Prosthetic Heart Valves and Anticoagulation use during Pregnancy

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Overview

1. Historical Perspective.
2. Bioprostheses (Tissue valves).
3. Mechanical prostheses.
4. Selection of PHV in women of childbearing age who desire to become pregnant.
5. Maternal and fetal risks associated with pregnancy in patients with PHV.
1953: Development of the heart/lung machine (cardiopulmonary bypass) allowed intra-cardiac procedures to be performed.

Later, improvements (cardio-plegia) led to asystolic arrest.

1960: First Cardiac Valve Replacement.

1968: Coronary Artery Bypass Surgery.
Classification of Prosthetic Heart Valves

1- Biological or tissue valves, with flexible leaflet occluders of animal or human origin.

2- Mechanical prostheses, with rigid, manufactured occluders.
Definitions

- **Autograft** valve refers to a *translocation within the same individual*, eg, of the pulmonary valve into the aortic valve position.

- **Autologous** (or autogenous) tissue valve involves *fabricating a valve from the patient’s own nonvalvular tissue*, eg, pericardium.
Definitions

Homograft (or allograft) valve refers to transplantation from a donor of the same species; eg, a donor’s aortic or pulmonary valve into a recipient’s aortic or pulmonary position.

Heterograft (or xenograft) valve is a transplant from another species, either an intact valve, eg, a porcine aortic valve, or a valve fashioned from heterologous tissue, eg, bovine pericardium.
Definitions

Complications of Prosthetic Heart Valves

- **Structural valvular deterioration (SVD):** any change in function of an operated valve resulting from an intrinsic abnormality causing stenosis or regurgitation.

- **Nonstructural dysfunction:** any abnormality resulting in stenosis or regurgitation of the operated valve that is not intrinsic to the valve itself exclusive of thrombosis and infection. This includes inappropriate sizing, also called valve prosthesis–patient mismatch.

The American Association for Thoracic Surgery (AATS) and the Society of Thoracic Surgeons (STS) Guidelines for Clinical Reporting. In 1988

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Definitions

Complications of Prosthetic Heart Valves Cont.

- **Valve thrombosis**: any thrombus, in the absence of infection, attached to or near an operated valve that occludes part of the blood flow path or interferes with function of the valve.

- **Embolism** is any embolic event that occurs in the absence of infection after the immediate perioperative period. This includes any new, temporary or permanent, focal or global neurological deficit and peripheral embolic event.

the American Association for Thoracic Surgery (AATS) and the Society of Thoracic Surgeons (STS) Guidelines for Clinical Reporting. In 1988

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Choice of Prosthesis

- Durability of Prosthesis.
- Necessity for anticoagulation.
- Risk of Thrombo-embolism & Bleeding.
- Re-operation rate.
- Hemodynamic Performance.
- Possible future pregnancy.
Tissue Valves

1. Porcine Heterografts.
2. Stentless Porcine Xenografts.
3. Pericardial (Xenograft) Aortic valves.
5. Pericardial Autograft Valves.
1- Stented Porcine aortic Heterografts

- Widely used for the mitral & the aortic positions.
- Mounted on rigid or flexible stents to which the leaflets and sewing ring are attached.
- Most of the information regarding pregnancy in women with bioprosthetic valves has been obtained in women with porcine heterografts.

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Porcine Heterografts

Hancock valve

Medtronic Intact valve

Carpenter-Edwards valves

Braunwald E, Heart Disease. 7th edition. 2005;1553–621
Durability of the Hancock Bioprosthesis Compared With Standard Aortic Valve Bioprostheses

Table 2. Actuarial Estimates of Freedom From All Valve-Related Morbid and Fatal Events After 5 and 12 Years

