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Review Article

Coronary Artery Diseases During Pregnancy: Minimizing Adverse Consequences and Improving Clinical Outcome

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Abstract

Coronary artery disease in pregnancy is a catastrophic situation that may endanger the lives of both the mother and the fetus. Cardiac diseases may account for up to 15% of maternal mortality. Pregnancy may increase the risk of acute myocardial infarction up to 4-fold. Various hemodynamic derangements may occur during pregnancy including expansion of plasma and blood volume, compression of inferior vena cava and fall in both systemic and pulmonary vascular resistances. If pregnant women present with acute coronary artery disease, medical management should be attempted first and if any intervention or surgery is needed, efforts must be made to lower the risk. A multidisciplinary approach is essential involving obstetrician, cardiologist, cardiac surgeons, anesthesiologist and neonatologists or pediatrician. Pregnancy is considered to be a relative contraindication to thrombolytic therapy due to some complications. Revascularization may be considered in acute coronary syndrome in pregnant women like other nonpregnant patients. Primary per cutaneous coronary intervention or coronary artery bypass graft have been performed successfully during pregnancy and may be considered as therapeutic option in pregnancy in selective cases. Percutaneous coronary intervention (PCI) is considered to be relatively safe for maternal and fetal survival during pregnancy. Main worry in PCI is radiation exposure and need to dual antiplatelet therapy. Bare metal stent is preferred during pregnancy because of shorter duration of anticoagulation therapy. Early second trimester is the optimum surgical period to coronary artery bypass surgery (CABG) in pregnant women. Coronary artery bypass surgery can be safely done after 28 weeks of gestational age and immediately after cesarean section. Early detection, a multidisciplinary approach and timely interventions must be considered in coronary artery disease in pregnancy for better obstetric outcome.

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Introduction:

Cardiovascular diseases complicate 1 to 4% of pregnancies.[1] Cardiac diseases can be critical and account for 10 to 15% of maternal mortality.[2] There is a substantial array of congenital and acquired heart diseases that may be present in pregnant women. Acquired cardiac diseases seen in pregnancy are generally valvular in nature and rheumatic valvular heart disease is the most common form of acquired heart disease seen in pregnancy.[3] Due to its relative rarity in young women, ischemic heart diseases (IHD) including myocardial infarction (MI) are relatively rare in pregnancy. Coronary heart diseases (CHD) may

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present as a critical topic in pregnancy with an incidence of about 1/10000 deliveries in western countries.[4,5] With the increasing age and fertility of mother, the incidence of coronary artery disease in pregnancy is likely to increase.[6] Although rare, myocardial infarction and coronary artery diseases are catastrophic events that may endanger the lives of both the mother and the fetus. Several studies showed that pregnancy increases the risk of acute myocardial infarction (AMI) up to 4-fold in comparison to nonpregnant women of reproductive age group[4,5] and have worse maternal and fetal outcome.[7] AMI during peripartum period is associated with 5 to 37% maternal mortality. Fetal mortality is predominantly associated with maternal mortality and is about 9 to 34%. Higher prevalence of cardiovascular diseases among pregnant women is observed due to some risk factors like conception at higher age, obesity, diabetes, hypertension, preeclampsia, dyslipidemia, atherosclerosis, cigarette smoking, previous inadvertent use of oral contraceptives and many women with corrected congenital heart disease reaching adulthood.[8] Spontaneous coronary artery dissection (SCAD) and atherosclerotic coronary artery disease are the most frequent causes of MI in pregnancy.[7] When pregnant women present with acute myocardial infarction or coronary artery disease, medical management should be attempted first and if any intervention or surgery is needed, substantial efforts must be made to lower the risk to both mother and the fetus. For their optimum management a multidisciplinary approach is essential involving obstetrician, cardiologist, cardiac surgeons, anesthesiologist and neonatologists or pediatrician, where applicable. This will enable to provide proper surveillance of maternal and fetal wellbeing as well as planning of elective surgeries.[9] The objectives of this review article are to highlight and delineate the management strategies of myocardial infarction and coronary artery diseases encountered in pregnancy.

