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From the time of the conception of a dream child to the realization of a newborn baby, the mother's cardiovascular system undergoes phenomenal changes some of which are normal response to the excess demand created by the pregnancy, while a few other symptoms may deserve closer attention.

### ***Physiological changes during pregnancy***

The mother's cardiovascular system experiences increased demand from a growing fetus, which begins around 6-8 weeks of pregnancy.

The cardiac output (the volume of blood by the heart each minute), increases by 40% to 50% and reaches the peak towards the end of second trimester. This increase in cardiac output is due to an increase in blood volume, the amount of blood pumped during each heart beat, and to a slight increase in heart rate (10-15 beats per minute). There is a drop in blood pressure by about 10 mm Hg due to dilation of the blood vessels.

Fluid retention during pregnancy is due to pressure on the large veins in the belly by the enlarging uterus. There may be a mild increase in heart size to accommodate the increase blood volume. Slight leg edema may be noted.

During active labor, there is displacement of almost 500 ml blood from the uterus into the circulation

which increases the cardiac output. The blood pressure may rise in response to pain and anxiety.

Immediately following the delivery, there is an increase in venous blood return to the heart and subsequent increased cardiac output, which leads to a brisk diuresis. Most of the changes should be reversed by 1 to 2 weeks.

### ***Cardiovascular symptoms of pregnancy***

The above mentioned changes in the cardiovascular system can cause certain symptoms that are normal.

Due to increased intravascular blood volume and increase cardiac output, it is not uncommon to hear a heart murmur. The anemia associated with pregnancy dilutes the blood and may also contribute to a heart murmur. Some people may also experience palpitations and irregular beats. The other symptoms may include shortness of breath, fatigue, and decrease exercise capacity. Some people may notice purple fingers due to reduced oxygen levels combined with poor circulation to the fingers. Other symptoms may include dizziness and occasional fainting, especially if the mother is dehydrated.

### ***Pre-existing heart diseases***

Patients with pre-existing cardiovascular problems such as rheumatic heart disease, heart failure and other, must have prior consultation with their gynecologist and cardiologists to assess the risks and benefits of going through the pregnancy. The cardiovascular factors contributing to an adverse outcome during pregnancy are history of heart failure or stroke, history of significant arrhythmias requiring medicines, reduced functional capacity at rest,

critical valvular heart disease, and reduce left ventricular function.

Mitral valve prolapse is a common condition noted in young women. Some of them might be on a beta-blocker such as atenolol or metoprolol. Inderal is the only beta-blocker that has been found to be safe during pregnancy. You need to be under the supervision of a cardiac specialist if you have any cardiac problems.

### ***Blood thinners***

Women may be on blood thinners for a variety of reasons such as having an artificial heart valve, cardiac enlargement, and significant cardiac arrhythmias. Generally, these patients are on an oral blood thinner called warfarin (coumadin). This drug needs to be avoided, as its effect on the embryo and the fetus are unknown. Most pregnant women who need blood thinners are maintained in subcutaneous heparin or low molecular weight heparin during the first two trimesters of pregnancy. In rare cases, we may be able to resume coumadin after the first trimester and continue until the middle of the third trimester. Heparin does not cross the placenta. However there is a very small risk of developing low platelet count with heparin. That risk is lower with low molecular weight heparins.

### ***Diagnostic tests:***

During pregnancy, most doctors would avoid doing X-rays or other tests that can potentially harm the fetus. However, a simple electrocardiogram can detect irregular heart rhythms. A 24 hour Holter monitor also can help unravel any cardiac rhythm disturbances. Cardiac ultrasound is similar to the ultrasound used to evaluate the fetus. It is generally harmless. It can enable us to evaluate the heart size, thickness,

and the origin of new heart murmurs. Blood tests may be performed to determine diabetes, thyroid disorders, and electrolyte imbalances that may be contributing to the cardiovascular symptoms. Based on these simple harmless studies, most cardiovascular problems during pregnancy could be addressed.

### ***Treatment of cardiac symptoms***

Most cardiovascular symptoms are self-limiting and do not have serious underlying cardiovascular causes. Hydration is an important point to keep in mind. Electrolyte disturbance that may cause palpitations can be avoided by proper nutrition. Close monitoring of weight gain is important.

Patients with heart failure or irregular heart rhythms can be treated with digoxin. We should avoid ACE inhibitor or ARTBs that are used to treat hypertension or heart failure. ACE inhibitors cause fatal renal tissue damage.

Patients with atrial fibrillation with rapid ventricular response may be treated with beta-blockers, calcium channel blockers, or digoxin. Pregnancy related hormones increase the propensity for the blood to clot. Hence, these patients may also need blood thinners such as heparin or low molecular weight heparin during period of arrhythmias.

### ***Adverse effects of medicines***

Medicines that are given to treat the mother may also cross the placental barrier and reach the fetal circulation. So, we need to be aware of the effects of medicines taken by the mother on the fetus. For example, beta blockers given to the mother can cross the placental barrier and cause a reduction in the fetal heart rate. Similarly, ACE inhibitors can cross

the placental and cause fetal renal tissue damage.

### ***Preeclampsia***

It is an abnormal condition associated with pregnancy. There is undue retention of fluids with elevated blood pressure and protein in the urine. If unrecognized and untreated in a timely manner, it could lead to seizure. There is slowing of the fetal growth and chances for early placental detachment. When the blood pressure goes over 150/100 mm Hg, they need treatment with medicines to keep the blood pressure under control and preserve the kidney function.

### ***Postpartum cardiomyopathy***

This is a rare condition where the mother develops cardiac enlargement and overt symptoms of heart failure associated with shortness of breath, leg swelling, and fatigue (1 in 3000 pregnancies). Some people may also complain of bloating and abdominal swelling. These symptoms can develop during the last weeks of pregnancy and continue for up to nine months after pregnancy. This is more commonly seen in women over age 30, with multiple pregnancies, and with history of preeclampsia.

The treatment may include digoxin, diuretics, hydralazine, and beta-blockers. ACE inhibitors must be avoided to protect the kidneys. patients with severe congestive heart failure may need anticoagulation. Majority of the women recover normal heart function within 6 months after the onset of symptoms.

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