<table>
<thead>
<tr>
<th>Event</th>
<th>H-MO (n = 561)</th>
<th>H (n = 652)</th>
<th>C-E (n = 389)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5 year</td>
<td>12 year</td>
<td>5 year</td>
</tr>
<tr>
<td>SVD (%)</td>
<td>97 ± 1</td>
<td>66 ± 4</td>
<td>99 ± 0</td>
</tr>
<tr>
<td>NSVD (%)</td>
<td>99 ± 1</td>
<td>97 ± 1</td>
<td>99 ± 1</td>
</tr>
<tr>
<td>TE (%)</td>
<td>96 ± 1</td>
<td>92 ± 2</td>
<td>96 ± 1</td>
</tr>
<tr>
<td>ACH (%)</td>
<td>96 ± 1</td>
<td>94 ± 1</td>
<td>98 ± 1</td>
</tr>
<tr>
<td>PVE (%)</td>
<td>95 ± 1</td>
<td>92 ± 2</td>
<td>94 ± 1</td>
</tr>
<tr>
<td>REOP (%)</td>
<td>95 ± 1</td>
<td>65 ± 4</td>
<td>95 ± 1</td>
</tr>
<tr>
<td>VRM (%)</td>
<td>95 ± 1</td>
<td>84 ± 2</td>
<td>93 ± 1</td>
</tr>
<tr>
<td>VRM&amp;M (%)</td>
<td>82 ± 2</td>
<td>48 ± 4</td>
<td>82 ± 2</td>
</tr>
</tbody>
</table>

Data are presented as actuarial estimates ± 1 standard error of the mean.

ACH = anticoagulant-related hemorrhage; C-E = Carpentier-Edwards model 2625; H = standard Hancock model 242; H-MO = modified orifice Hancock model 250; NSVD = nonstructural valve dysfunction; PVE = prosthetic valve endocarditis; REOP = reoperation; SVD = structural valve deterioration; TE = thromboembolism; VRM = valve-related mortality; VRM&M = valve-related morbidity and mortality.
Percent Freedom from SVD

Follow-up Time (years)

Hancock MO - 250
Hancock - 242
C-E - 2625

p = NS

Al-Husami Ann Thorac Surg 1995;60: S221-8
2- Stentless Porcine Xenografts:

- Since the stent adds to the obstruction & increase stress on the leaflets, stentless valves have been developed for the aortic postion.
- More physiological flow & low transvalvular gradients than stented porcine valves.
- Provide superior hemodynamic profile compared to stented porcine aortic heterografts especially in patients with small aortic root *

Stentless Porcine Xenografts:

St. Jude Medical stentless valve

Edwards stentless valve

Medtronic Freestyle valve

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Braunwald E, Heart Disease. 7th edition. 2005; 1553–621
Bovine pericardial valves are fabricated rather than harvested directly.

Good long-term durability that appears to be equivalent or better than that of the procine bioprosthesis.

Greater risk to develop MS.
Carpenter-Edwards
Bovine Pericardial Valve
Figure 5. Freedom from structural valve deterioration (SVD) for porcine and pericardial aortic valve replacement patients.
Gao et al. Concluded

- Freedom from structural deterioration and reoperation makes pericardial valves bioprosthesis of choice for aortic valve replacement.

- The 10-year results for the pericardial valve continue to demonstrate a strong performance, which may broaden its indication to younger patients with aortic valve disease.
**4- Homograft (Allograft) Aortic Valves:**

- First tissue valve to be used in 1960.
- Harvested from cadavers within 24 hrs of donor death.

**Advantages:**

- Hemodynamics are superior to stented porcine valves and similar to stentless porcine valves.
- Low Thrombogenicity
- Extremely low rate of infection and are indicated for patients with native or prosthetic valve endocarditis.
- Preferable substitute for AVR in younger patients.
Disadvantages:

- Not on shelf.
- Re-operation difficult.

