

# Pregnancy and Heart Disease

- ♥ Normal physiology
- ♥ Pregnancy with Cardiovascular disease
- ♥ Specific heart diseases



פרופ' שמעון רייסנר  
לימודי המשך – אוניברסיטת ת"א  
19 ביוני 2007

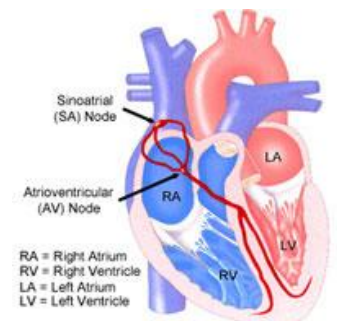
# Maternal Cardiovascular Adaptation to Pregnancy

## ♥ Functional:

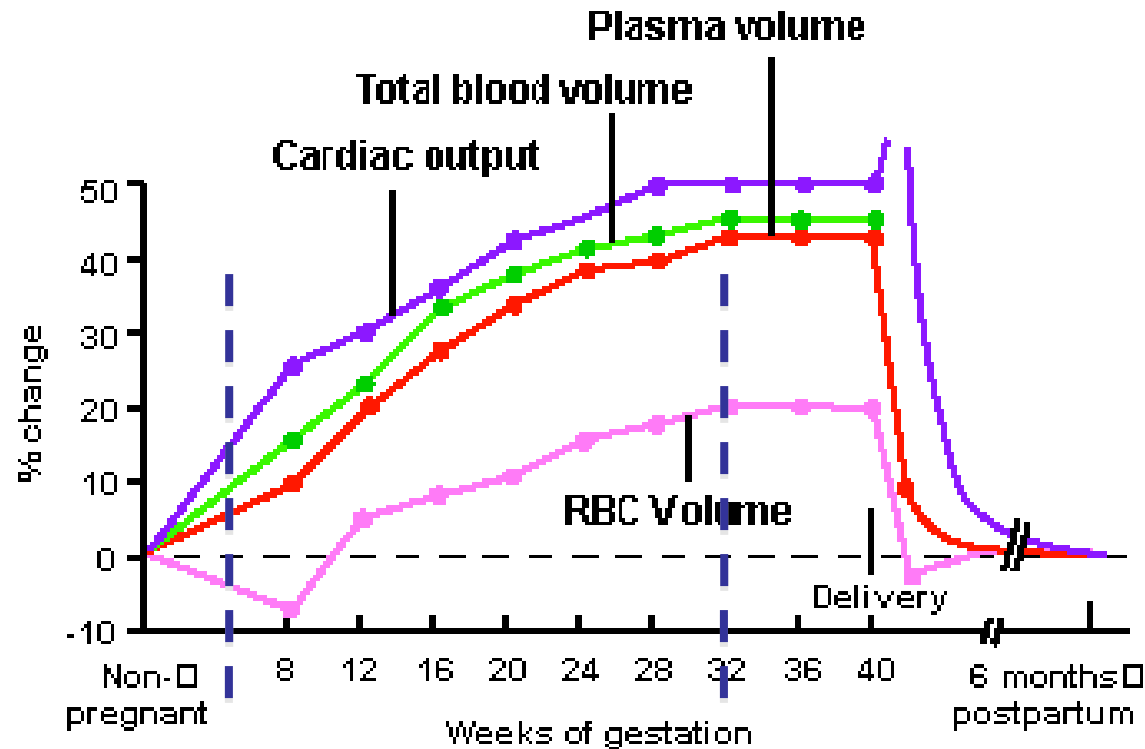
- ∅ Blood volume
- ∅ Cardiac output
- ∅ Blood pressure
- ∅ Systemic vascular resistance
- ∅ Venous vascular bed

## ♥ Structural

**Pregnancy ~ Prolonged Dynamic Exercise  
(+ volume overload)**

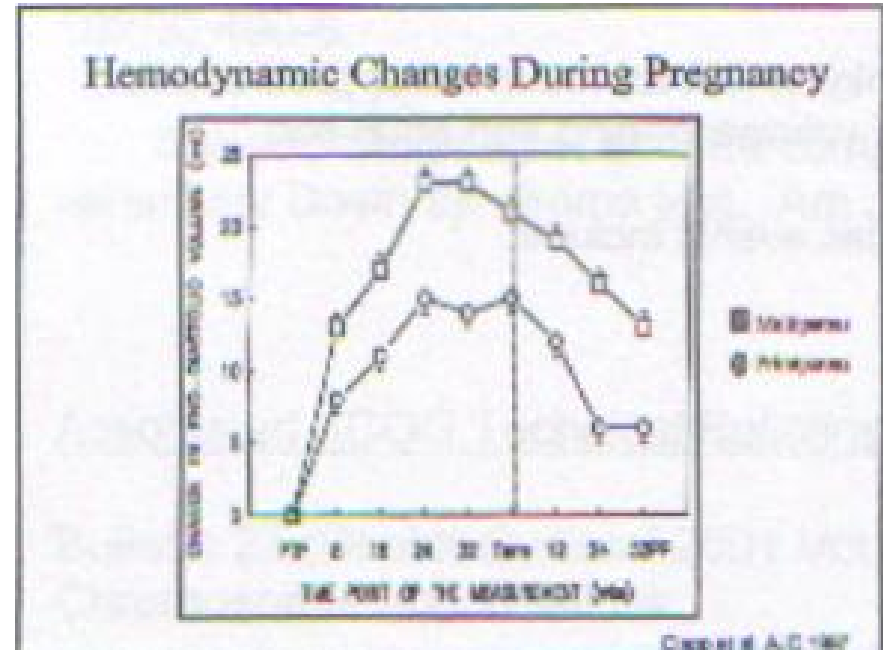
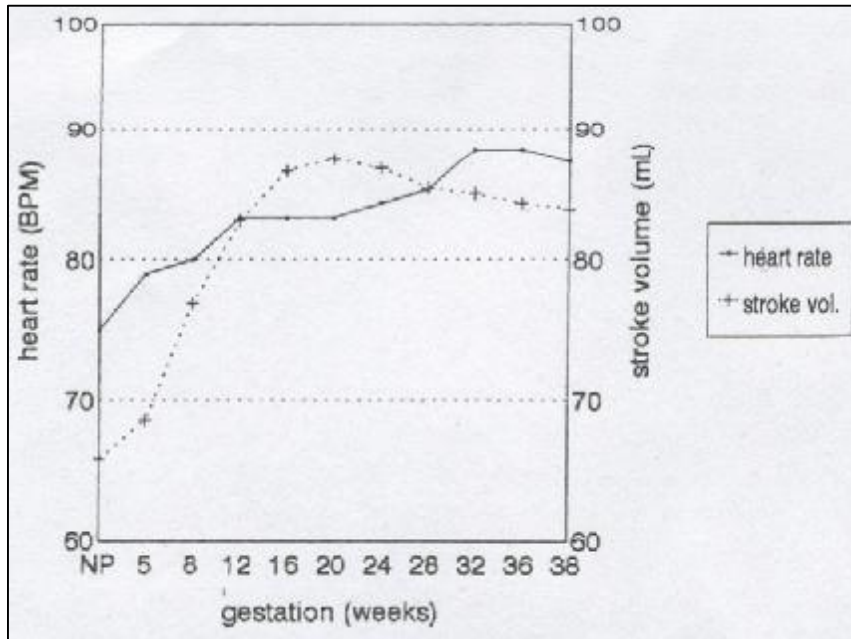


