Maternal Cardiac Disease Diagnosis and Management

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Department of Perinatology
Heart diseases in pregnancy

Today, 0.2-4% of all pregnancies are accompanied by cardiovascular diseases.

The most important cause of maternal deaths in developed countries is CVD.
Congenital heart diseases in developed countries and rheumatic heart diseases in developing countries are more common.

Ischemic heart disease and myocardial infarction are rare.
Maternal mortality due to cardiac disease was 15.5% in 2007, 18.4% in 2008 and 15.8% in 2009.
<table>
<thead>
<tr>
<th>Age</th>
<th>15–19</th>
<th>20–24</th>
<th>25–29</th>
<th>30–34</th>
<th>≥35</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valvular heart disease</td>
<td>0</td>
<td>5</td>
<td>10</td>
<td>9</td>
<td>9</td>
<td>33</td>
<td>25.6</td>
</tr>
<tr>
<td>Hypertension</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>9</td>
<td>17</td>
<td>13.2</td>
</tr>
<tr>
<td>Aortic aneurysm rupture, aortic coarctation</td>
<td>0</td>
<td>5</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>12</td>
<td>9.3</td>
</tr>
<tr>
<td>Pulmonary embolism</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>11</td>
<td>8.5</td>
</tr>
<tr>
<td>Ischemic heart disease</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>7</td>
<td>2</td>
<td>11</td>
<td>8.5</td>
</tr>
<tr>
<td>Others</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>11</td>
<td>8.5</td>
</tr>
<tr>
<td>Congenital heart disease</td>
<td>0</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>10</td>
<td>7.8</td>
</tr>
<tr>
<td>Cardiomyopathy</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>9</td>
<td>7.0</td>
</tr>
<tr>
<td>Venous system disease</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>8</td>
<td>6.2</td>
</tr>
<tr>
<td>Unclassified</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>4</td>
<td>3.1</td>
</tr>
<tr>
<td>Hypertrophic heart disease</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>1.6</td>
</tr>
<tr>
<td>Heart failure</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0.8</td>
</tr>
<tr>
<td>Total</td>
<td>3</td>
<td>26</td>
<td>26</td>
<td>37</td>
<td>37</td>
<td>129</td>
<td>100.00</td>
</tr>
</tbody>
</table>
Haemodynamic Changes in Pregnancy

- Blood volume
- Cardiac Output (30-50%)
- Heart rate (10-20/мин)
- Systemic vascular resistance
Haemodynamic Changes in Pregnancy

Blood pressure;
- Decreases in first trimester,
- Returns to normal in second trimester,
- After the 32 week, it starts to increase slightly.

Pregnancy is a kind of STRESS TEST for cardiovascular system

The decrease in diastolic blood pressure is greater.
Physiological Changes That Produce Thrombosis Risks in Pregnancy

- **Venous stasis**
  - Decrease in venous flow
  - Mechanical pressure of the uterus
  - Decrease in movement

- **Prothrombotic state**
  - Increase in thrombin formation
  - Increase in procoagulant factor levels
    - Factor VII, VIII, X, fibrinogen, von Willebrand factor
  - Decrease in anticoagulant protein S level
  - Acquired active protein C resistance
  - Decrease in fibrinolysis

There is a tendency to hypercoagulability in pregnancy.
Hemodynamic changes in Labour

First Stage

Uterine contractions increase heart rate due to increased venous return.

Oxygen consumption increases threefold due to sympathetic tonus increase throughout the labour.
Hemodynamic changes in Labour

Second Stage

Intra abdominal pressure increase (Valsalva) increases venous return and increases heart rate (25-50%).

Especially in second stage Blood Pressure increases.
Hemodynamic changes in Labour

Third Stage

The venous return increases even further after the uterus has left the pressure on the VCI after birth.

The most important hemodynamic changes occur in the first 24 hours of the postpartum.
Postpartum hemodynamic changes

VCI pressure is off
Venous return ↑

“auto-transfusion”
Contracted uterus to Systemic circulation

Blood loss at birth

Effective blood volume ↑

LV filling pressure, Stroke volume and cardiac output ↑

Clinical worsening
Maternal Mortality

- During contractions
- Between contractions

Percent change

Pre | Early | Mid | Late | Second stage | Immed. | 10 min | 1 hour

Maternal Mortality

- Antepartum
- Labour
- PP first 48 days
- PP 3-42 days
Classification of the functional capacity of the heart
The New York Heart Association (NYHA)