Homograft (Allograft) Aortic Valves
Homograft Aortic Valve Durability

1,022 patients mean age 47yrs: Actuarial Survival

Whole Cohort:
- 1022 patients
- 649 events
- 231 events

Events: 225
- 95 events
- 35 events
- 2 events

Years:
- 0 to 30

Survival Rates:
- 90 +/- 1%
- 77 +/- 2%
- 60 +/- 3%
- 42 +/- 4%
- 19 +/- 7%
5- Pericardial Autograft Valves:

- Patient’s own pericardium is inserted into a frame, then used into either the aortic or the mitral position.
- Long-term durability appears to be excellent.

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6- Pulmonary Autografts
(The Ross procedure)

The patient’s own Pulmonary valve is removed and used to replace the Aortic valve, then the aortic homograft valve is then inserted into Pulmonary position.
The Ross procedure cont.

Advantages

- Viable aortic valve
- Nonthrombogenic
- Risk of endocarditis is low.
- No anticoagulation.
- Long-term durability appears to be excellent.
- It can be used in children, adolescents, and young women who wish to be pregnant.
The Ross procedure cont.

Disadvantages

- Longer operation.
- High incidence of Pulmonary homograft stenosis.
- High re-operation in this group of patients because of progression of aortic regurgitation.
- Concomitant severe mitral valve regurgitation.

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The Ross procedure cont.

Contraindications:

- Bicuspid valves and dilated aortic roots, because the implanted pulmonary artery tissue exposed to higher aortic pressures leading to significant dilation of the autograft.
- Marfan's Syndrome.
- Some connective tissue disease (R. arthritis/ SLE).
- Active rheumatic heart disease.
- Triple vessel CAD/ Mitral v. dis.
Does pregnancy accelerate the rate of bioprosthetic SVD?
Does pregnancy accelerate the rate of bioprosthetic SVD?

<table>
<thead>
<tr>
<th>Study</th>
<th>SVD</th>
<th>Bioprostheses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hanania et al.</td>
<td>7</td>
<td>74</td>
</tr>
<tr>
<td>Kadri et al.</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td>Sbarouni et al.</td>
<td>17</td>
<td>49</td>
</tr>
<tr>
<td>Born et al.</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>Lee et al.</td>
<td>4</td>
<td>57</td>
</tr>
<tr>
<td>Badduke et al.</td>
<td>8</td>
<td>17</td>
</tr>
</tbody>
</table>

Graft survival rate 17% in two pregnancies vs 55% in one pregnancy.

37 pregnancies.
10 SVD per 70 Non-pregnant.
# Reports Failed to Support the previous studies

<table>
<thead>
<tr>
<th></th>
<th>Preg.</th>
<th>Non - Preg</th>
<th>SVD Preg.</th>
<th>SVD Non</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Avila et al.</strong></td>
<td>48</td>
<td>37</td>
<td>27%</td>
<td>30%</td>
<td>Re-operation (8% in both groups)</td>
</tr>
<tr>
<td><strong>Jamieson et al.</strong></td>
<td>53</td>
<td>202</td>
<td>51%</td>
<td>41%</td>
<td></td>
</tr>
<tr>
<td><strong>Salazar et al.</strong></td>
<td>58</td>
<td>107</td>
<td>3.5% Per patient-year</td>
<td>3.4% Per patient-year</td>
<td></td>
</tr>
</tbody>
</table>
Fig 1. Freedom from structural valve deterioration. (N.S. = not significant; SE = standard error.)

Early Mortality for re-operation

**Table 3. Valve-Related Reoperation and Mortality**

<table>
<thead>
<tr>
<th>Complications</th>
<th>Pregnant Group (n = 53)</th>
<th>Nonpregnant Group (n = 202)</th>
<th>Total (n = 255)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SVD</td>
<td>27 (50.9%)</td>
<td>80 (39.6%)</td>
<td>107 (42.0%)</td>
</tr>
<tr>
<td>PVE</td>
<td>2 (3.8%)</td>
<td>6 (3.0%)</td>
<td>8 (3.1%)</td>
</tr>
<tr>
<td>NSD</td>
<td>1 (1.9%)</td>
<td>...</td>
<td>1 (0.4%)</td>
</tr>
<tr>
<td></td>
<td>30 (56.6%)</td>
<td>86 (42.6%)</td>
<td>116 (45.5%)</td>
</tr>
<tr>
<td>Mortality</td>
<td>2 (3.8%)</td>
<td>5 (2.5%)</td>
<td>7 (2.7%)</td>
</tr>
</tbody>
</table>

*p* = not significant, pregnant versus non-pregnant group.