# Blood Volume



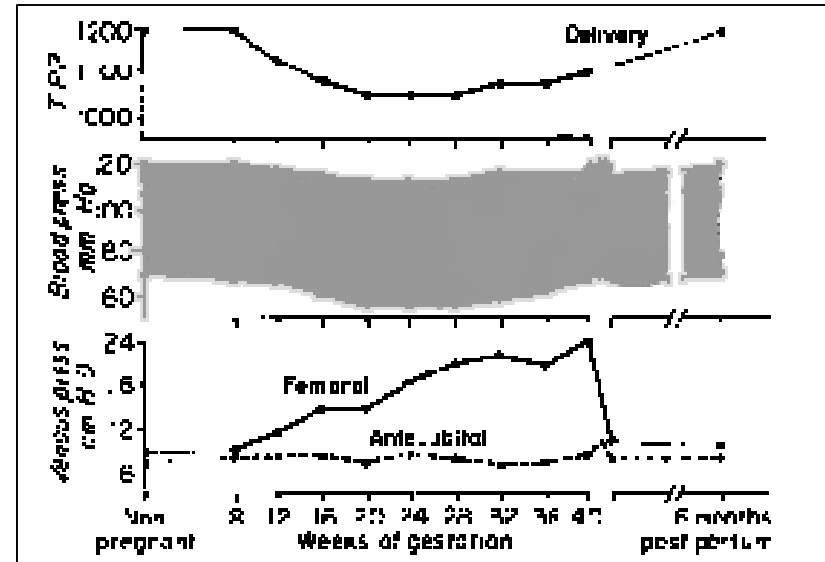
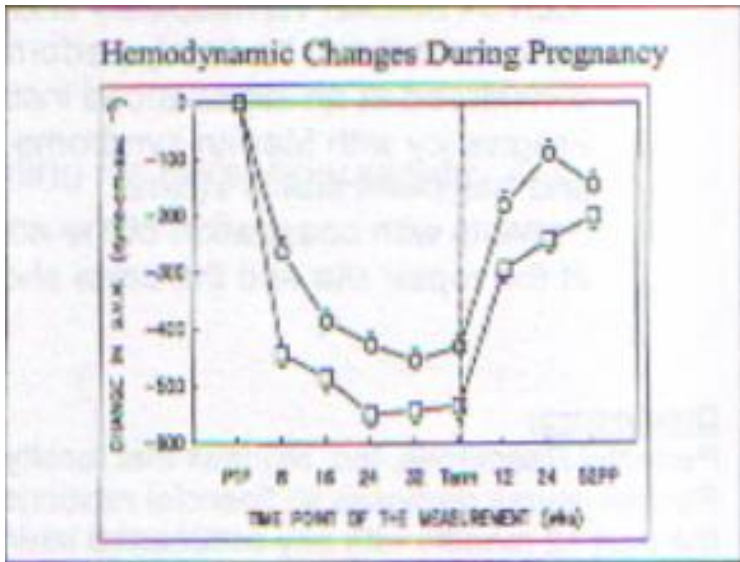
- ♥ Plasma volume in 40-45% (1200-1600cc)
- ♥ RBC mass in 20-25%
- ♥ Early, from 6-8 weeks to maximum at 32 week
- ♥ Fast return to baseline (weeks)

# Cardiac output



- ♥ Increases by 30-50% (50% by 8 weeks)
- ♥ HR ↑ X SV ↑ = CO ↑↑
- ♥ Uterine blood flow ↑ from 2% to 17% of CO
- ♥ Renal blood flow ↑ by 50%

# Systemic Vascular Resistance Blood & Venous Pressure

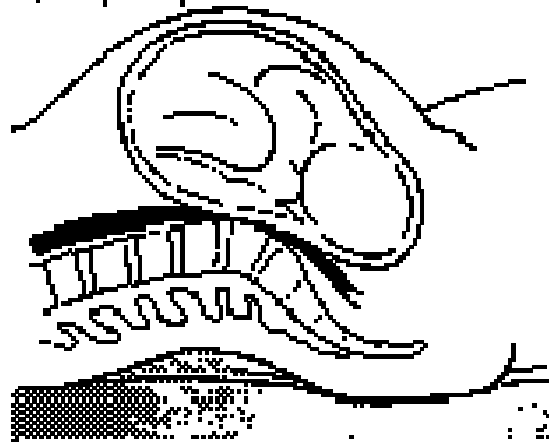


- ♥ SVR - decreases as early as 5 weeks (trigger for increasing HR and SV)
- ♥ Fem. venous pressure ↑ - velocity ↓ = STASIS
- ♥ BP decreases (diastolic > systolic, from 7 – 32 weeks)

# Aorto-caval compression (hypotension, anesthesia)



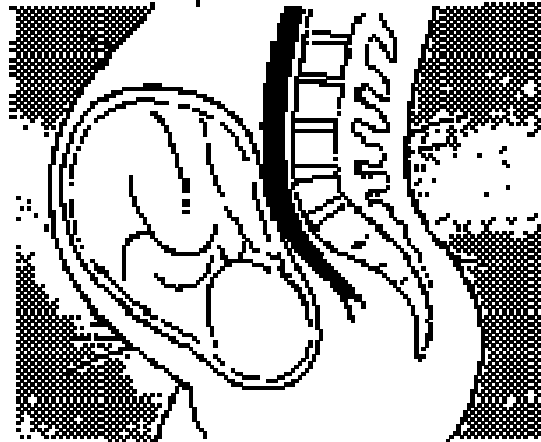
A. Supine position



Side view

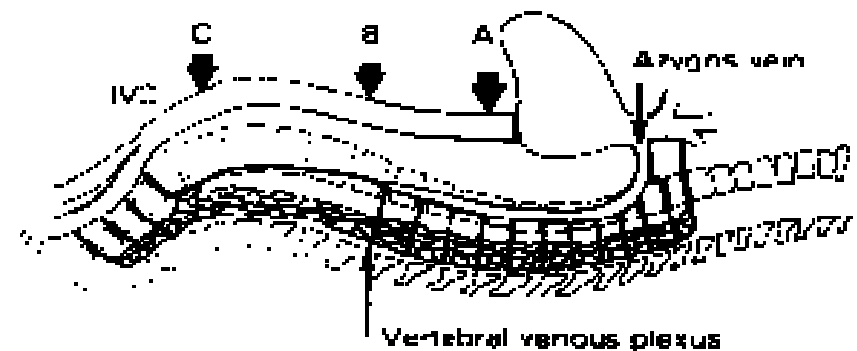


B. Lateral position



Top view

SITES OF OBSTRUCTION



# Anatomic Changes

- ♥ **Ventricular mass (1<sup>st</sup> trimester)**
- ♥ **End-diastolic volume (2<sup>nd</sup>-3<sup>rd</sup> trimesters)**
- ♥ **LV \ RV \ Venous \ Arterial compliance (collagen)**
- ♥ **LV + RV contractility**
- ♥ **Left atrial diameter**



# Third trimester hemodynamic changes

**TABLE 8-1. HEMODYNAMIC PROFILES FOR NONPREGNANT AND PREGNANT PATIENTS IN THE THIRD TRIMESTER**

	Nonpregnant	Pregnant	Change
Cardiac output (liters/min)	4.3 ± 0.9	6.2 ± 1.0	+43%
Heart rate (beats/min)	71 ± 10	83 ± 10	+17%
SVR (dyne-sec-cm <sup>-5</sup> )	1530 ± 520	1210 ± 266	-21%
PVR (dyne-sec-cm <sup>-5</sup> )	119 ± 47	78 ± 22	-34%
CVP (mm Hg)	3.7 ± 2.6	3.6 ± 2.5	NS
COP (mm Hg)	20.8 ± 1.0	18.0 ± 1.5	-14%
PCWP (mm Hg)	6.3 ± 2.1	7.5 ± 1.8	NS
COP-PCWP (mm Hg)	14.5 ± 2.5	10.5 ± 2.7	-28%



# Common cardiac findings in **normal pregnancy**

♥ Symptoms – Fatigue, Dyspnea, Light-headedness

♥ Physical findings – pulsative JVP, ejection SM

♥ ECG –

∅ Sinus tachycardia

∅ APB's + VPB's

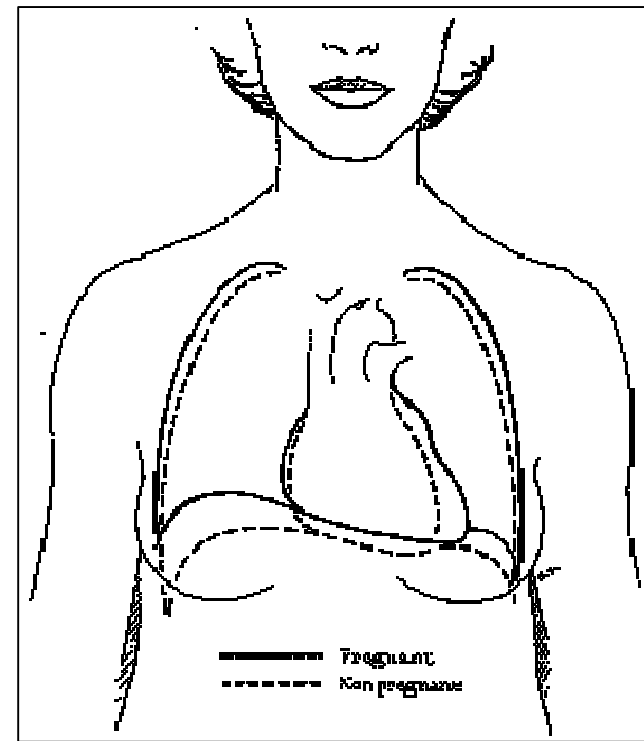
∅ ST-T changes

♥ Echo:

