolonged hospitalization from 20 week

3) NYHA IV: throughout pregnancy

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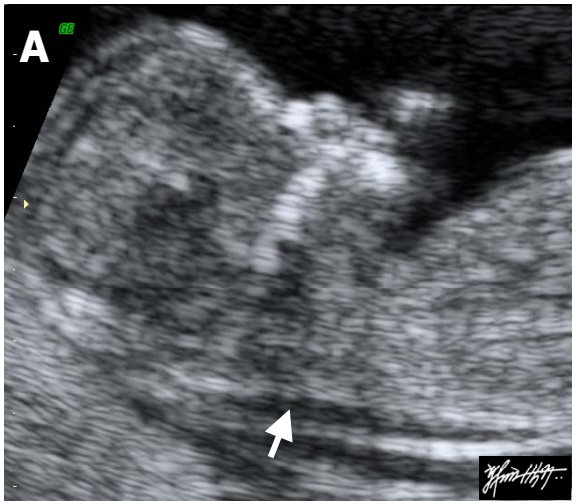
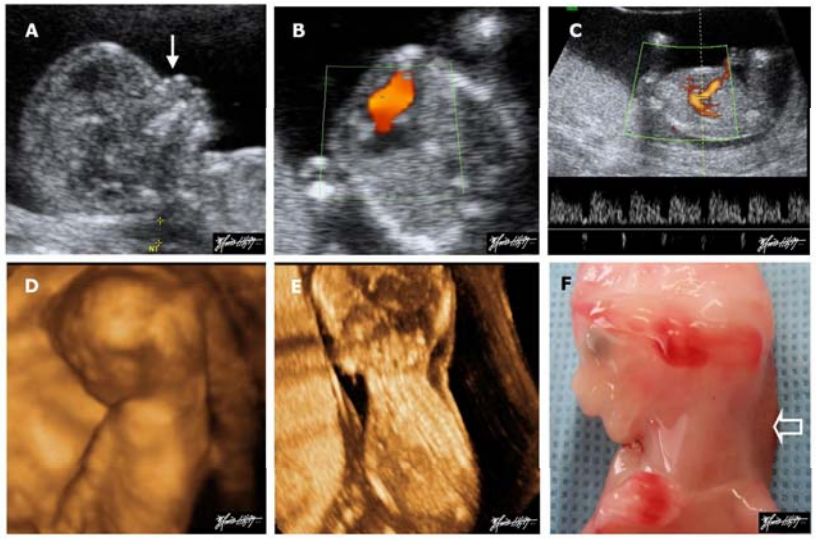
Fetal investigation



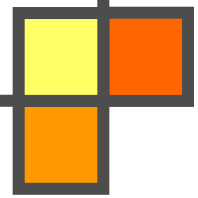


- NT at 10^{+3}-13^{+6} week

  Increased NT: associated with CHD
- Subsequent scans every 4 weeks
- Targeted ultrasound and fetal echo at 20-24 week
- Increased risk of IUGR, preterm delivery

  ⇨ USG, BPP, NST etc.

Labor and delivery



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Timing of delivery

- **Depend on balance & severity of maternal & fetal conditions**

1) Current NYHA functional status (hemodynamic compensation)

2) Fetal compromise (FGR, oligohydroamnios, fetal distress etc.)

3) The functional status trend over time

- **NYHA I, II without fetal indication**

  : allow spontaneous labor

- **NYHA III, IV**

  : well-orchestrated elective delivery (anesthesia, cardiology, neonatology) / labor induction or elective C/S

Route of delivery

Vaginal delivery

- With facilitated second stage is preferred & safe (ex, vacuum or forcep delivery)
- Invasive hemodynamic monitoring only in:

- Severe valve stenosis
- Recent heart failure
- Severe cyanotic heart disease
- Pulmonary HTN

Cesarean section

- Avoids physical stress of labor
- but not free from hemodynamic consequences
- Indications in CHD only for:

- Obstetric reasons.
- Therapeutic anticoagulation with warfarin within 2 weeks
- Pulmonary HTN
- Unstable aortic lesion with risk of dissection (aortic root Ø > 4 cm) or aneurysm
- Severe obstructive lesions