Hemodynamics in Pregnancy:

Throughout normal pregnancy, changes in cardiovascular system occur to increase oxygen delivery to the fetus. Cardiac output rises up to 40% above baseline, with simultaneous increases in both heart rate and plasma volume. As circulating blood volume progressively increases, red cell mass increases comparatively at a lesser rate than the increasing plasma volume, leading to relative hemodilution and physiological anemia. Furthermore, there is a fall in both systemic and pulmonary vascular resistances, lowering the blood pressure during the first half of pregnancy.[8] When pregnancy advances, inferior vena caval compression may occur from the gravid uterus, reducing venous return and eventually cardiac output. Women with cardiac disease may be in a preexisting physiologically compensated state. The cardiovascular alterations during pregnancy can expedite the decompensated state, relatively unresponsive to medical therapy.[10] Additionally, the hypercoagulable state of pregnancy predisposes to thrombosis, which should be a particular concern.

The period of cardiac decompensation during pregnancy:

The first danger period during 12 and 16 weeks, when hemodynamic changes of pregnancy begin. Second critical period between 28 and 32 weeks when hemodynamic changes of pregnancy peak and cardiac demands are at maximum. Third critical period is during labor and delivery as cardiac output increases by 15 to 20 % due to uterine contraction. Immediate postpartum period is another danger period. Classification of the severity of heart disease can predict maternal and neonatal outcomes and can help during pre-conceptional counseling.[11]

Incidence and Prevalence of Coronary Artery Disease and Myocardial Infarction in Pregnancy:

The estimated prevalence of CAD in pregnancy is 1 in 10000.[3] SCAD and underlying atherosclerotic disease are major risk factors for MI during pregnancy. The risk factors for SCAD in pregnancy include smoking (23%), family history (16%), hypertension (9%), and lipid disorder (7%).[12] The risk factors for CAD in women of reproductive age are increasing age, black women, multigravidity, diabetes mellitus, hypertension, pre eclampsia, obesity, cigarette smoking, family history of CAD, dyslipidemia, family history of atherosclerosis, thrombophilia, inadvertent use of oral contraceptive.[9] Dyslipidemia may be worsened during pregnancy as HDL significantly decreases

during pregnancy. Pregnancy associated cause is pre-eclampsia as endothelial dysfunction and vasospasm occur.[6] The approximate incidence of acute myocardial infarction is about 0.6 to 1 per 10,000 pregnancies,[4,6] with a case fatality rate that range from 5.1% to 37% in various series. Acute myocardial infarction most frequently occurs during third trimester or peripartum period.[8] Most maternal deaths occur at the time of infarction or within two weeks of infarction, usually more relevant with labor and delivery. Fetal demise occurs in 12% to 34% of cases, which are mostly associated with maternal death.[7] Patients having high risks for coronary artery disease should be screened noninvasively during pre-conceptional period. Proper control of hypertension and diabetes must be achieved before conception.

Pathophysiology of Acute myocardial infarction in pregnancy

MI occurs most commonly in 3rd trimester. The pathophysiology of AMI in pregnancy is similar to nonpregnant patients. But there are some special factors related to pregnancy like SCAD, thrombosis and coronary artery spasm that are more common in pregnant women, compared with nonpregnant women.[13] During antepartum period rupture of atherosclerotic plaque is a very common cause of acute myocardial infarction in pregnant patients.[13]

Coronary artery dissection is another vital cause of MI. The usual hemodynamic changes in pregnancy including increased heart rate and cardiac output, physiological anemia, increased stress, anxiety, pain, uterine contraction and blood loss during delivery can increase oxygen demand during arterial spasm and can reduce coronary supply.[6,7] The fundamental causes include increased vascular response to angiotensin II and noradrenalin and lower response to vasodilators in gestational hypertension and preeclampsia, increased renin level following uterine hypoperfusion in supine position. Also, administration of few drugs like Ergometrine to control of hemorrhage or use of Bromocriptine to suppress lactation can initiate coronary artery spasm and reduce coronary supply in peripartum and postpartum period.[14,15]

Various changes in the coagulation system occur during pregnancy including decreased tissue plasminogen activator (tPA), increased fast-acting tPA inhibitor, change in the level of coagulation factors and reduction in functional protein S levels lead to arterial thrombosis in pregnancy.[16] Smoking is another risk factor which increases platelet aggregability.