∅ Mild LVE; LAE

∅ Functional TR & MR

∅ Small pericardial effusion



# Labor & Delivery

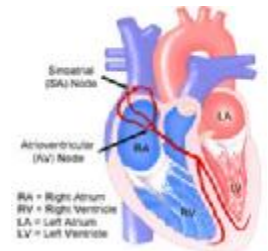
(anxiety, pain, uterine contractions)

## Parameter

- ♥ Blood volume
- ♥ Cardiac Output
- ♥ Heart rate
- ♥ Blood pressure

## Change

- ♥ Increase in 300-500 ml
- ♥ Increase in 30-60% (contractions)
- ♥ Variable
- ♥ Increase (25-35 mmHg during contractions)



# Cesarean Section

- ♥ **Avoids anxiety, pain, uterine contractions**
- ♥ **Hemodynamic effects of anesthesia, intubation \ extubation, blood loss**
- ♥ **Surgical procedure**
- ♥ **Future pregnancies**

# Postpartum

high risk of complications (up to 1 hour)



♥ Increase in cardiac output:

∅ Release of caval obstruction

∅ Autotransfusion of uteroplacental blood

∅ Mobilization of extravascular fluid

♥ Blood loss

LVEDV ↑

LVEDP ↑

SV ↑

CO ↑





# Pregnancy with Cardiovascular disease

- ♥ Continues to pose a challenge
- ♥ Increases the risk of pregnancy to both the mother and the fetus
- ♥ Requires specific care in purpose:
- ∅ Minimize maternal morbidity\mortality
- ∅ Fetal well-being

# **Largest multicenter study:**

(Siu et al, Circulation 2001;104:515)

- ♥ **599 pregnancies in 562 women with different CVD**
- ♥ **Independent predictors for maternal cardiac events:**
  - ∅ **Prior cardiac event**
  - ∅ **NYHA  $\geq$  III**
  - ∅ **Cyanosis**
  - ∅ **Left heart obstruction**
  - ∅ **Myocardial dysfunction**

# Clinical Evaluation

- ♥ Preconception
- ♥ Ante + peripartum
- ♥ Labor and delivery
- ♥ Postpartum



# Preconception

- ♥ Past Hx of cardiac events
- ♥ Physical examination – CHF
- ♥ Functional capacity – (exercise test)
- ♥ ECG \ Holter – Arrhythmias
- ♥ Echo – disease type @ severity, LV function; RV function and PA Pressure
- ♥ Evaluate Risk with patient and family
- ♥ Link cardiologist @ obstetrician
- ♥ Discontinue potentially harmful drugs

# Ante + Peripartum

## ♥ Follow-up\*:

Disease Risk W of preg.	Mild Small F-U visits	Mod-Severe Significant F-U visits
- 24	1	every 4 - 6w
24 - 32	1	every 2 - 4w
> 32	1	every 1 - 2w

- ♥ Physical exam
  - ♥ Functional capacity
  - ♥ ECG
  - ♥ Echo
- Compared to:
- ∅ Baseline
  - ∅ Normal physiology

- ♥ Drug therapy:
- ∅ If necessary
- ∅ Safe drugs
- ∅ Smallest dose

\* Very individual

# Labor and delivery

- ♥ **Mode & timing of delivery**: shared decision of Patient & Obstetrician & cardiologist & anesthesiologist
- ♥ **Always suggest** - Vaginal delivery & short 2<sup>nd</sup> stage
- ♥ **Cesarean section in pts with:**
  - ∅ Obstetric indications
  - ∅ Cardiac instability
  - ♥ Antibiotic prophylaxis
  - ♥ Anticoagulation
- ♥ **Hemodynamic monitoring in pts with:**
  - ∅ CHF; FC  $\geq$  III
  - ∅ Severe left heart obstruction – AS; COA
  - ∅ Left ventricular dysfunction
  - ∅ Pulmonary hypertension

# Early Postpartum

♥ Blood loss

♥ Increased venous return:

∅ Blood shift from the emptied uterus into the systemic circulation

∅ Decreased caval compression

∅ Mobilization of fluid from the limbs and lower body

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♥ Heart failure – often **very transient**

♥ Hemodynamic monitoring for 12 to 24 h after the delivery.

# Antibiotic prophylaxis

## (Cardiology viewpoint)

- ♥ The incidence of endocarditis is no different in pregnant women with valvular heart disease than in nonpregnant women
- ♥ ACC & AHA do not recommend prophylactic treatment in uncomplicated vaginal delivery or cesarean section
- ♥ Prophylaxis - Vaginal infection + high-risk:
  - ∅ Prosthetic valves
  - ∅ History of bacterial endocarditis
  - ∅ Valvular heart disease (AS/ AR / MS / MR)
  - ∅ Hypertrophic cardiomyopathy
- ♥ Organisms:
  - ∅ SBE - Streptococci
  - ∅ ABE - *Staph aureus*, *Strept pneumoniae*, and *Neisseria gonorrhoeae*

# Antibiotic prophylaxis (Ob&G viewpoint)

- ♥ Campuzans et al, Arch Gynecol Obstet 2003;268:251:
- Ø Review of IE complicating 68 pregnancies
- Ø Maternal mortality - 22%
- Ø Fetal mortality - 15%
- ♥ The recommended regimens:
- Ø Ampicillin 2.0 g IM\IV + gentamicin (1.5 mg/kg, not to exceed 120 mg) given at initiation of labor or within 30 min of a cesarean section
- Ø Ampicillin (1 g IM\IV) or amoxicillin (1 g orally) 6 h later.
- Ø For patients allergic to ampicillin and amoxicillin, vancomycin (1.0 g IV over 1 to 2 h)

# Anticoagulation therapy\*

- ♥ **Pregnancy** - hypercoagulability (increased factor VIII; fibrinogen & blood viscosity)
- ♥ **Indications** - prosthetic valves, venous or arterial thromboembolism, AF

Drug	Crosses placenta	Side effects	comments
Coumadin	yes	-Teratogenic – nasal, musculoskeletal hypoplasia, (4-10%--67% 1 <sup>st</sup> trimester) -Fetal hemorrhage (forceps) - prematurity; stillbirth	-Contraindicated 6-12 weeks - Safe 2 <sup>nd</sup> + 3 <sup>rd</sup> trimester - Use smallest effective dose (< 5 mg)
Unfractionated heparin	no	-Thromboembolism > coumadin (less effective) - Heparin Induced Thrombocytopenia (HIT) - Osteoporosis - IV - logistic problems - SC – painful	x 2 PTT 2-2.5 times control value  - Adjusted (high) dose
LMWH	no	- FDA 2004* <b>alert</b> - Less side effects	-Limited (good) experience - Measure plasma anti Xa level

\*Limited data (**prosthetic valves**); Consult (Ob&G + coagulation expert)

# Suggested Protocol

week	action	High risk	Low risk	comments
Pregnancy	Stop Coumadin			
6 - 12	Assess risk	IV or SC Heparin	LMWH	
13 - 35	Assess risk	Coumadin consider adding low dose Aspirine	SC or LMWH	INR 2-3 PTT x 2-3
36 - delivery	Stop Coumadin	IV Heparin	SC or LMWH	PTT x 2-3
Delivery	Stop Heparin			- If under coumadin - CS - If no bleeding resume 4-6h
After delivery	Reassess risk			Continue $\geq$ 6 weeks