<table>
<thead>
<tr>
<th>CLASS</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLASS I</td>
<td>Patients with cardiac disease but without resulting limitations of physical activity.</td>
</tr>
<tr>
<td>CLASS II</td>
<td>Patients with cardiac disease resulting in slight limitation of physical activity.</td>
</tr>
<tr>
<td>CLASS III</td>
<td>Patients with cardiac disease resulting in marked limitation of physical activity.</td>
</tr>
<tr>
<td>CLASS IV</td>
<td>Patients with cardiac disease resulting in inability to carry on any physical activity without discomfort.</td>
</tr>
</tbody>
</table>
Which heart disease has a higher risk of mortality?
1. Low risk for maternal mortality(< %1)
   (a) Septal defects
   (b) Cardiac functional capacity I-II
   (c) Patent ductus arteriosus
   (d) Pulmonary / Tricuspid lesions

2. Moderate risk for maternal mortality(5-15%)
   (a) Cardiac functional capacity III-IV
   (b) Mitral-Aort stenosis
   (c) Marfan’s syndrome(normal aorta)
   (d) Uncomplicated aortic coarctation
   (e) MI history
3. High risk for maternal mortality (25-50%).

(a) Eissenmenger’s syndrome

(b) Pulmonary hypertension

(c) Marfan’s syndrome (abnormal aortic root)

(d) Peripartum cardiomyopathy

(e) Symptomatic obstructive lesions (AS, PS)

(f) Severe ventricular dysfunction (EF <30%)

(g) Severe cyanotic heart diseases

(h) Prostatic valve diseases

(i) Significant uncorrected CHD
Table 3. World Health Organization Proposed Classification of Pregnancy Risk

<table>
<thead>
<tr>
<th>Modified WHO Class</th>
<th>Definition</th>
<th>Types of CHD</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHO I</td>
<td>No increased risk of maternal mortality</td>
<td>Mild pulmonary stenosis</td>
</tr>
<tr>
<td></td>
<td>No or mild increased risk of maternal morbidity</td>
<td>Small, uncomplicated PDA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Successfully repaired ASD, VSD, PDA, PAPVR</td>
</tr>
<tr>
<td>WHO II</td>
<td>Small increase in risk of maternal mortality, or</td>
<td>Unoperated ASD or VSD</td>
</tr>
<tr>
<td></td>
<td>Moderate increase in risk of maternal morbidity</td>
<td>Repaired tetralogy of Fallot</td>
</tr>
<tr>
<td>WHO II–III</td>
<td></td>
<td>Mild LV Impairment</td>
</tr>
<tr>
<td></td>
<td>Native or tissue valvular disease, not WHO Class I or IV</td>
<td>Marfan syndrome without aortic dilatation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bicuspid aortic valve with aortic root &lt; 45 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Repaired coarctation of the aorta</td>
</tr>
<tr>
<td>WHO III</td>
<td>Significantly increased risk of maternal mortality or severe morbidity</td>
<td>Systemic right ventricle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fontan circulation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unrepaired cyanotic heart disease</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other complex CHD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Marfan syndrome with aortic dilatation 40 to 45 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bicuspid aortic valve with aortic dilatation 45 to 50 mm</td>
</tr>
<tr>
<td>WHO IV</td>
<td>Extremely high risk of maternal mortality or severe morbidity. Pregnancy</td>
<td>Pulmonary hypertension of any cause</td>
</tr>
<tr>
<td></td>
<td>is contraindicated.</td>
<td>Severe systemic ventricular dysfunction (EF &lt;30%, NYHA class III–IV)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Severe symptomatic AS or MS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Native severe coarctation</td>
</tr>
</tbody>
</table>

Adapted from Regitz-Zagrosek et al with permission of the publisher. Copyright ©2011, Oxford University Press (UK), European Society of
### Table 4  Predictors of maternal cardiovascular events and risk score from the CARPREG study

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Risk Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior cardiac event (heart failure, transient ischaemic attack, stroke before pregnancy or arrhythmia).</td>
<td></td>
</tr>
<tr>
<td>Baseline NYHA functional class &gt;II or cyanosis.</td>
<td></td>
</tr>
<tr>
<td>Left heart obstruction (mitral valve area &lt;2 cm², aortic valve area &lt;1.5 cm², peak LV outflow tract gradient &gt;30 mmHg by echocardiography).</td>
<td></td>
</tr>
<tr>
<td>Reduced systemic ventricular systolic function (ejection fraction &lt;40%).</td>
<td></td>
</tr>
</tbody>
</table>

**CARPREG risk score:**

- For each CARPREG predictor that is present a point is assigned. Risk estimation of cardiovascular maternal complications
- 0 point  5%
- 1 point  27%
- >1 point  75%