Clinical Presentation and Diagnosis:

Due to physiological changes, normal pregnancy can mimic some cardiac symptoms like palpitation, dyspnea, tachypnea, tachycardia, dizziness, fatigue, pedal edema, decreased exercise tolerance and even syncope and make confusion for diagnosis. In this context, although AMI during pregnancy is rare, it should remain in the concern for obstetricians and cardiologists while pregnant patients presenting with chest discomfort. Usual presentation of AMI in pregnancy is similar as in nonpregnant patients, which is predominantly based on ischemic symptoms like angina, chest pain, shortness of breath and sweating. Some pregnant women may manifest dyspnea, nausea, vomiting, indigestion and epigastric pain. Delayed diagnosis is usually due to these atypical symptoms and low index of suspicion of myocardial infarction in pregnant patients. Additionally, some of cardiac signs like engorged jugular vein, apical point displacement, parasternal lift, increase S1 or S2 heart sounds and even extra heart sounds such as S3 or systolic ejection murmur can be found in normal pregnant patients.

Electrocardiography is the cornerstone for the diagnosis of acute myocardial infarction in pregnant patients similar to nonpregnant patients. Physiological alteration of cardiac enzymes and some pregnancy-related electrocardiographic changes in normal pregnant women such as left axis deviation due to diaphragmatic elevation by fetus, Q wave and T inversion in lead III and increased R/S ratio in leads V1 and V2 can make the electrocardiographic diagnosis of ischemia more challenging. Estimation of cardiac troponin level is preferred over other cardiac markers as troponin levels not rise with uterine contraction or with the cell breakdown and resultant significant rise of myoglobin, creatine kinase and creatine kinase MB that occurs during labor and delivery.[16] Although echocardiography is it is not a confirmatory test for ischemia, it is usually done to evaluate wall motion. Coronary Angiogram (CAG) can be helpful in diagnosis of AMI, but

radiation exposure is an important concern and thus CAG should be used only in the definite acute myocardial infarction as therapeutic measures by primary percutaneous coronary intervention.[13]

The diagnosis of coronary artery disease is difficult during pregnancy as there is a low level of suspicion and there is also a reluctant tendency to intervene during this time. Fetal risk is also an important concern. So, noninvasive methods should be attempted first considering the safety of fetus. Exercise electrocardiography in diagnosing coronary artery disease in pregnancy may cause fetal bradycardia during maximal exercise in healthy women. So, a submaximal exercise protocol with fetal monitoring is suggested for the evaluation of ischemic myocardial disease during pregnancy.[18] Nuclear imaging should be avoided throughout pregnancy. During first trimester there is risk of teratogenesis, In the second and third trimesters, nuclear imaging may pose a risk of intrauterine growth retardation and central nervous system abnormalities. During pregnancy, stress echocardiography is a considerable safe option for assessing ischemia and left ventricular function and can be suggested for patients with known or suspected coronary disease. The European committee suggests against the use of dobutamine stress testing. Nuclear stress test is prohibited.[19] Although there are several limitations to CT coronary angiography in terms of safety, Invasive coronary angiography remains the standard diagnostic procedure for conclusive evaluation of the cause of MI. Cardiac catheterization has some risks, but can be allowed in emergency conditions of pregnancy. Some important precaution measures like proper abdominal shielding, using brachial or radial approach and lower fluoroscopy times should be taken to minimize fetal exposure to radiation. A study of 859 cases of acute myocardial infarction in pregnancy and postpartum reveals that only 45% had undergone cardiac catheterization and among those, 81% underwent angioplasty, stent placement or CABG. **Intravascular ultrasound (IVUS)** helps to visualize the entire thickness of the wall with limited spatial resolution.[20] **Optical coherence tomography (OCT)** has superior spatial resolution with limited depth of penetration. **These diagnostic modalities are** adjunctive to diagnostic angiography in SCAD.[21]