# Specific heart diseases

## ♥ Valvular Heart Disease:

∅ MS \ MR \ AS \ AR \ PS

## ♥ Diseases of the aorta:

∅ Coarctation of aorta \ Marfan

## ♥ Cardiomyopathies:

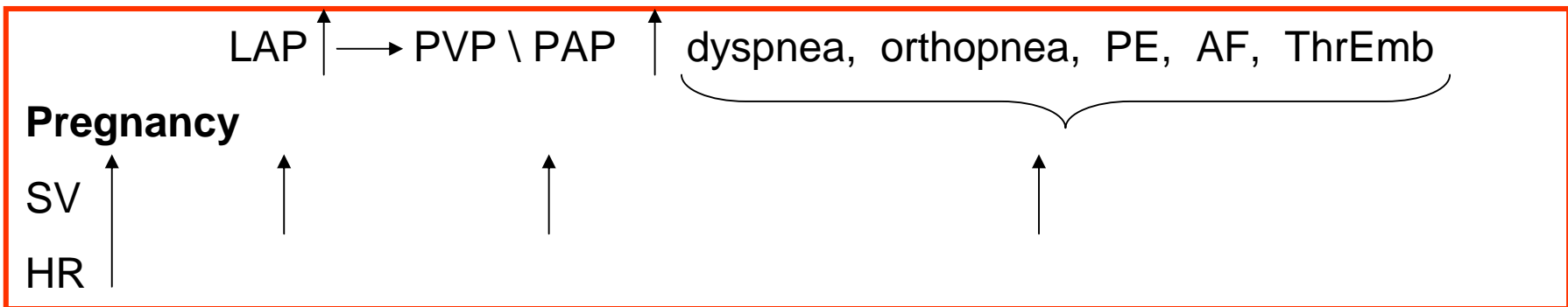
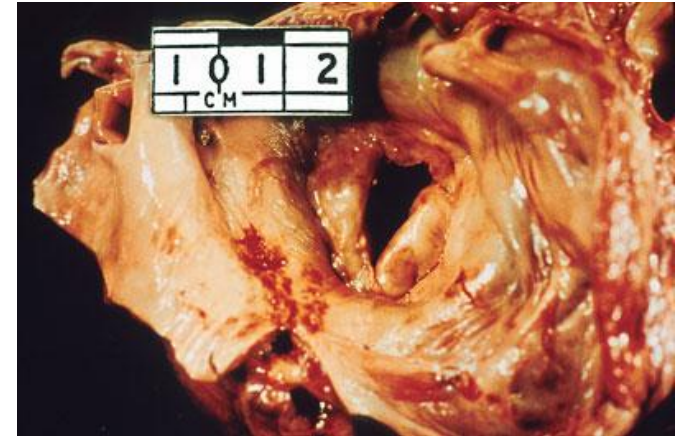
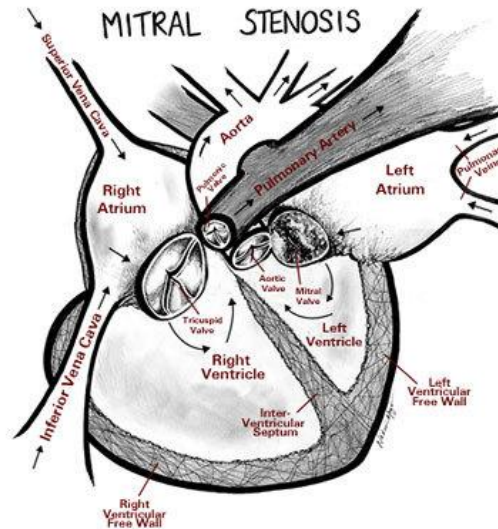
∅ Hypertrophic CDM

∅ Peripartum CDM

## ♥ Primary pulmonary hypertension

# Mitral Valve Stenosis

- Ø RHD
- Ø Young Women
- Ø + MR (mild)
- Ø + AS\AR - rare



# Maternal & Fetal Risk

Table II – Distribution of complications by percentage		
Maternal complications	N	%
Progression to functional class III/IV	20/41	48.8
Balloon mitral valvulotomy	16/45	35.5
Need for heart surgery during pregnancy	3/45	6.7
Embolic phenomenon	1/43	2.3
Maternal death	1/43	2.3
<b>Fetal/neonatal complications</b>		
Low birth weight	10/34	29.4
Premature delivery	10/42	23.8
Extended stay of newborn in nursery or neonatal ICU	6/42	14.3
Stillbirth	2/42	4.8
Abortion	1/42	2.4

ICU- Intensive care unit.

## ♥ Prognosis:

∅ High morbidity

∅ Low mortality

∅ Rare thrombo-embolic events (?)

## ♥ Risk Factors:

∅ MVA < 1.0 cm<sup>2</sup>

∅ Baseline FC ≥ II

**Paulo José Bastos Barbosa. Prognostic Factors of Rheumatic Mitral Stenosis During Pregnancy and Puerperium. Arq. Bras. Cardiol. Sep 2000**

# Management

**Woman with MS [MVA < 1 (< 1.5 cm<sup>2</sup>) FC ≥ II]**

**Preconception**



**Consider Balloon Mitral Valvuloplasty**

**Pregnant**



**Diuretic  
b blocker (selective)  
physical activity  
AF – digoxin, anticoag  
Salt intake  
FU – very close  
Interventions**

# ספור מקרה מס 1

- **הוזמנת לתת יעוץ במרפאה להריון בסיכון גבוה:**

- גברת בת 41 בשבוע ה-28 להריון, נ+ ילד בן 10, לפי מכתב הרופא המטפל מקופת החולים ידוע על מחלה ראומטית מיטראלית.

- בחודשיים – שלשה האחרונים מתלוננת על עייפות, קוצר נשימה במאמץ קל, והרגשת "דופק מהיר".

- **בבדיקה:** מתנשמת אחרי שעלתה מהכסא למיטת הבדיקה, דופק 96\דקה סדיר, ל"ד 110/70 מ"מ כספית, ורידי הצוואר בולטים, קול 1 מוגבר, 2P מוגבר עם אוושה סיסטולית ודיאסטולית בגבול הסטרנום השמאלי. ריאות – נקיות, בטן – הריון (קשה למשש כבד), גפיים – בצקת קלה בקרסוליים

- **אתלה – מבקשות לבצע את הבדיקות הבאות:**

- ECG – NSR; 100\min; neg T wave in V1-V3
- Echo – LVEDD \ LVEDD = 46\28 mm; RV – normal; LA = 50 mm; rheumatic MV; MVA=0.8 cm<sup>2</sup>; Mean PG = 14 mmHg; minimal MR; mild AR; moderate TR with estimated systolic PAP=60 mmHg

## ההמלצה שלך: ♥

..... להמשיך בדיקות – אילו? ?

טפול תרופתי – איזה? ומעקב – מתי? ?

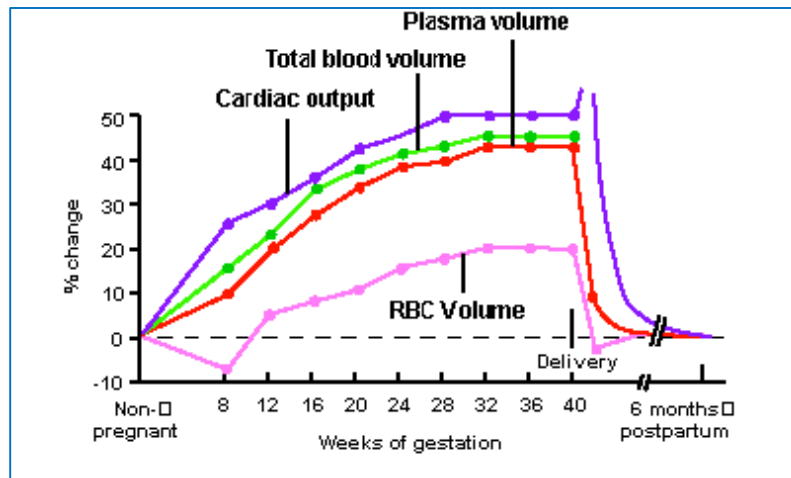
Ballon mitral valvuloplasty (BMV) – מתי? ?

Mitral Commissurotomy \ MVR – מתי? ?

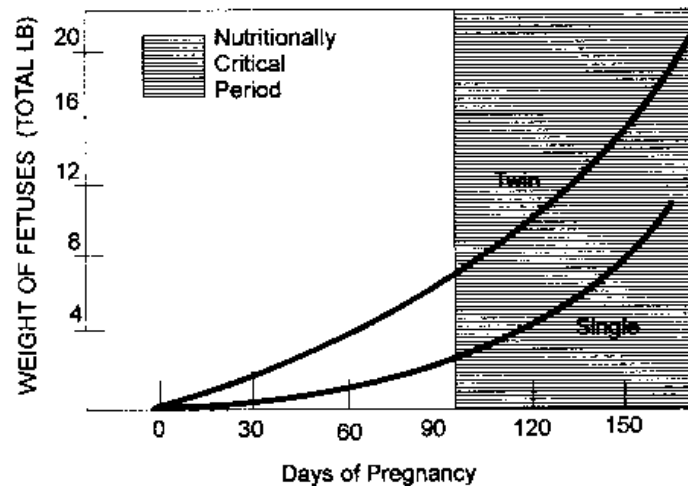
.....אחר? ?