LV = left ventricular; NYHA = New York Heart Association.
Predictors of pregnancy complications in women with congenital heart disease

**Table 5** Predictors of maternal cardiovascular events identified in congenital heart diseases in the ZAHARA and Khairy study

<table>
<thead>
<tr>
<th>ZAHARA predictors</th>
<th>Predictors from Khairy</th>
</tr>
</thead>
<tbody>
<tr>
<td>History of arrhythmia event.</td>
<td>Smoking history.</td>
</tr>
<tr>
<td>Baseline NYHA functional class &gt;II.</td>
<td>Reduced subpulmonary ventricular function and/or severe pulmonary regurgitation.</td>
</tr>
<tr>
<td>Left heart obstruction (aortic valve peak gradient &gt;50 mm Hg).</td>
<td></td>
</tr>
<tr>
<td>Mechanical valve prosthesis.</td>
<td></td>
</tr>
<tr>
<td>Moderate/severe systemic atrioventricular valve regurgitation (possibly related to ventricular dysfunction).</td>
<td></td>
</tr>
<tr>
<td>Moderate/severe sub-pulmonary atrioventricular valve regurgitation (possibly related to ventricular dysfunction).</td>
<td></td>
</tr>
<tr>
<td>Use of cardiac medication pre-pregnancy.</td>
<td></td>
</tr>
<tr>
<td>Repaired or unrepaired cyanotic heart disease.</td>
<td></td>
</tr>
</tbody>
</table>

NYHA = New York Heart Association.
Valvular disease

- Regurgitant valve lesions are better tolerated than stenotic lesions.
- The risk of developing complications in patients with left valve problems is greater than in right valves.
Anticoagulant Medication in Heart Diseases
All mechanical heart valve pregnancies need anticoagulant therapy

Warfarin is especially suitable for 2nd and 3rd trimester

It is recommended that all valve patients receive **Aspirin** 75-100 mg at 2 and 3 trimester
Warfarin

- Passes the placenta
- Abortion, preterm labor, embryopathy in the first trimester (6-12 hft)
- NS & Eye anomalies (2 – 3 trimester)
- Fetal bleeding (especially at birth)
What is the optimal management of pregnant women with valvular heart disease in pregnancy?

*Chan WS Haemostasis 1999*

<table>
<thead>
<tr>
<th></th>
<th>Embryopathy %</th>
<th>Thromboembolic complication %</th>
<th>Maternal death %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OA during pregnancy</strong></td>
<td>6.4</td>
<td>3.9</td>
<td>1.8</td>
</tr>
<tr>
<td><strong>Heparin during pregnancy</strong></td>
<td>0</td>
<td>33</td>
<td>15</td>
</tr>
<tr>
<td>1.tr Heparin, 2-3.tr OA</td>
<td>3.4</td>
<td>9.2</td>
<td>4.2</td>
</tr>
</tbody>
</table>

976 women-1234 pregnancies
1. Trimester: Pregnant with mechanical heart valve disease

Anticoagulant Therapy

Basal Warfarin Dose ≤5 mg/d
- Continue Warfarin with INR
- LMWH (Anti Xa)

Basal Warfarin Dose >5 mg/d
- UFH IV infusion (APTT)

AHA/ACC 2014
2 and 3. Trimester

Warfarin (INR) and ASA 75-100 mg

36.W - Before vaginal delivery is planned

Warfarin stop and LMWH or IV UFH infusion

AHA/ACC 2014
Labour

After 36 w

LMWH therapy

Labor induction or planned C/S change treatment at least 36 h before

IV UFH infusion

ESC 2011-AHA/ACC 2014

IV UFH infusion

Stop 4-6 h before birth

Begin 4-6 h after birth
Emergency birth management in anticoagulated pregnant
Cesarean section is necessary if birth is started during warfarin treatment.

