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Selected Cardiac Lesions and Pregnancy

Pregnancy represents a challenge to the cardiovascular system. Many hemodynamic changes occur throughout pregnancy that add stress and work to the heart. Maternal cardiac disease adds an additional challenge. Options for prolonging or terminating pregnancy, timing and mode of delivery, and intrapartum monitoring must be carefully scrutinized.

Pregnancy is a state of hyperhydration resulting in blood volume expansion. Additional hemodynamic changes occur. Red blood cell mass increases during pregnancy. Cardiac output increases by 40-50% until it peaks in the second trimester; stroke volume is up and the heart rate increases by 10-20 beats per minute. Systemic vascular resistance decreases. During labor, pain and sympathetic stimulation increase cardiac output and blood pressure. Additionally, cardiac output is increased postpartum by autotranfusion from the uterus, as well as by relief of caval compression after delivery. By two weeks postpartum, most women have returned to their pre-pregnancy cardiac baseline.

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Now that more patients with heart disease are reaching adulthood and childbearing age, challenges arise for those providing obstetric care. Heart disease complicates about 1% of all pregnancies; congenital heart disease represents about 70-80% of cases. It remains a leading cause of indirect maternal death.

Recent studies have shown that pregnancies complicated by cardiac disease are associated with a 17-20% rate of fetal complications such as intrauterine growth restriction, oligohydramnios, and premature delivery. One study of 207 women with cardiac disease compared New York Heart Association (NYHA) classification and outcome. Women with NYHA class I/II did better overall than NYHA class III/IV, including fewer maternal cardiac complications (23% vs. 57%), fewer cesarean sections (13.9% vs. 46.3%), and fewer fetal complications (19.3% vs. 28.5%). Increasing severity of disease as indicated by increasing NYHA class has also been shown to be associated with more frequent miscarriages and preterm deliveries. The recurrence risk of congenital heart defects has been shown to be 2.5%. Atrial septal defects recur most commonly.

While there are a wide array of cardiac lesions that one may encounter, they do not all represent the same risk to the mother or the child (Table 1). Several important disorders such as Eisenmenger's syndrome, coarctation of the aorta, and the Marfan Syndrome are beyond the scope of this article. Other structural abnormalities are more frequently encountered clinically. Determining the appropriate plan for these patients can be tenuous as the gold-standard of treatment has not been established. Each lesion deserves careful consideration separately to fully understand the appropriate treatment.

Atrial Septal Defect (ASD), Ventricular Septal Defect (VSD), Patent Ductus Arteriosus (PDA)

ASD, VSD, and PDA are the most common forms of heart defects encountered and have little adverse effect on pregnancy. Pregnancy, labor, and delivery are well-tolerated except in the setting of pulmonary hypertension. Uncomplicated and/or surgically corrected ASD, VSD and PDA can be followed expectantly with no special consideration needed. If the patient becomes hypoxemic, short of breath, or has signs of congestive heart failure, attention must be paid to the possibility of the development of pulmonary hypertension. Paradoxical emboli are also a concern as pregnancy is a hypercoaguable state and the heart defect may allow for passage of embolus into the arterial system.

Delivery may be vaginal with epidural anesthesia as desired. Vaginal operative delivery or cesarean delivery is not necessary except for obstetric indications.

Mitral Valve Stenosis

Mitral valve stenosis is the most common valvular abnormality seen in pregnancy and is usually associated with rheumatic disease. Although rheumatic disease is rare in the United States, it is still common in the immigrant population and should not be overlooked.

Pregnancy can exacerbate mitral stenosis by decreasing ventricular filling time (increased heart rate) and subsequently increasing pulmonary congestion (increased blood volume). This can lead to right atrial enlargement and the development of atrial fibrillation, pulmonary congestion, and dyspnea. Atrial fibrillation must be treated in pregnant women as it is an important predictor of impending heart failure. Treatment while pregnant should include a mild diuretic to decrease volume overload, a beta-blocker for rate control, and antiarrhythmics as needed.