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Monitoring

- **Major risk during labor and delivery**

  : hypotension, hypoxemia, myocardial ischemia, arrhythmia

- **One-on-one nursing & physician care**
- **V/S and monitoring**

  1) BP: Radial arterial monitoring in NYHA III, IV

  2) BT: At least every 4 hours

  3) SaO_2: Routinely used

  4) ECG: Continuous (rate & rhythm)

  5) I/O: Check hourly, Foley catheter

- **Fetal continuous monitoring**

  "Fetus is an excellent parameter of maternal perfusion"

Analgesics & anesthesia

- Anxiety, labor: ↑ Catecholamin, maternal tachycardia, O_2 consumption
- Combined spinal-epidural anesthesia: excellent
  - ⇨ ↓ preload & afterload: (+) effect on most cardiac disease
- Epidural anesthesia: Caution in hypertrophic cardiomyopathy, AS, R-L shunt
- Eisenmenger's reaction: contraindication of epidural anesthesia
  - ⇨ Meperidine or morphine combine with pudendal block (2nd stage)

Position during labor & delivery

- Alternate between right and left lateral decubitus
- Avoid prolonged supine position
- At delivery time, wedge under right hip (10~12 cm)
- Vaginal delivery
  : ↓ 2nd stage labor with low or outlet vacuum

Endocarditis prophylaxis

- **Antibiotic prophylaxis at the time of delivery is <u>not recommended for patients expected to have uncomplicated vaginal delivery or cesarian section</u>, unless clinically overt infection is present.**

- **Patients at high risk for endocarditis may receive antibiotics at the discretion of their physician:**
  - **Those with prosthetic heart valves.**
  - **Previous bacterial endocarditis.**
  - **Complex cyanotic CHD (ex. TOF, TGA)**
  - **Surgically constructed systemic-pulmonary shunt**

Endocarditis prophylaxis

American College of Cardiology/American Heart Association Recommendations for Antimicrobial Prophylaxis to Prevent Bacterial Endocarditis *(ACOG Practice Bulletin, 2003)*

Cardiac Lesion	Prophylaxis for Uncomplicated delivery	Prophylaxis for Suspected Bacteremia[a]
High Risk		
Prosthetic cardiac valves (both homograft and bioprosthetic)	Optional	Recommended
Prior bacterial endocarditis	Optional	Recommended
Complex congenital cyanotic heart disease	Optional	Recommended
Surgically constructed systemic pulmonary shunts or conduits	Optional	Recommended
Moderate Risk		
Congenital cardiac malformations (except repaired ASD, VSD, or PDA, or isolated secundum ASD)	Not recommended	Recommended
Acquired valvular dysfunction (most commonly rheumatic heart disease)	Not recommended	Recommended
Hypertrophic cardiomyopathy	Not recommended	Recommended
Mitral valve prolapse with valvular regurgitation or thickened leaflets or both	Not recommended	Recommended
Negligible Risk [b]		
Mitral valve prolapse without valvular regurgitation	Not recommended	Not recommended
Physiologic, functional, or innocent heart murmurs	Not recommended	Not recommended
Previous disease without valvular dysfunction	Not recommended	Not recommended
Previous rheumatic fever without valvular dysfunction	Not recommended	Not recommended
Cardiac pacemakers and implanted defibrillators	Not recommended	Not recommended
Prior coronary bypass graft surgery	Not recommended	Not recommended

[a], For example, intra-amniotic infection, [b], Risk for developing endocarditis is not higher than the general population

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Endocarditis prophylaxis

American heart association guidelines for bacterial endocarditis prophylaxis for genitourinary and gastrointestinal procedures

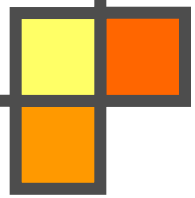
---

High-risk patients: ampicillin plus gentamicin
Ampicillin, 2 g IV, plus GM, 1.5 mg/kg (≤ 120 mg) IV or IM, within 30 min before the procedure
Ampicillin 1 g, IV or IM, or amoxicillin, 1 g po, 6 hours after the initial dose.

Penicillin-allergic patients: vancomycin and gentamicin
Vancomycin, 1 g IV over 1-2 h, plus GM, 1.5 mg/kg (≤ 120 mg) IV or IM
Infusion to be completed within 30 min before the procedure.