NSD = nonstructural dysfunction; PVE = prosthetic valve endocarditis; SVD = structural valve deterioration.

In Summary

- Deterioration of bioprosthetic heart valves during pregnancy has been reported in several studies, but could not be confirmed by others.

- Although most available data might support an accelerated SVD of bioprosthetic valves during pregnancy, this could simply reflect the well-established deterioration of tissue valves in young individuals.

Elkayam et al. JACC Vol. 46, No. 3, 2005
Choice of Prosthesis

- Durability of Prosthesis.
- Necessity for anticoagulation.
- Risk of Thrombo-embolism & Bleeding.
- Re-operation rate.
- Hemodynamic Performance.
- Possible future pregnancy.
Figure 8. Freedom from thromboembolic events by type of valve replacement. Test of difference between 3 valve types, \( P=0.0001 \). Abbreviations as in Figure 2.
First 3 postop. Months, the thromboembolic rate is high for that anticoagulation is required while sewing ring becomes endothelialized. Thromboembolic event is 1-2/100 patients-years.
Early Mortality for re-operation

Because women of childbearing age who receive bioprosthetic valves are likely to need re-operation, the risk associated with a second surgery has to be considered when a PHV is being selected.

Early mortality for re-operation in such patient populations has been reported to be 3.8% in one study (1) and 8.7% in another (2).

Hemodynamic profiles are similar to those of comparable sized.

The hemodynamic profile of the stented porcine heterografts is, in general, inferior to that of low profile mechanical prostheses of comparable size.

Mechanical Prostheses

- Caged-ball
- Tilting-disc
- Bileaflet valves
Starr-Edwards Caged-ball

- The oldest prosthetic valve in continuous use.
- Has the longest record of predictable performance of any artificial valve.
- Were extensively used in women of child-bearing age & during pregnancy.

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Caged-ball Disadvantages

- Bulky, therefore, it is not suitable for:
  1. Mitral position in patient with small LV cavity.
  2. Aortic position in patient with a small aortic annulus, or those requiring a valve-aortic arch composite graft.

- The incidence of thromboembolism is slightly higher than other mechanical prostheses valves.

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Caged-ball

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Lahey Clinic Cath Lab. 2006
Bileaflet valves

- St. Jude Bileaflet valves are the most widely used.
- Less bulky
- Lower profile than caged-ball, and are therefore has superior hemodynamics.
- Favorable flow characteristics especially in the smaller sizes and causes a lower transvalvular pressure gradient & cardiac output. Therefore, it is useful in children.
Bileaflet Valves Cont.

- Thrombogenicity in Mitral position is < other prosthetics.
- The leaflets swing apart during opening, creating 3 flow areas, 1 central and 2 peripheral.
St. Jude Bileaflet valve
Tilting-disc

1- Omniscience valve:
   The disc swings to an 80 degree angle, providing a large central flow orifice.

2- Medtronic-Hall valve:
   Has a central perforation to improve the Hemodynamics.
Mechanical PHVs Problems during Pregnancy

Risk of thromboembolism and maternal bleeding.

On Fetal, increased risk of:
1. Fetal loss.
2. Prematurity.
3. Low birth weight.
5. Mortality.
Summary & Recommendations

The selection of PHV for women of childbearing age remains difficult and needs to be individualized.

Bileaflet mechanical valves provide a superb record of durability, excellent hemodynamic profile, and relatively small risk of thromboembolic and bleeding complications with careful anticoagulation.
Summary and Recommendations

Cont.

- In women who are not interested in anticoagulation or for whom close follow-up is not possible, a tissue valve is preferred.