Medical Management of Myocardial Infarction:

Although the management of acute myocardial infarction should follow the standard principles of care, fetal safety should always be a crucial consideration. Except some small differences, therapeutic choice of AMI in pregnant women is similar to nonpregnant patients. Management of the pregnant patient needs a multidisciplinary approach involving the obstetrician, cardiologist and anesthesiologist. Preferably, the patient should be treated in an intensive care unit for providing optimum comprehensive obstetric care with meticulous maternal and fetal monitoring. In cardiogenic shock, provisions for emergency mechanical circulatory support should be available. If maternal cardiac arrest develops, resuscitation as well as delivery should be performed following the existing guidelines. A plan for emergency delivery of a potentially viable fetus in any case of sudden maternal deterioration should also be in consideration. The most appropriate medical management protocol for pregnant patients with acute myocardial infarction is still contradictory. Recommended drug regimens are beta blockers, heparin or enoxaparin, Aspirin, nitrates, clopidogrel. If required, nondihydropyridine, calcium channel blockers may be used.[22,23] Angiotensin converting enzyme inhibitors, angiotensin II receptor blockers and direct renin inhibitors are contraindicated as there is substantial risk of teratogenicity and fetal demise.[24] Although cholesterol-lowering therapy reduces recurrent coronary events and mortality, the use of statins should be avoided during pregnancy in consideration of safety. Among beta blockers, labetalol and metoprolol can be safely used due to their lower teratogenicity.[23] Nitrates can be safely used in pregnancy with careful dose titration to avoid maternal hypotension and subsequent uterine hypoperfusion.[26] Unfractionated heparin (UFC) and low molecular heparin (LMWH) can be used in pregnancy as these do not cross the placenta and are not teratogenic, but heparin should be discontinued 12 to 24 hours before induction of labor or elective cesarean section.[27] Sometimes protamine sulphate may be needed to decrease the risk of bleeding and to allow safe local and epidural anesthesia. Once adequate homeostasis has been achieved, heparin can be

resumed following delivery. Antiplatelet therapy is necessary in acute myocardial infarction. Aspirin in first trimester is associated with fetal teratogenicity, but lower dose (from 40 mg/day to 75 mg/day) later during pregnancy may not cause fetal harm and may be used safely in patients with known coronary artery disease at second and third trimester of pregnancy as well as during lactational period.[28] As the safety of using thienopyridines such as clopidogrel is not well-established during pregnancy, it may only be used in selected cases for shortest duration when strictly essential, but breastfeeding should be avoided in these patients.[29] Streptokinase (SK) has been assigned to pregnancy category C by the FDA. Animal reproduction studies have not been conducted with SK. Successful use of streptokinase during human pregnancy without adverse fetal effects has been reported. There are no controlled data in human pregnancy. Streptokinase should be given during pregnancy only when benefit outweighs risk. There are no reports of adverse effects on the fetus associated with the use of SK. Although little SK crosses the placenta, pregnancy is considered a minor contraindication to the use of SK, and obstetrical delivery within 10 days is considered a major contraindication.[30] Recombinant tissue plasminogen activators can be used as they don't cross the placenta, but they may cause subchorionic hemorrhage. Although nifedipine is safe during pregnancy, only limited safety data is available about other calcium channel blockers. Diltiazem and Verapamil should be prohibited in pregnancy and lactational period .[31]

Revascularization

Revascularization may be considered in acute coronary syndrome in pregnant women like other nonpregnant patients. Survival is the primary concern and revascularization should not be withheld because the patient is pregnant. PCI or CABG have been performed successfully during pregnancy and may be considered as therapeutic option in pregnancy in selective cases. PCI is considered to be relatively safe for maternal and fetal survival during pregnancy, although there is limited data about the efficacy and safety of primary PCI in pregnant women with AMI.[32] Main worry in primary PCI is radiation exposure and need to dual antiplatelet therapy at the minimum for one month after bare metal stents (BMS) or 12 months after drug eluted stents (DES) use. Therefore, BMS is preferred during pregnancy.[33] In dual antiplatelet therapy period, epidural anesthesia for labor is contraindicated.