Moderate-risk patients: amoxicillin or ampicillin
Amoxicillin, 2 g po, 1 h before the procedure, or
Ampicillin, 2 g IV or IM within 30 min of beginning the procedure.

Postpartum care



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Postpartum hemodynamic changes

"Remember!!! Majority of death occur during puerperium."

- **Immediate postpartum period**

1) Greatest risk for pulmonary edema

(risk persists 24-72h postpartum)

2) New hemodynamic state

- Increase in cardiac output (60-80%).

- Release of venacaval obstruction by the gravid uterus

- Autotransfusion of uteroplacental blood

- Rapid mobilization of extravascular fluid

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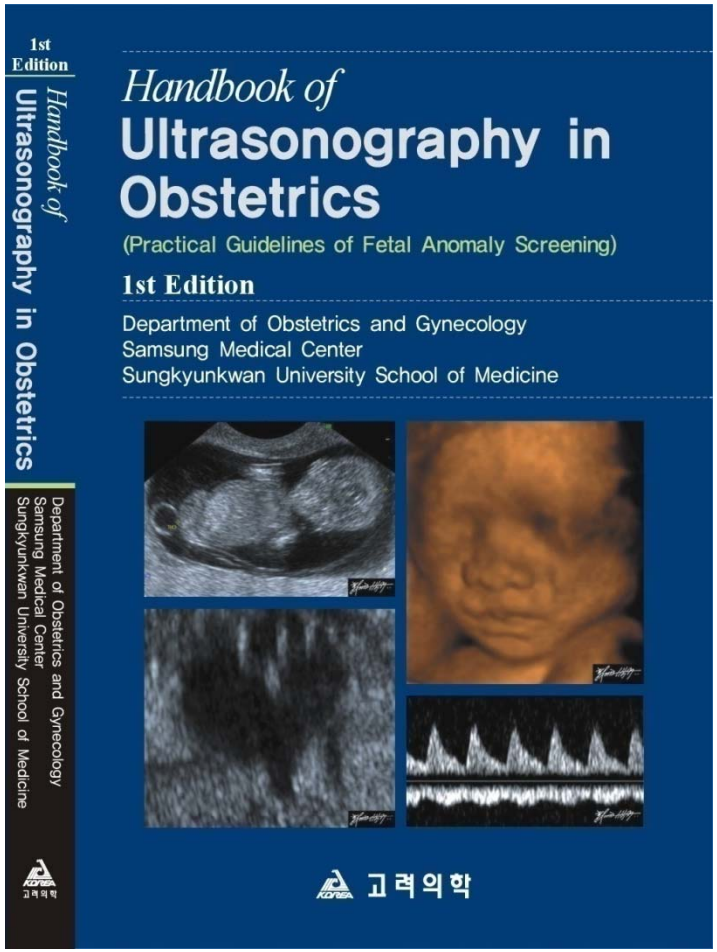
Postpartum care

- **Minimize postpartum bleeding**
  1) Uterine massage
  2) Uterotonics: Oxytocin, methergin, misoprostol, carbetocin
- **Minimize risk of thromboembolism**
  1) Early assisted ambulation, elastic stockings
  2) Prophylactic anticoagulation until mobilization
- **Breastfeeding**
  1) Breast feeding can be encouraged during anticoagulant Tx
  2) Heparin is not secreted in breast milk and the amount of warfarin is low.

Postpartum care

- **Contraception**
  - **IUD: Not indicated in patients at risk for infective endocarditis, previous endocarditis, valvular prostheses, receiving chronic anticoagulation**
  - **Hormonal**
    1) **Recommend triphasic pills in high risk patients: remain controversial (cf. Not recommended in Eisenmenger's SD)**
    2) **Parenteral medroxyprogesterone acetate**
       : **low complication, BUT weight gain**
    3) **Barrier method: safe**
    4) **Permanent sterilization**
       : **consider in patients with high reproductive risk**

Thank you for your attention!~



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2008년 04월 12일(토) 11:48 Updated. Rx Digest • 고혈압 동반한 심부전 환자 처방

메디게이트뉴스 > 병원·의원

삼성서울, 선천성 심장병 기금 기부

핸드북 수익금 한국심장재단에 전달

성균관의대 삼성서울병원 산부인과가 최근 최근 발간된 'Handbook of Ultrasonography in Obstetrics'에서 마련된 수익금 375만원을 한국심장재단에 쾌척했다.