# פקטורים העוזרים להחלטה

## Woman with Severe MS [MVA < 1 ; FC ≥ II]; PHT



- Diuretic
- b blocker
- physical activity
- AF – digoxin, anticoagulant
- Salt intake
- FU – very close
- Interventions



חסרים נתונים (רופא נשים):  
 ? מצב העובר – גודל וכ"ו  
 ? שבוע אפשרי ליילד  
 (ניהול סיכונים)



# המלצות

METOPROLOL 50 (+50) MG; FUSID 40 MG; rest; low Na intake  
FU Visit 2 weeks or with any clinical deterioration

## אין שפור \ מצב מחמיר

ORTHOPNEA ♥

חולשה בולטת, בצקת ברגליים ♥

דופק -100-90\דקה (אחרי 20 דקות מנוחה) ♥

אקו – עליה בלחץ הריאתי, TR ♥

גודש בורידי הכבד

התערבות

שינוי בטפול ♥

ניתוח

BMV

## שפור במצב החולה \ מצב יציב

שבוע 30 ♥

פחות קוצר נשימה ♥

דופק 84\סדיר ♥

אקו – לחץ סיסטולי ריאתי ♥

כ45 מ"מ כספית

המשך מעקב 2-3 שבועות או ♥

עם כל שינוי במצבה הקליני

של החולה

ניהול סיכונים

# BMV during pregnancy

- ♥ NYHA FC III - IV who did not respond adequately to pharmacologic therapy
- ♥ At the end of the 2<sup>nd</sup> trimester or the start of the 3<sup>rd</sup> trimester
- ♥ Abdominal & pelvic shielding & minimum radiation
- ♥ Very good results with **experienced operators** (Inoue balloon + echo-Doppler guided):
- ∅ Symptoms (FC)
- ∅ MVA increase to 1.7 - 2.2 cm<sup>2</sup>
- ∅ Vaginal delivery suggested in most patients
- ♥ Complications (rare) - tamponade, blood loss, transient AF, MR, embolization, precipitous labor, radiation, m\p normal growth & development of children (limited data)

**Rarely needed – strict indications**

Source – Elkayam U, J Am Coll Cardiol, 2005; 46:223-230

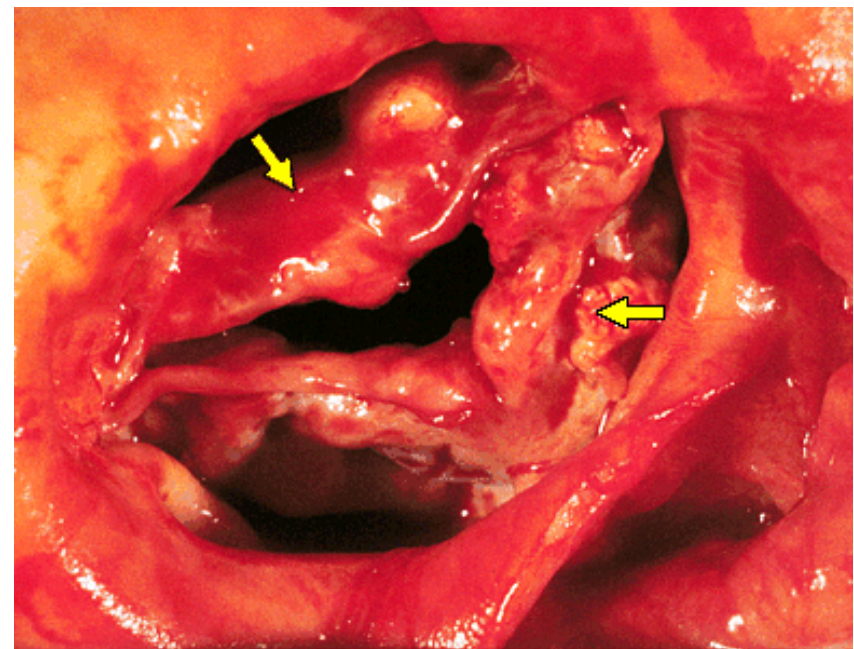
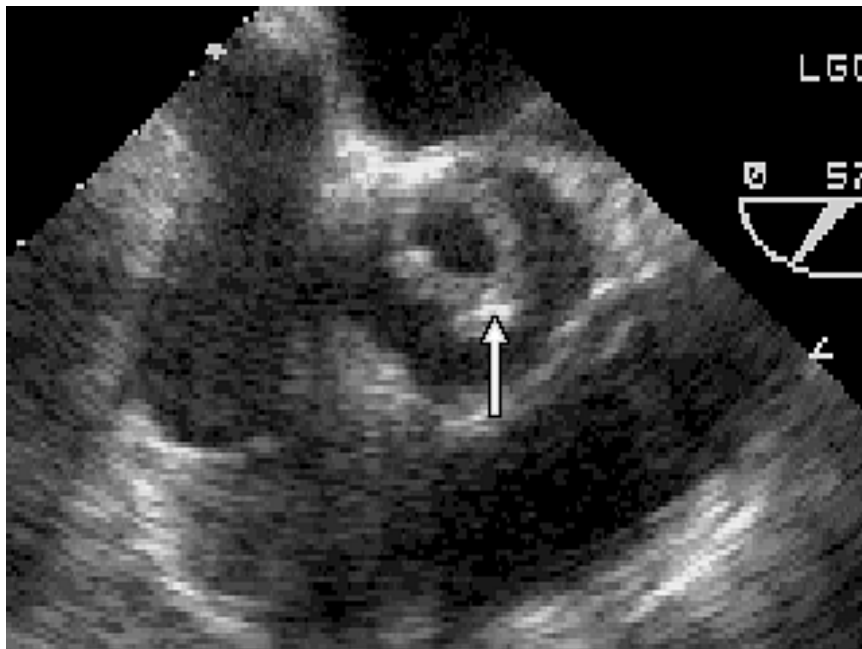
# Mitral Valve Regurgitation

- ♥ RHD or MVP
- ♥ Well tolerated – low SVR at pregnancy
- ♥ Asymptomatic patients – follow-up
- ♥ Symptomatic patients:
  - ∅ Diuretics
  - ∅ Digoxin (?)
  - ∅ ACEI - **contraindicated**
  - ∅ Organic nitrates and hydralazine
  - ♥ Surgery - should be avoided

# Aortic Valve Stenosis

**Congenital bicuspid \ unicuspid**

**Severe (symptomatic) considered high risk**



# Aortic Valve Stenosis

0.8      1                      1.5                      2                      3-4    **cm<sup>2</sup>**