- In the aortic position, homografts, pericardial valves, and stentless porcine xenografts have not been extensively used in pregnancy.

- (Ross procedure) is associated with higher rate of SVD and need for re-operation compared with the new-generation mechanical prostheses.
Preconception evaluation and consultation

- Careful history & physical examination.
- Echo-Doppler study to evaluate cardiac and valvular function.
- Exercise testing with maximum oxygen consumption, can provide an objective estimation of functional capacity.
- The patient and her family should be advised on potential complications that might occur during pregnancy.
- Marked impairment of LV function, symptomatic (class III and IV) should be advised against pregnancy.
MANAGEMENT OF COMPLICATIONS
Effect of Valvular Heart Disease (VHD) on Maternal Outcome of Pregnancy

<table>
<thead>
<tr>
<th></th>
<th>VHD</th>
<th>Controls</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congestive heart failure</td>
<td>38%</td>
<td>0%</td>
<td>&lt;0.00001</td>
</tr>
<tr>
<td>Arrhythmias</td>
<td>15%</td>
<td>0%</td>
<td>0.002</td>
</tr>
<tr>
<td>Initiation or increase of cardiac medications</td>
<td>41%</td>
<td>2%</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Hospitalizations</td>
<td>35%</td>
<td>2%</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Mortality</td>
<td>2%</td>
<td>0%</td>
<td>ns</td>
</tr>
</tbody>
</table>
Safe Drugs

1- Digoxin
2- Diuretics
3- Nitrates
4- Hydralazine
5- beta blockers.
Contraindicated Drugs:

1- **ACE inhibitors**: neonatal anuria, renal failure, limb deformities, cranial ossification deficits, and lung hypoplasia, renal tubular dysplasia, prolonged neonatal hypotension, and patent ductus arteriosus.

2- **Angiotensin receptor antagonist**.

3- **Amiodarone**: changes in fetal thyroid function, Congenital hypothyroidism, Mental Retardation.

4- **Sodium Nitroprusside**: animal study showed adverse fetal effect.

5- **Statins**: Sever CNS defects and limb deformities.
Anticoagulant use During Pregnancy in Women with Valvular Heart Disease
Hematologic Changes During Pregnancy

- ↑ Clotting factor concentration (Fibrinogen, Von Willebrand Factor, Factor VIII)
- ↑ Platelet adhesiveness.
- ↓ Fibrinolysis.
- ↓ Protein S activity.
- Stasis throughout vascular bed.
- ↑ risk thrombosis & embolism.
Prosthetic Valve Thrombosis

- Pregnancy is associated with an increased incidence of thromboembolism due to a hypercoagulable state.
- Thromboembolic events occur in 7%-23% of patients, one-half of them with valve thrombosis.
- 1-4% maternal mortality.
Prosthetic Valve Thrombosis
Cont.

Patients at high risk:
1- Older generation valve in the mitral position.
2- Multiple prosthetic valves.

Most effective anticoagulant has the highest risk of fetal complications.

Prosthetic Valve Thrombosis

Cont.

- **S&S:** Sudden dyspnea, Muffled sounds & New murmurs.
- **Complications:** peripheral embolization and bleeding, were reported in 18% and death in 5.6%.
- **Dx:** TEE.
- **Rx:** Thrombolytic agent for 24-72 hrs, heparin & Aspirin.
- **Surgery** is required for nonresponders & mobile thrombi & in whom thrombolysis is contraindicated.
Warfarin Anticoagulation

- Low molecular weight- Crosses placenta.
- Effect greater in the fetus than the mother, ↓ Vit K dependent factors in fetal liver.
- Fetal Complications: spontaneous abortions, stillbirths, hemorrhage, warfarin embryopathies (chondromalacia punctata, stippled epiphyses and nasal and limb hypoplasia, CNS abnormalities, optic atrophy, microcephaly, mental retardation, spasticity, hypotonia, and Low IQ).
- Retroplacental hemorrhage.
Warfarin Embryopathies

- Exposure 6-12 weeks gestation.
- Past reported 30% risk.
- Incidence 4-10%

Oakley et al: Br Heart J 1995

Dose related, low risk with < 5 mg/day

Vitale et al: J Am Coll Cardio 1999
UF Heparin in Pregnancy

- High molecular weight, dose not cross placenta.
- Short half life.
- Variable response - dose adjusted, Close PTT monitoring.
- Treatment of choice - late pregnancy, delivery.