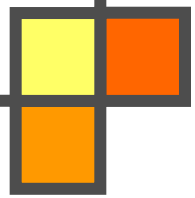
24일 삼성서울병원에 따르면 산부인과는 산전 초음파가 단순히 태아의 기형을 발견하는데 그치는 것이 아니라 적절한 치료를 통해 태아 또는 신생아의 건강을 회복시키는데 그 의미가 있다는 취지 하에 책의 수익금 중 30%를 심기형을 가지고 태어난 아이들의 치료를 위해 기부했다.

산과 초음파 관련 의학교과서인 'Handbook of Ultrasonography in Obstetrics'는 최석주 삼성서울병원 산부인과 교수가 집필·편집을 하고, 김종화·노정래·오수영 교수(이상 산부인과)와 박병관 교수(영상의학과)가 감수를 하여 2007년 2월에 발간된 핸드북이다.

윤병구 산부인과장은 "수익금 375만원이 선천성 심기형을 산전에 진단받은 신생아들의 치료를 위해 쓰이기를 바란다"고 말했다.

이인복기자 (iblee@medigatenews.com)
기사등록수정 일시 : 2007-10-24 / 09:22:50

Congenital Heart Diseases



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Atrial septal defect

- Asymptomatic until 40s
- Secundum type: 70%
- Pregnancy is well tolerated without pulmonary HTN
- Pulmonary HTN: 10% of uncorrected case
- R-L shunt ⇨ paradoxical embolism ⇨ embolic stroke
  - Isolated ASD: Observation or antiplatelet therapy
  - With risk factors for VTE (e.g., immobility)
    : Compression stocking and prophylactic heparin
- Bacterial endocarditis prophylaxis: negligible (needed if patch closure)

Ventricular septal defect

- Paramembranous type: mc
- Physiologic derangement: related to size
  1) < 1.25 cm^2: no pulmonary HTN and HF
  2) > Aortic valve orifice: symptoms rapidly develop
  3) > 1.5 cm: 50% risk of Eisenmenger syndrome
- Pregnancy is well tolerated with small to moderate L-R shunts
- Eisenmenger syndrome: maternal mortality 30-50%
- Bacterial endocarditis prophylaxis is often required

Persistent ductus arteriosus

- Physiologic consequence: related to size
- Unrepaired PDA: pulmonary HTN, HF, PA-Ao reversal flow (50% risk)
- Sudden drop of BP at delivery may leads to fatal collapse
- Avoid conduction analgesia or hypotension
- Bacterial endocarditis prophylaxis: unrepaired PDA

Tetralogy of Fallot

- Most common cyanotic CHD in pregnancy
- During pregnancy

  : peripheral resistance ↓ Eisenmenger syndrome

  shunt ↑ ⇨ cyanosis ↑
- Severe maternal hypoxemia and polycythemia

  : miscarriage, preterm delivery, IUGR, fetal death

  (Hct > 65 % ⇨ 100 % pregnancy loss)
- Unrepaired TOF, maternal mortality: 10 %
- Repaired and no cyanosis: do well

Marfan's syndrome

- **High mortality rate: 30%**
  - **Low: no cardiac involvement & aortic root Ø < 40 mm**
  - **High: cardiac involvement or aortic root Ø > 40 mm**
    - **⇨ aortic dissection risk ↑**
- **Aortic root Ø > 50-60 mm**
  - **Elective surgery before pregnancy**
  - **Surgery during pregnancy: risk for fetal hypoxia**
- **Superimposed HTN increase stress on arterial wall (risk of dissection): prophylactic β-blocker is recommended**

Cardiovascular medications

- **β-adrenergic blocking agents:** Neonatal respiratory depression, sustained bradycardia, hypoglycemia (when used in late pregnancy or just before delivery)
- **Thiazide diuretics:** Neonatal electrolyte imbalance, jaundice, thrombocytopenia, liver damage, death (when used in 3rd trimester or for more periods)
- **ACE inhibitors:** Absolute contraindication during pregnancy, decreased renal function, oligohydramnios, neonatal renal failure