The fresh frozen plasma can be given before the cesarean section to keep the INR within the range of 2-2.4

Oral K vit (0.5-1 mg) may be given, but the effect requires 4-6 hours to start.
Patient using UFH / LMWH

- Protamine should be used

- (1 ml Protamine neutralizes 1000 IU heparin)

- It should not be forgotten that Protamine will partially reduce the effect of LMWH
Infective endocarditis prophylaxis in heart patients
Antibiotic Prophylaxis for Infective Endocarditis

Delivery

Infective endocarditis prophylaxis is no longer recommended for vaginal or cesarean delivery in the absence of infection, regardless of the type of maternal cardiac lesion. Mitral valve

Routine IE prophylaxis is not recommended for every vaginal or caesarean delivery
Antibiotic prophylaxis is only:
- History of infective endocarditis
- Artificial valve replacement
- Complex cyanotic heart disease
- Heart transplantation
<table>
<thead>
<tr>
<th>Situation</th>
<th>Agent</th>
<th>Regimen—Single Dose 30-60 minutes before procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral</td>
<td>Amoxicillin</td>
<td>Adults: 2 g  Children: 50 mg/kg</td>
</tr>
<tr>
<td>Unable to take oral medication</td>
<td>Ampicillin OR</td>
<td>Adults: 2 g IM or IV*  Children: 50 mg/kg IM or IV</td>
</tr>
<tr>
<td></td>
<td>Cefazolin or ceftriaxone</td>
<td>Adults: 1 g IM or IV  Children: 50 mg/kg IM or IV</td>
</tr>
<tr>
<td></td>
<td>Cephalexin**†</td>
<td>Adults: 2 g  Children: 50 mg/kg</td>
</tr>
<tr>
<td></td>
<td>OR</td>
<td>Clindamycin: 600 mg  Children: 20 mg/kg</td>
</tr>
<tr>
<td></td>
<td>OR</td>
<td>Azithromycin or clarithromycin: 500 mg  Children: 15 mg/kg</td>
</tr>
<tr>
<td>Allergic to penicillins or ampicillin—Oral regimen</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cefazolin or ceftriaxone†</td>
<td>Adults: 1 g IM or IV  Children: 50 mg/kg IM or IV</td>
</tr>
<tr>
<td></td>
<td>OR</td>
<td>Clindamycin: 600 mg IM or IV  Children: 20 mg/kg IM or IV</td>
</tr>
</tbody>
</table>
Dilated cardiomyopathy and pregnancy

- Pregnancy is not recommended for EF<40%
- Termination is recommended if pregnancy has occurred.
- EF 40-50%, if the effort test is bad, the functional capacity can not tolerate pregnancy.
Peripartum Cardiomyopathy
National Heart, Lung, and Blood Institute and Office of Rare Diseases (National Institutes of Health) Workshop Recommendations and Review

Table 1. Definition of Peripartum Cardiomyopathy

<table>
<thead>
<tr>
<th>Classic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Development of cardiac failure in the last month of pregnancy or within 5 months of delivery</td>
</tr>
<tr>
<td>2. Absence of an identifiable cause for the cardiac failure</td>
</tr>
<tr>
<td>3. Absence of recognizable heart disease prior to the last month of pregnancy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Additional</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Left ventricular systolic dysfunction demonstrated by classic echocardiographic criteria, such as depressed shortening fraction or ejection fraction</td>
</tr>
</tbody>
</table>
Dedected in 2-4 thousand live births

Etiology was not clearly demonstrated.
  – Angiogenic disorders
  – Prolactin
  – Inflammatory cytokines
  – Myokarditis
  – Abnormal immune response
Peripartum CMP-Risk factors

- Pregnancies over 30 years
- Race
- Multiple pregnancies
- **Preeclampsia-Eclampsia-Chronic HT history**
- Maternal cocaine use
- Long-term oral tocolytic therapy with β-adrenergics
Peripartum CMP-Prognosis

- Complete or near complete improvement is seen within 6 months after delivery at 50-60%.
- Worsening, heart failure and transplantation need
- Mortality rate 10-32%
- Repetitive risk for subsequent gestation is 30%
Effect of levosimendan and predictors of recovery in patients with peripartum cardiomyopathy, a randomized clinical trial

Murat Biteker · Nilüfer Ekşi Duran · Hasan Kaya · Sabahattin Gündüz ·

Mortality 25%  Complete cure 46%
Chest Pain- Management

- Generally, emergency service issue

Common Causes of Chest Pain

**Cardiac**
- Coronary artery disease
- Aortic valvular disease
- Pulmonary hypertension
- Mitral valve prolapse
- Pericarditis
- Idiopathic hypertrophic subaortic stenosis

**Pulmonary**
- Pulmonary embolism
- Pneumonia
- Pleuritis
- Pneumothorax

**Vascular**
- Dissection of the aorta

**Neural**
- Herpes zoster

**Musculoskeletal**
- Costochondritis
- Arthritis
- Muscular spasm
- Bone tumor

**Gastrointestinal**
- Ulcer disease
- Bowel disease
- Hiatal hernia
- Pancreatitis
- Cholecystitis

**Emotional**
- Anxiety
- Depression
Cardiac causes:
- ACUTE CORONARY SYNDROME
- ACUTE PULMONARY EMBOLISM
- ACUTE AORT DISSECTION
- ACUTE MYO-PERİCARDİTİS