$\Delta MG > 50$  mmHg

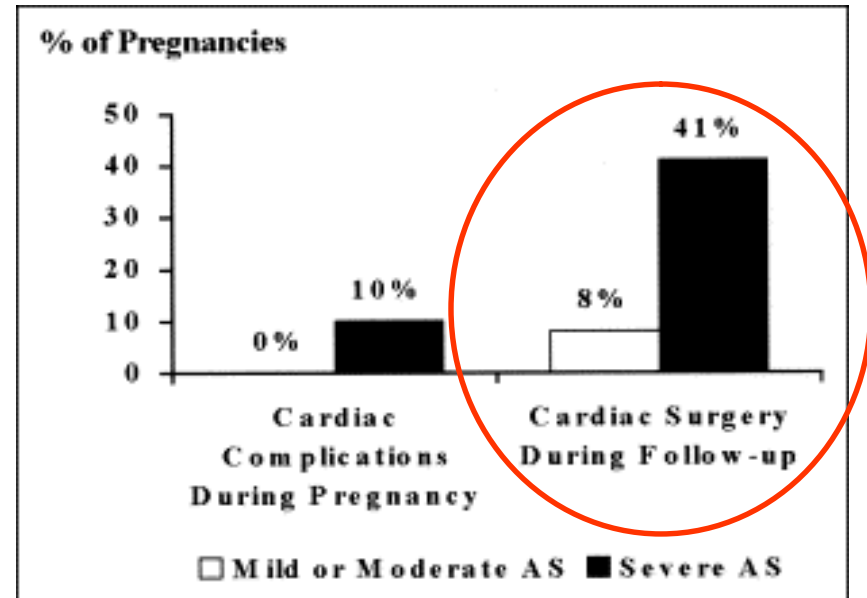
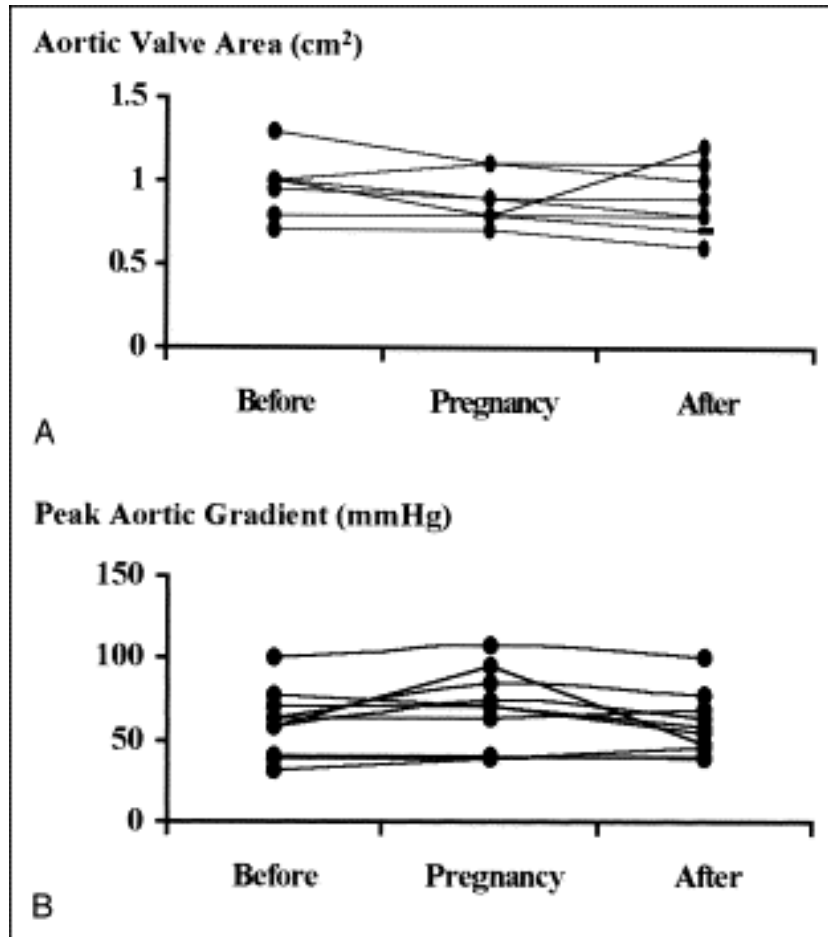
$\Delta PG > 100$  mmHg



**Critical \ severe      moderate      mild      sclerosis      normal**

**Critical  $\leq 0.5$  cm<sup>2</sup> / m<sup>2</sup> BSA (+ symptoms)**

# Effect of Pregnancy



Mean Follow-up 3.7 years

Silversides et al. Early and intermediate-term outcomes of pregnancy with congenital aortic stenosis. AJC June 2003


# Maternal & fetal risk

Silversides, AJC June 2003

	No. of Pregnancies (%) (n = 49)	Mild or Moderate AS (n = 20)	Severe AS (n = 29)
Early maternal cardiac outcomes*			
Total	3 (6%)	0	3
Pulmonary edema	2 (4%)	0	2
Atrial arrhythmias	1 (2%)	0	1
Early fetal or neonatal outcomes*			
Total	6 (12%)	4	2
Premature	5 (8%)	4	1
Small for gestational age	1 (2%)	1	0
Respiratory distress syndrome	3 (6%)	2	1

- ♥ Most patients with AS tolerate pregnancy well
- ♥ Maternal mortality is rare
- ♥ Maternal & fetal morbidity is rare but significant
- ♥ High rate of cardiac surgery after pregnancy

# Management

- ♥ Asymptomatic patients - close monitoring
  - ♥ Avoiding intense exercise, vasodilators, and diuretics
  - ♥ Low dose b blockers (ACC\ AHA 2006 guidelines)
  - ♥ Low LVEF and \ or symptomatic & inappropriate or unwilling intervention - digoxin, diuretics
  - ♥ Percutaneous balloon valvuloplasty (or AVR)
- ♥ prophylactic(?)      therapeutic
- 
- ```
graph TD; A[Percutaneous balloon valvuloplasty (or AVR)] --> B[prophylactic(?)]; A --> C[therapeutic];
```



# If: Severe (early) symptoms (resistant to medical therapy?)



## Termination of pregnancy

## Intervention\* (valvuloplasty)

- ♥ **Early delivery (if possible):**
- ∅ Hemodynamic monitoring
- ∅ Vaginal with assisted 2<sup>nd</sup> stage
- ∅ Epidural – caution (drop in SVR; BP; CO)
- ∅ Cesarean mostly d/t obstetrical indications with general anesthesia
- ♥ **Abortion** - early delivery impossible

- ♥ TEE guided + minimal fluoroscopy
- ♥ **Risk to mother**
- ♥ **Risk to the fetus:**
- ∅ Transient ischemia
- ∅ Radiation
- ∅ Fetal loss (rare)
- ♥ Often “bridge to surgery”

\* (data from case reports)

## ספור מקרה מס 2

### • הוזמנת לתת יעוץ במלר"ד:

• גברת בת 24 בשבוע ה-34 להריון ראשון, שוחררה משירות בצבא עקב מחלה מסתמית.

• כ-3 חודשים קוצר נשימה במאמץ קל-בינוני והרגשת אי נוחות בחזה עם החמרה ברורה בימים האחרונים.

• בבדיקה: דופק 90\דקה סדיר, ל"ד 100/60 מ"מ כספית אוושה סיסטולית המתאימה ל-AS, ריאות – נקיות, בטן – הריון (קשה למשש כבד), גפיים – דפקים נימושים ושווים וללא בצקת

• אתלה – מבקשת לבצע את הבדיקות הבאות:

- ECG – NSR; 90\min; borderline criteria of LVH
- Echo – LVEDD \ LVEDD = 46\28 mm; IVS 13 mm; RV – normal; LA = 41 mm; bicuspid AV; AVA=0.8 cm<sup>2</sup>; Mean PG = 50 mmHg; minimal AR; minimal TR; impossible to estimate PA pressure

## ההמלצה שלך: ♥

..... להמשיך בדיקות – אילו? ?

טפול תרופתי – איזה? ומעקב – מתי? ?

Balloon valvuloplasty – מתי? ?

ניתוח AVR – מתי? ?

..... אחר? ?

# Aortic Valve Stenosis

0.8    1                    1.5                    2                    3-4    **cm<sup>2</sup>**

$\Delta MG > 50$  mmHg

$\Delta PG > 100$  mmHg



**Critical \ severe                    moderate                    mild                    sclerosis                    normal**

**Critical  $\leq 0.5$  cm<sup>2</sup> / m<sup>2</sup> BSA (+ early symptoms)**

פקטורים: שבוע 34, AS קשה, סימפטומים מתגברים שהחלו מוקדם

## Termination of pregnancy

### ♥ Possible:

- ∅ Hemodynamic monitoring?
- ∅ Vaginal with assisted 2<sup>nd</sup> stage
- ∅ Epidural – caution (drop in SVR; BP; CO)
- ∅ Cesarean mostly d/t obstetrical indications with general anesthesia + Hemodynamic monitoring

### ♥ Impossible:

- ∅ Close FU – every week (or in hospital)
- ∅ Clinical deterioration

Consider Valvuloplasty

**\*Consult – Ob&G + anesthesiologist**

# ספור מקרה מס 3

- למרפאה נכנסת אימא עצבנית + גברת צעירה  
חודש לפני החתונה בשאלה לגבי הסיכון בהריון:
- בת 24, אסימפטומטית, למרות אזהרות של ההורים  
והרופא המטפל נסעה וחזרה מטיול תרמילאים קשה  
בדרום אמריקה.
- בבדיקה: דופק 76\דקה סדיר, ל"ד 100/60 מ"מ  
כספית אוושה סיסטולית המתאימה לAS, ריאות –  
נקיות, בטן – במ"פ, גפיים – דפקים נימושים ושווים  
וללא בצקת
- אתלה – מבקשות לבצע את הבדיקות הבאות:

- ECG – NSR; 70\min; borderline criteria of LVH
- Echo – LVEDD \ LVEDS = 46\28 mm; IVS 13 mm; RV – normal; LA = 41 mm; bicuspid AV; AVA=0.8 cm<sup>2</sup>; Mean PG = 50 mmHg; minimal AR; minimal TR; impossible to estimate PA pressure

## ההמלצה שלך: ♥

להמשיך בדיקות – אילו? .....