Vaginal delivery should be planned and forceps or vacuum used to shorten the second stage. Cesarean should only be performed for obstetric indications. Epidural anesthesia should be used to decrease the sympathetic effect on the heart, however, this may result in a rapid decrease in systemic vascular resistance as patients cannot increase cardiac output to meet need. This can be reversed with small doses of phenylephrine or ephedrine. Epidural anesthesia should not be avoided due to this risk as the overall effect of the epidural in decreasing cardiac work is favorable. Central monitoring of cardiac function (arterial line, Swan-Ganz catheter) should be considered in women with advanced disease and for those who may decompensate quickly during delivery. The physician should not hesitate to institute such monitoring if he/she does not feel comfortable with the patient's vital signs.

Mitral Valve Regurgitation and Prolapse

Mitral valve regurgitation is most likely due to prolapse in healthy young women. Hemodynamic changes during pregnancy may help mitral regurgitation as systemic vascular resistance is reduced which may decrease regurgitation. If the patient is symptomatic, surgical repair of valve should be considered before pregnancy. Vaginal delivery is well tolerated with epidural anesthesia and adequate volume replacement.

Aortic Regurgitation

Aortic regurgitation is most likely due to a bicuspid aortic valve or dilated aortic annulus (usually due to Marfan's). Outcome and treatment are identical to mitral regurgitation. Vaginal delivery and epidural anesthesia are both appropriate for aortic regurgitation.

Aortic Stenosis

Unlike other valvular lesions in pregnancy, aortic stenosis may become problematic, even if asymptomatic before conception. If the patient is symptomatic, pregnancy should be delayed until after correction. These patients' cardiac outputs are fixed due to the non-compliant valve, and thus they cannot accommodate to the hemodynamic changes associated with pregnancy. Maintenance of cardiac output is dependent on heart rate. Bradycardia will result in hypotension and tachycardia can decrease cardiac output by decreasing ventricular filling time and can lead to myocardial ischemia. Therefore, these patients must be monitored closely during pregnancy.

Maternal and perinatal mortality rates with aortic stenosis have been reported at 11% and 4 %, respectively. Deterioration in maternal functional status may occur in 20% of pregnancies with aortic stenosis. Balloon valvuloplasty has been performed in pregnancy with success and without complications for patients with severe aortic stenosis.

Assisted vaginal delivery is the delivery mode of choice. This will shorten the second stage of labor for these patients whose cardiac output is fixed. Epidural anesthesia should be used with caution, and patients should be given generous fluid resuscitation to avoid hypotension and reflex tachycardia. Postpartum hemorrhage must be treated aggressively in these patients to ward off an acute decrease in preload.

Pulmonic Valve Stenosis

Pulmonic stenosis as an isolated clinical entity is a rare occurrence. It has not been shown to be associated with increased risk to mother or baby. Isolated pulmonic stenosis is very well tolerated in pregnancy and patients may be managed expectantly.

Mechanical Valve Replacement

Mechanical valve replacement does not cause any problems in pregnancy regarding hemodynamic stability. The mechanical valve should function as any normal valve would in pregnancy. However, the need for anticoagulation complicates pregnancy a great deal. Maternal mortality secondary to valve thrombosis is reported in 1-4% of women. Pregnancy has not been shown to increase the rate of mechanical valve dysfunction, nor to accelerate deterioration of bioprosthetic valves. However, in a young woman who desires future fertility, an allograft valve may be the best choice.

Vaginal delivery with epidural anesthesia should be attempted in these patients. Cesarean delivery should be performed for obstetric reasons or if the patient has not been off warfarin for at least two weeks prior to delivery to decrease the risk of intraventricular hemorrhage in the baby.

Antibiotic Prophylaxis

Antibiotic prophylaxis against endocarditis during labor is a controversial. Bacteremia is much less likely with delivery than with dental procedures, and thus, prophylaxis is not as imperative with labor and delivery. The American Heart Association recommends that uncomplicated vaginal or cesarean deliveries without evidence of infection do not need antibiotic prophylaxis. Patients in the high risk category for endocarditis are an exception to this recommendation (Table 2). Despite the suggestions, antibiotic prophylaxis is often administered.