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UF Heparin in Pregnancy

- ↑ risk of prosthetic valve thrombosis
  → thrombo-embolic events, ↑ maternal & fetal mortality.

- Long term use not recommended
  Osteoporosis= 30%, sterile abscesses.

- ↑ risk of maternal hemorrhage bleeding at utroplacental junction.
Uncertainty Regarding LMWH

- Dose not cross the placenta, no teratogenic effects.
- Antithrombotic protection.
- Potential advantages.
  - ↑ Bioavailability, administration ease.
  - ↓ Osteoporosis & Thrombocytopenia.

Melissari E; Thromb& Hemost 1992
Uncertainty Regarding LMWH Cont.

- Weight based administration inadequate in pregnancy.*
- Measurement of anti-Xa activity necessary to ensure adequate anticoagulation in pregnancy.
- Peak (4 hr post) anti-Xa level = 1.0 U/ml.
- Avoid excessive AC, anti-Xa level > 1.5 U/ml.
Complications of Enoxaparin Use During Pregnancy

- Pregnancies: 624
- Hemorrhagic events: 72 (10.4%)
- Serious Hemorrhage: 11 (1.6%)
- Neonatal hemorrhage: 14 (2.0%)
- Major Congenital abnormalities: 17 (2.5%)

Congenital Anomalies with use of Lovenox in Pregnant Women

2002:
“There have been reports of congenital anomalies in infants born to women who received enoxaparin during pregnancy including cerebral anomalies, limb anomalies, hypospadias, peripheral vascular malformation, fibrotic dysplasia, and cardiac defect. A cause and effect relationship has not been established nor has the incidence been shown to be higher than in the general population.”

July 2003:
“Pregnant women with thromboembolic disease, including those with mechanical prosthetic heart valves, and those with inherited or acquired thrombophilias, also have increased risk of other maternal complications and fetal loss regardless of the type of anticoagulant used.”
FDA Precautions for use of Lovenox in Pregnant Women

2002

“The use of lovenox injection is not recommended for thromboprophylaxis in patients with prosthetic heart valves.”

July 2003

“The use of Lovenox injection for thromboprophylaxis in pregnant women with mechanical prosthetic heart valves has not been adequately studied”
ACC/AHA Recommendation for Anticoagulation During Pregnancy in Patients With Mechanical Prosthetic Valves

1. The decision whether to use heparin during the first trimester or to continue oral anticoagulation throughout pregnancy should be made after full discussion with the patient and her partner; if she chooses to change to heparin for the first trimester, she should be made aware that heparin is less safe for her, with a higher risk of both thrombosis and bleeding, and that any risk to the mother also jeopardizes the baby.

2. High-risk women (a history of thromboembolism or an older-generation mechanical prosthesis in the mitral position) who choose not to take warfarin during the first trimester should receive continuous unfractionated heparin intravenously in a dose to prolong the mid-interval (6 h after dosing) activated partial thromboplastin time to 2 to 3 X control value. Transition to warfarin can occur thereafter.

3. In patients receiving warfarin, the international normalized ratio should be maintained between 2.0 and 3.0 with the lowest possible dose of warfarin, and low-dose aspirin should be added.

4. Women at low risk (no history of thromboembolism, newer low-profile prosthesis) might be managed with adjusted-dose subcutaneous heparin (17,500 to 20,000 U twice daily to prolong the mid-interval (6 h after dosing) activated partial thromboplastin time to 2 to 3 X control value.