להציע לה שתפנה לאמוץ, הריון ולידה מסכנים את חייה ?

לאפשר לה להיכנס להריון עם הסבר מפורט על הסיכונים ?

להפנות ל Balloon valvuloplasty עם הסבר מפורט על הסיכונים ?

להפנות לניתוח – AVR סוג התותב? ניתוח אחר?? ?

אחר..... ?

## ♥ דילמה עם 3 אפשרויות:

∅ להמשיך בדיקות - **מבחן מאמץ** אם תקין לחלוטין



∅ לאפשר לה להיכנס להריון עם הסבר מפורט על הסיכונים (ולכתוב בגיליון ובמכתב לרופא):

- בזמן ההריון והלידה – צפוי הריון קשה עם ירידה בתפקוד, פגיעה ביכולת לעבוד, קוצר נשימה, סיכון קטן לחייה, סיכון להפלה וללידת פג, יתכן שיהיה צורך בהתערבות דחופה
- סבירות להתקדמות המחלה המסתמית בעקבות ההריון והלידה

∅ להפנות ל Balloon valvuloplasty עם הסבר מפורט על הסיכונים

∅ להפנות לניתוח – ROSS? תותב – מכני \ ביולוגי?



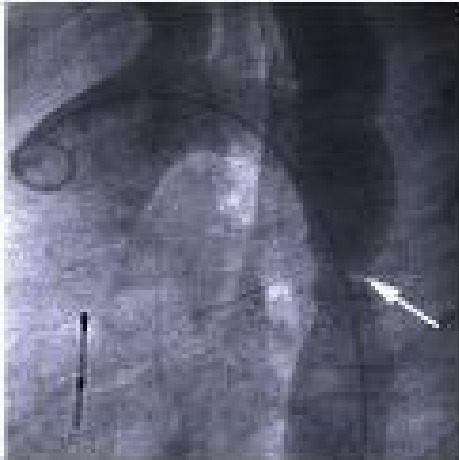
# Aortic Valve Regurgitation

- ♥ Congenital bicuspid \ RHD \ endocarditis \ dilated annulus
- ♥ Well tolerated – low PVR; increased HR
- ♥ Severe asymptomatic – follow-up
- ♥ Severe symptomatic AR + LV dysfunction:
  - ∅ Salt restriction
  - ∅ Diuretics
  - ∅ Digoxin
  - ∅ Stop ACEI
  - ∅ Hydralazine and nitrates

# Pulmonary Valve Stenosis

- ♥ Congenital valvular \ subvalvular \supravalvular \ s\p Ross procedure (deterioration of the homograft)
- ♥ Very well tolerated
- ♥ Severity of PS does not impact maternal or fetal outcome ≠ MS or AS
- ♥ Pre-pregnancy balloon valvuloplasty:
- ∅ Pressure gradient >50 mm Hg
- ∅ Symptomatic

# Coarctation of aorta



♥ **Left heart obstruction (@ AS)**  
**= generally safe in pregnancy\***

♥ **Unless high risk:**

♥ **Severe hypertension**

♥ **Aneurysm**

⊘ **Root dilatation (±BAV)**

⊘ **Post stenotic**

\* Connolly JACC 1996 – 87 pregnancies; no maternal death; 93% live birth rate

# COA – evaluation of high risk\*

## ♥ Tests required:

∅ LV function (echo)

∅  $\Delta$  Arm / leg BP

∅ Systolic BP response to exercise

## ♥ Imaging of the aorta to r/o:

∅ Root size (CT angio; echo)

∅ Aneurysms (CT angio; cath)

\* Consultation before pregnancy

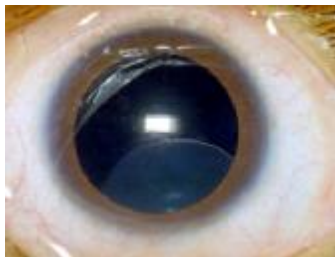
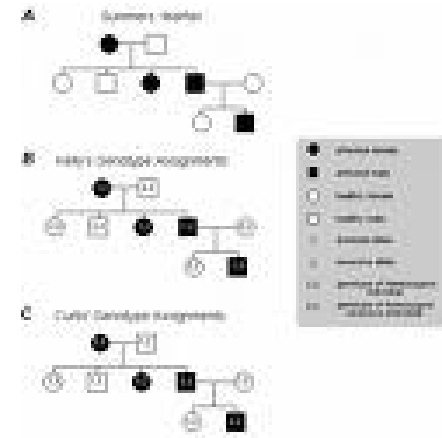
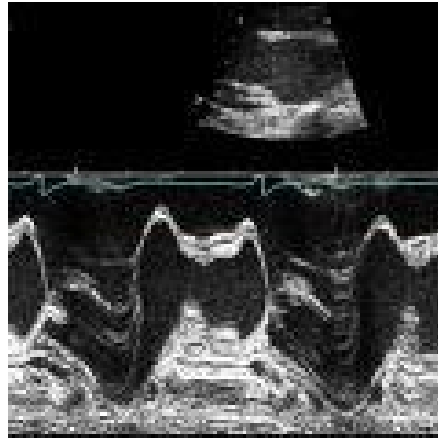
# COA high risk

- ♥ Abnormal LV function (low FC)
- ♥  $\Delta$  Arm / leg BP  $>$  20 mmHg
- ♥ Exercise systolic BP  $>$  230 mmHg
- ♥ Aneurysms (root; post stenotic)



**Consider intervention**

# Marfan Syndrome



- ♥ 1:5,000 in the population
- ♥ single gene mutation on chromosome 15; controls Fibrillin 1
- ♥ Autosomal Dominant – 75%
- ♥ Spontaneous mutation - 25%
- ♥ Diagnosis - Ghent criteria

# Pregnancy With Marfan Syndrome

## ♥ Risks:

- ∅ To the baby – 50% chance of inheriting the gene
- ∅ To the mother (Stress; high CO etc)
- ü Aortic dissection (mostly fatal; 3<sup>rd</sup> trimester)
- ü Accelerated aortic dilatation – go to surgery  $\geq 4.5$  cm?

## Low risk

- ♥ Aortic root  $< 40$  mm + mild AR
- ∅ Pregnancy not advisable
- ü If pregnant -  $\beta$  blockers; FU every 6-8 weeks; vaginal delivery

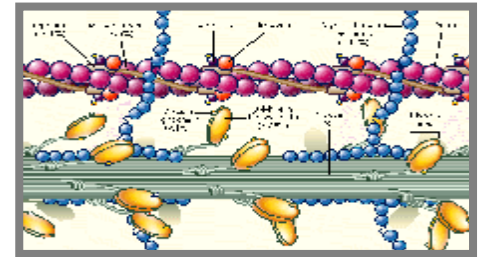
## High risk

- ♥ Aortic root  $> 40$  mm +  $\geq$  moderate AR
- ∅ Pregnancy **strongly** not advisable
- ü If pregnant -  $\beta$  blockers; close FU every 2-4 weeks; cesarean section

Am Journal of Obstetrics & Gynecology. Rossiter et al, 1995; 173(5):1599-1606  
Annals Int Med. Alkayam et al, 1995;123:117-122 (?)  
ACC \ AHA Guidelines. J Am Coll Cardiol, 2006; 48:1-148

# Hypertrophic (obstructive) cardiomyopathy

- ♥ Common congenital disease (0.02-0.2%)
- ♥ Mutation in genes that encode cardiac sarcomere proteins (> 200 mutations)
- ♥ 50% autosomal dominant
- ♥ **Screening**: 25% of 1<sup>st</sup> degree relatives = “new” asymptomatic patients including young women