Cardiovascular drugs

4. Medications

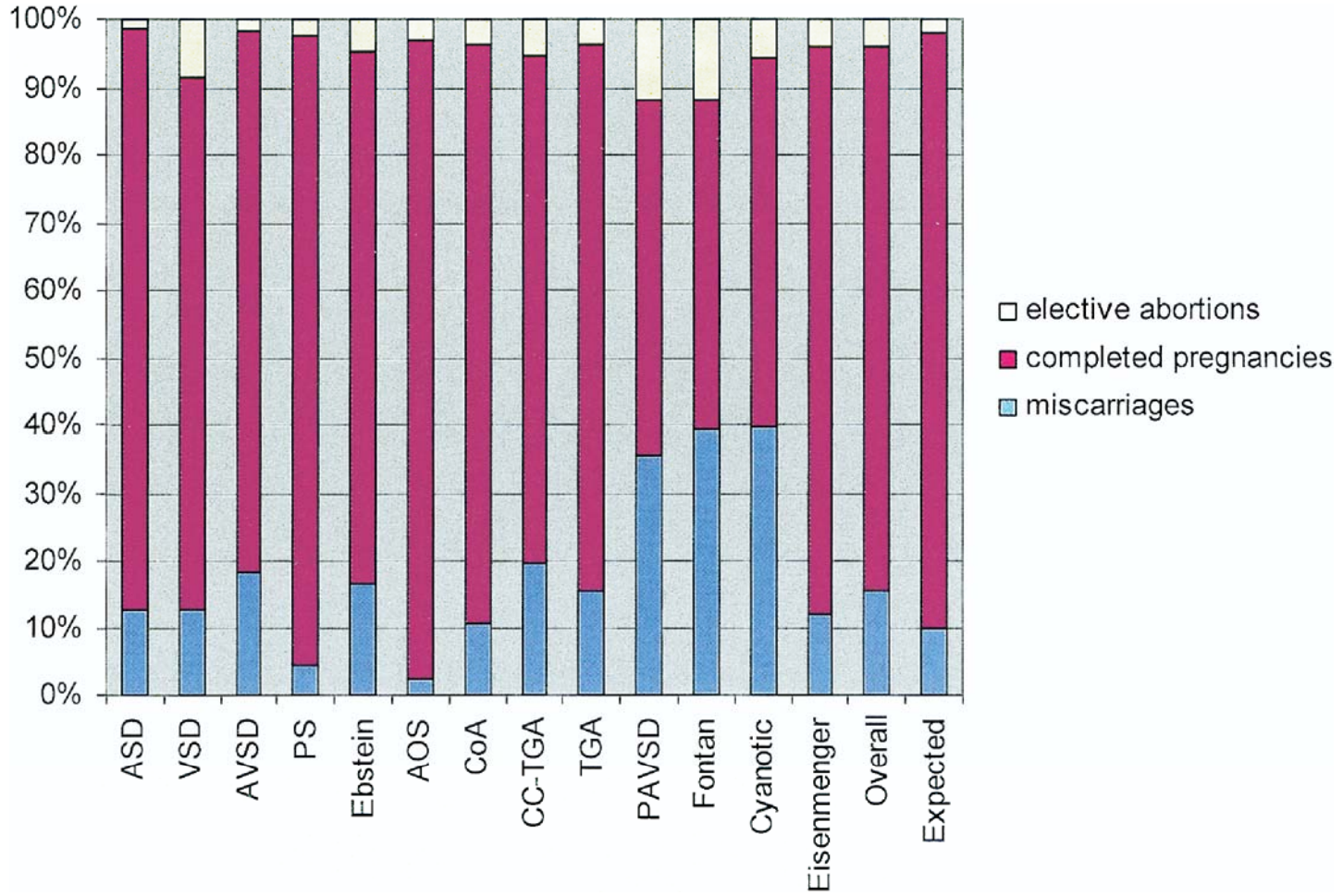
- **Pneumococcal & Influenza vaccination should be considered d/t particulary intolerance of respiratory infections**

Medication	FDA	Teratogenesis	Breast feeding
ACE inhibitor	D	Hypocalvaria, renal defect, oligohydroamnios, potter sequence	Yes
Atenolol	C	Hypospasia?	Yes
Azathioprine	D	Skeletal anomaly in animal	Not recommend
Coumadin	D	CNS anomaly, Warfarin embryopathy	Yes
Cyclosporin	C	Apparently not	No
Digoxin	C	No	Yes
Heparin	C	No	Yes
Prednisone	B	No	Yes
Propranolol	C	No	Yes