5. Warfarin should be stopped no later than week 36 and heparin substituted in anticipation of labor.

6. If labor begins during treatment with warfarin, a cesarean section should be performed.

7. In the absence of significant bleeding, heparin can be resumed 4–6 hours after delivery, and warfarin begun orally.
2003 AHA/ACC
Scientific Statement on Warfarin

- UFH/LMWH throughout pregnancy.
- Warfarin throughout pregnancy switch to UFH/LMWH at wk 38.
- UFH/LMWH first trimester, warfarin 2nd trimester, UFH/LMWH at wk 38.

* Premature labor common, recommendation to switch at week 36.

Hirsh et al Circulation April 1, 2003
American College of Chest Physicians recommendations, published in 2004

Recommendations of the Seventh ACCP Consensus Conference on Antithrombotic Therapy for Prophylaxis in Patients With Mechanical Heart Valves

1. Aggressive adjusted-dose UFH, given every 12 hours subcutaneously throughout pregnancy; mid-interval activated partial thromboplastin time maintained at $\geq 2 \times$ control levels, or anti-Xa heparin level maintained at 0.35 to 0.70 IU/ml.

OR

2. LMWH throughout pregnancy, in doses adjusted according to weight or as necessary to maintain a 4-hour postinjection anti-Xa heparin level of about 1.0 IU/ml.

OR

3. UFH or LMWH, as above, until the 13th week; change to warfarin until the middle of the third trimester, then restart UFH or LMWH therapy until delivery.

ACCP=American College of Chest Physicians; LMWH=low molecular weight heparin; UFH=unfractionated heparin
# Anticoagulation Prophylaxis in Pregnant Women With a Prosthetic Heart Valve

<table>
<thead>
<tr>
<th>Higher Risk</th>
<th>Lower Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>First-generation PHV (e.g., Starr-Edwards, Bjork Shiley) in the mitral position, atrial fibrillation, history of TE on anticoagulation</td>
<td>Second-generation PHV (e.g., St. Jude Medical, Medtronic-Hall) and any mechanical PHV in the aortic position.</td>
</tr>
<tr>
<td>Warfarin (INR 2.5-3.5) for 35 weeks, followed by UFH (mid-interval aPTT &gt; 2.5) or LMWH (pre-dose anti-Xa ~ 0.7) + ASA 80-100 mg q.d.</td>
<td>SC UFH (mid-interval aPTT 2.00-3.0) 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 LMLWH (pre-dose anti-Xa level ~ 0.6)</td>
</tr>
<tr>
<td>OR</td>
<td>OR</td>
</tr>
<tr>
<td>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 &gt; 2.5) or LMWH (pre-dose anti-Xa ~ 0.7) + ASA 80-100 mg q.d.</td>
<td>SC UFH (mid-interval aPTT 2.0-3.0) or LMWH (pre-dose anti-Xa ~ 0.6) throughout pregnancy</td>
</tr>
</tbody>
</table>

*aPTT = activated partial thromboplastin time; ASA = acetylsalicylic acid; INR = international normalized ratio; LMWH = low molecular weight heparin; PHV = prothetic heart valve; SC = subcutaneous; TE = thromboembolism; UFH = unfractionated heparin.*

Anticoagulation in Pregnancy
Summary and Conclusions

- Decision regarding AC for PHV in pregnancy requires detailed discussion.
- Insufficient data to predict efficacy & safety of any regimen.
- Risk of AC in pregnant pt was PHV related to inadequate dosing & monitoring.
- Meticulous monitoring must be emphasized.
Summary and Conclusions

Low dose Aspirin:
1- Safe- antithrombotic effect has not proven.
2- Recommended for pt with shunts, cyanosis &
   biological valves.
3- Possible ↓ incidence of preeclampsia.

LMWH
Not enough information available in 2008.

Thrombolytic therapy
Emergency use only.
Jimmy, Answer me!! Please!