# Hypertrophic (obstructive) cardiomyopathy

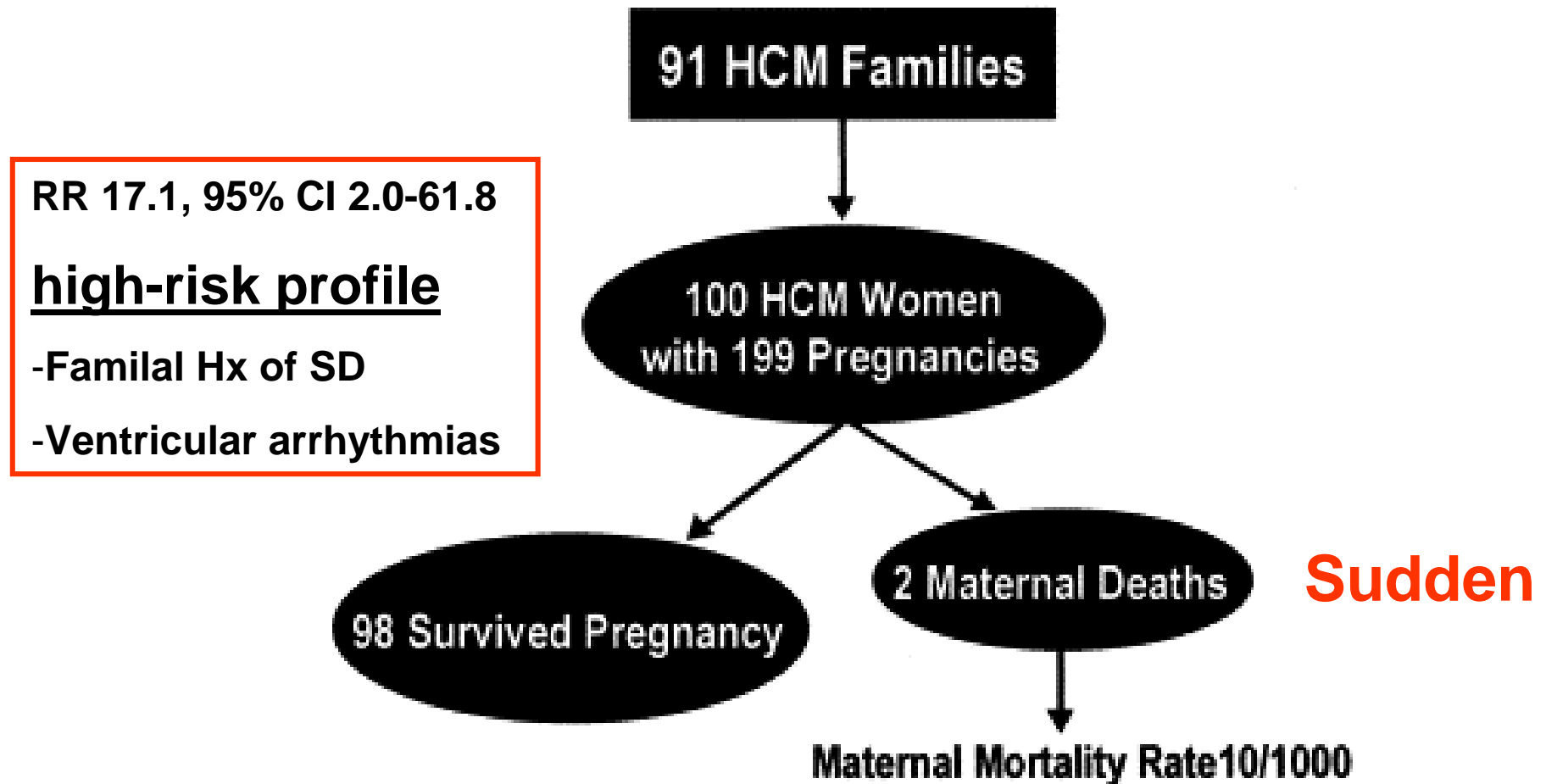
- ♥ Variable morphology + clinical presentation + prognosis:
  - ∅ Asymptomatic (most patients, screening)
  - ∅ “Diastolic heart failure”- CHF & normal LVEF
  - ∅ Arrhythmias (VT, AF), syncope, emboli
  - ∅ Sudden death (young asymptomatic patients)
- 

## ♥ Pregnancy (based on case reports):

- ♥ Stress
- ♥ Increased heart rate
- ♥ Increased volume

Considered “High risk  
– of death and “CH  
Cesarean section

# Maternal Mortality



**Autore et al. Risk associated with pregnancy in hypertrophic cardiomyopathy. JACC November 2002.**

# Maternal Morbidity (n=40)

♥ CHF - **15%** mostly in patients with:

∅ Low FC

∅ LV Outflow obstruction

∅ Massive hypertrophy (30 mm)?

♥ Arrhythmia –rare

♥ Cesarean section - **40%**

∅ Known disease – 70%

∅ Unknown – 10%

# Conclusions

- ♥ **Mortality** – is low, but increased compared with the general population and confined to **high risk patients**
- ♥ Major progression of symptoms, atrial fibrillation, and syncope are uncommon and significantly related to the patient's clinical condition **before pregnancy**
- ♥ Most young women with HCM can be reassured about their potential risks of pregnancy

# ספור מקרה מס 4

- למרפאתך נכנסה גברת בשבוע 14, הריון 1:
- בת 30, אסימפטומטית. לאחד האחים נמצאה קרדיומיופטיה. ב screening נמצא אצלה אק"ג פתולוגי מאד
- בבדיקה: דופק 76\דקה סדיר, ל"ד 100/60 מ"מ כספית אוושה סיסטולית קצרה ב LSB, ריאות – נקיות, בטן – במ"פ, גפיים – דפקים נימושים ושווים וללא בצקת
- אתלה – מבקשת לבצע את הבדיקות הבאות:

- ECG – NSR; 70\min; criteria of LVH + strain
- Echo – LVEDD \ LVEDD = 46\28 mm; IVS= 23 mm; PW=12; mm; RV – normal; LA = 42 mm; no MV SAM; minimal MR; no LVOT gradient at rest or post Valsalva

## ההמלצה שלך: ♥

..... להמשיך בדיקות – אילו? ?

להציע לה לבצע הפלה ?

להציע לה להמשיך את ההריון תוך טפול תרופתי עם הסבר מפורט על הסיכונים ?

להפנות ל SEPTAL ABLATION ע"י אלכוהול עם הסבר מפורט על הסיכונים ?

להפנות ל AICD ?

.....אחר. ?

# פקטורים להחלטה -

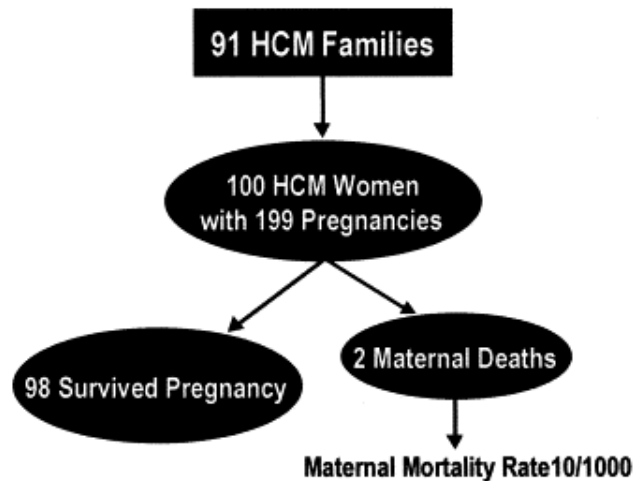
RR 17.1, 95% CI 2.0-61.8

## high-risk profile

- Familial Hx of SD
- Ventricular arrhythmias

## הערכת סיכון:

ספור משפחתי – מוות פתאומי בגיל צעיר  
 -הולטר 48 שעות - VT  
 -מבחן מאמץ – נפילת ל"ד, סחרחורת – עלפון, VT



| סיכון | נמוך = 0        | בינוני = 1 | גבוה $\geq 2$ |
|-------|-----------------|------------|---------------|
| המלצה | חוסמי ביתא מעקב | ??         | הפלה AICD     |

Autore et al. Risk associated with pregnancy in hypertrophic cardiomyopathy. JACC November 2002.

# Peripartum CDM

- ♥ Idiopathic CHF with systolic dysfunction in the last month of pregnancy – 5 month of delivery
- ♥ Incidence – 1\3000 live birth (?)
- ♥ Risk factors:
  - ∅ Multiparity
  - ∅ Advanced maternal age
  - ∅ Preeclampsia / hypertension
  - ∅ African race

70% of pregnancy related death from CDM



# Clinical presentation & management

- ♥ **Diagnosis of CHF – clinical; chest x ray; echo**
- ♥ **Supportive therapy – diuretics; afterload reduction (hydralazine / ACEI); nitrates/ dobutamine; IVIG (steroids)??**
- ♥ **Prognosis – most patients spontaneous recovery**
- ♥ **Subsequent pregnancy – very high risk with persistent LV dysfunction**

Elkayam, NEJM 2001

# Primary Pulmonary hypertension (& Eisenmenger)

- ♥ Very high mortality  $\cong$  40% during or immediately after delivery
- ♥ Triggering \ acceleration of PPH
- ♥ Pregnancy contra-indicated
- ♥ If pregnant abortion recommended
- ♥ Case reports on NO therapy