HIGH MORTALITY RISK, THESE DIAGNOSIS SHOULD BE EXCLUDED BEFORE LEAVING ER
Patients presenting with chest pain to the ER

Monitorisation, Vital signs
Medical History / Physical examination

EKG
Blood sample for routine tests

These steps must be completed within 10 minutes of the patient entering the emergency department door.
Differential diagnosis

1. Step  Which clinic is compatible with chest pain?

2. Step  Which clinic is compatible with physical examination and ECG findings?

3. Step  Biomarkers for preliminary confirmation

4. Step  Imaging methods for preliminary confirmation and determination of treatment
Heart Diseases - Management

Heart diseases – Antenatal care
**Frequency** – Cardiologic follow-up

According to the modified WHO classification;

- I  1-2 times during pregnancy
- II Each trimester
- II-III Each trimester – every month
- III At least once a month – twice a month
- IV Contraindicated – Termination – If pregnancy continues, at least once a month - twice a month
Heart Diseases - Management

Heart Diseases - Birth planning
In those with normal cardiac function, spontaneous term delivery should be preferred.

- Oxytocin is suitable for induction of labor.
- There is no absolute contraindication for misoprostol and dinoprostone.
Cesarean section indications

- Birth with warfarin treatment
- Marfan syndrome (aortic root > 45 mm)
- Acute or chronic aortic dissection
- Patients with severe heart failure
Suitable for caesarean section;

- Severe aortic stenosis
- Severe PHT
- Eisenmenger syndrome
- Patients with mechanical heart valve
- Epidural analgesia/anesthesia is recommended
- Delivery can be assisted by forceps or vacuum extraction.
- Routine antibiotic prophylaxis is not recommended
Labour

- If the cervix is appropriate;
  - Oxytocin
  - Artificial rupture of membranes
- If the cervix is not appropriate;
  - Mechanical
    - Foley catheter
    - CRB (Cervical Ripening Balloon)
  - Prostaglandine
Preterm labour-tocolysis

- İndomethacin
- Nifedipine
- Beta adrenerjik agonist
- Atosiban (oxytocin receptor antagonist)
Postpartum

- Hemodynamic and ECG monitoring should continue for 48-72 hours postnatally.
Pregnancy outcomes
- Premature birth 17%
- RDS and IVH 3% (for premature infants 16%)
- Fetal and Neonatal mortality 1%

Risk factors for poor pregnancy outcomes

- NYHA III-IV
- Cyanosis
- Left cardiac stenosis
- Smoking
- Multiple pregnancy
- Use of anticoagulant throughout pregnancy
Heredity

- Increased risk for recurrence risks in offspring of adults with CHD 2.7 – 10.7 – 4.1 – 7 %

J Am Coll Cardiol 2003; 42:923
J Am Coll Cardiol 1994; 23:1459
Lancet 1998; 351:311
Circulation 2001; 104:515

All pregnancies with CHD, fetal ECO should be recommended during 19-22. gestational weeks
Which method of contraception is appropriate for heart disease?
**WHO medical eligibility for contraceptive use: Cardiovascular disease (2010)**

<table>
<thead>
<tr>
<th>Medical Condition</th>
<th>COC</th>
<th>POP</th>
<th>DMPA</th>
<th>Cu-IUD</th>
<th>LNG-IUD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple risk for arterial CVD (age, DM, HT, smoking...)</td>
<td>3/4</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>DVT/PE</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

**WHO 1**-Appropriate  **WHO 2**-Preferable  **WHO 3**-Should be used with caution  **WHO 4**-Contraindicated
<table>
<thead>
<tr>
<th></th>
<th>COC</th>
<th>POP</th>
<th>DMPA</th>
<th>Cu-IUD</th>
<th>LNG-IUD</th>
<th>Valvular HD</th>
<th>PPCMP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uncomplicated</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Normal</td>
</tr>
<tr>
<td>Complicated</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>Moderate to severe cardiac dysfunction</td>
</tr>
</tbody>
</table>

**WHO**

- **WHO 1** - Appropriate
- **WHO 2** - Preferable
- **WHO 3** - Should be used with caution
- **WHO 4** - Contraindicated
Monitoring, treatment and care of a pregnancy candidate or pregnant woman with heart disease is a team work

– Midwife
– Family physician
– Obstetrician
– Cardiologists
– Anesthetist
– Pediatricians
THANK YOU ...