Induction and augmentation

- **Mechanical method (e.g., Foley catheter)**
  - **Avoid hemodynamic effect**
  - **Low hyperstimulation & fetal bradycardia**
  - **Choice in higher functional class & cyanotic disease**
  - **Prophylaxis for bacterial endocarditis**
- **Prostaglandin (Misoprostol, Dinoprostone)**
  - **Low functional class without tachycardia or asthma**
- **Oxytocin infusion**
  - **Careful I/O check**

Pregnancy outcome



Drenthen et al. Outcome of Pregnancy in Women with Congenital Heart Disease
J Am Coll Cardiol 2007

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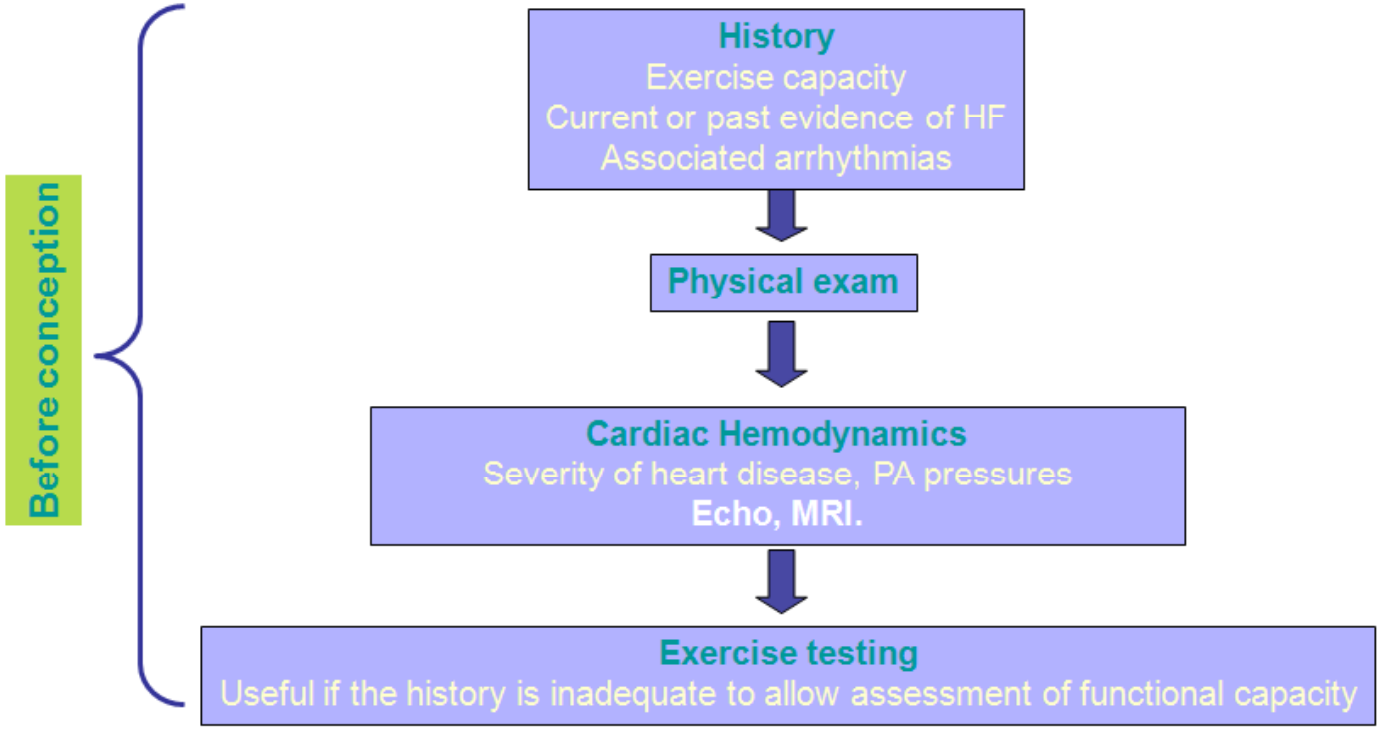
Summary



Reimold et al. NEJM 2003;349:52-59

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