Conclusion

Most cardiac disease is well-tolerated in pregnancy. These patients do not require much special monitoring during pregnancy. They should receive mid-pregnancy level 2 ultrasound in an attempt to rule out a fetal cardiac anomaly as there is a risk of recurrence. Echocardiography is not routinely indicated. These patients do, however, need a team approach (cardiologists, obstetric and anesthetic providers) as few cases are isolated and uncomplicated.

Vaginal delivery should be attempted in all patients regardless of the type or severity of the cardiac disease. Operative vaginal delivery will reduce the length of the second stage of labor and decrease the work required by the patient. Cesarean should only be pursued for obstetric reasons. Nonetheless, scheduled induction at 38-39 weeks may be prudent, if the cervix is favorable, to ensure appropriate physicians and ancillary staff are on hand at the time of delivery. Epidural anesthesia is appropriate for most patients (aortic stenosis may be an exception) with appropriate fluid maintenance. Central hemodynamic monitoring should be undertaken in patients who might decompensate, especially those with mitral and/or aortic stenosis. Antibiotic prophylaxis should be used with known infection and for those in the high risk category such as those with mechanical valves or complex lesions.

If a team approach and close monitoring are undertaken, most patients will be able to carry to term and deliver health children. Management of these women may seem daunting, but with a logical, physiologic approach, they can be managed successfully with minimal maternal and fetal morbidity and mortality.

— *Jona Rushing, M.D.*
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Table 1
Maternal and Fetal Risk Associated with Cardiac Disease

Low Maternal & Fetal Risk—Maternal Mortality<1%
Artrial Septal Defect, Patent Ductus Arteriosus, Ventricular Septal defect
Mild-to-Moderate Mitral Stenosis
Mild-to-Moderate Pulmonary Valve Stenosis
NYHA class I/II Mitral Regurgitation with normal LV systolic function
Mitral Valve Prolapse with or without regurgitation with normal LV systolic function
NYHA class I/II Aortic Regurgitation with normal LV systolic function
Asymptomatic Aortic Stenosis with normal LV systolic function
High Maternal and Fetal Risk—Maternal Mortality 5-15%
Severe Aortic Stenosis with or without symptoms
NYHA class III or IV Aortic Regurgitation
NYHA class III or IV Mitral Regurgitation
NYHA class II, III, or IV Mitral Stenosis
Valvular disease with left ventricular systolic dysfunction (EF<40%)
Reduced functional status (NYHA class III or IV)
High Maternal Risk—Maternal Mortality 25-50%
Pulmonary Hypertension
Left ventricular systolic dysfunction (EF <40%)
Previous Heart Failure
Previous Stroke or TIA

Table 2
American College of Cardiology/American Heart Association Recommendations for Antibiotic Prophylaxis for Bacterial Endocarditis

Cardiac Lesion	Uncomplicated Delivery	Suspected Bacteremia
<u>High Risk</u>		
Prosthetic Cardiac Valves	Optional	Recommended
Prior Bacterial Endocarditis	Optional	Recommended
Complex Cyanotic Congenital Cardiac Malformation	Optional	Recommended
Surgically Constructed Systemic Pulmonary Shunts/Conditions	Optional	Recommended
<u>Moderate Risk</u>		
Congenital Cardiac Malformation[a]	Not Recommended	Recommended
Acquired Valvular Dysfunction	Not Recommended	Recommended
Hypertrophic Cardiomyopathy	Not Recommended	Recommended
Mitral Valve Prolapse w/regurgitation or thickened leaflets	Not Recommended	Recommended
<u>Negligible Risk</u>		
Mitral Valve Prolapse w/o Regurgitation	Not Recommended	Not Recommended
Uncomplicated Heart Murmurs[b]	Not Recommended	Not Recommended
Previous rheumatic fever w/o Valvular dysfunction	Not Recommended	Not Recommended
Cardiac Pacemakers and Implanted Defibrillators	Not Recommended	Not Recommended
Prior CABG	Not Recommended	Not Recommended
Previous Kawasaki disease w/o Valvular dysfunction	Not Recommended	Not Recommended

[a]Except repaired ASD, VSD, or PDA or isolated septum atrial septal defect (prophylaxis unnecessary)
[b]Not attributed to any other valvular or structural abnormality

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