Angioplasty itself has similar risks to pregnant and nonpregnant women. As pregnant women have two to four times increased risk of pulmonary embolisms (PE), computed tomography, pulmonary angiography (CTPA) is a well-established and valued method of diagnosis with low risk from ionizing radiation. CT angiography has increased risk to both mother and fetus and if performed, dose reduction methods should be taken to minimize radiation exposure.[34] In addition, proper abdominal shielding, minimizing fluoroscopy times and use of brachial or radial approach is suggested to reduce exposure to the fetus.

Experience in thrombolytic therapy for acute myocardial infarction in pregnancy is limited. Pregnancy is considered to be a relative contraindication to thrombolytic therapy due to some complications including maternal hemorrhage (8.1%), maternal death not related to lytic therapy (1.2% to 7%), preterm labor (2.9%) and fetal demise (5.8% to 8%).[35] The maximum pregnant patients exposed to thrombolytics have been treated for pulmonary embolus, deep vein thrombosis or thrombosed prosthetic heart valves.[36] In some critical cases thrombolytics may be considered when primary PCI is not available. Thrombolysis should be avoided if coronary dissection has been diagnosed on coronary angiography because there is chance of propagation of the dissection and expansion of the intramural hematoma.[37] Thrombolysis should also be avoided in patients with placenta previa or abnormal placental insertion or in those who are near to term. Thrombolysis with tPA, is theoretically possible for large molecular weight which makes it unlikely to cross the placenta. But there is an increased risk of disastrous hemorrhage.[38] Intra aortic balloon pumps are used to enhance left ventricular output and coronary perfusion. But compression of the inferior vena cava during pregnancy can have negative impact on the hemodynamic status, although the patient should be positioned in the left lateral recumbent position to lower compression of the inferior vena cava.

Management of spontaneous coronary artery dissection in pregnancy:

Conservative strategy is the reasonable strategy for management of SCAD-related MI in pregnancy due to the unsuitable revascularization techniques, high rate of recurrence and favorable outcomes with spontaneous healing in the majority of patients, particularly in relatively stable patients with small area of myocardial involvement.

Coronary artery bypass grafting

The cardiopulmonary bypass technique (CPB) was introduced by John Gibbon for closing an ASD on 5th May 1953. The first reported use of CPB in pregnancy was for atrial septal defect closure during first trimester in 1959, with subsequent spontaneous abortion of the fetus occurring 3 months later.[39] CABG was developed as a surgical procedure in the 1960s. Majdan JF et al. reported in 1983 the first case of CABG with CPB at 12 weeks gestation with delivery of a normal full-term baby.[40] A 1983 survey of Society of Thoracic Surgeons, members on intracardiac surgery in pregnancy by Becker found more than 80% fetal survival amongst 68 procedures performed, and reported literature fetal mortality with CPB ranging from 16%–33%.[41] Gradually appreciable technical advancements have been promoted for better maternal and fetal outcomes. Recent studies reported similar maternal mortality (about 1.7 to 3%), compared with nonpregnant women. Fetal mortality depends on time of cardiac surgery as well as various technical concerns like preoperative left lateral recumbent positioning of mother while gestational age exceeds 20th weeks to minimize aorto-caval compression, maintaining maternal mean arterial blood pressure about 70 mmHg or more throughout surgery and preserving normothermic or mild hypothermic condition, high flow extra corporeal circulation, close monitoring of fetal heart rate to prevent fetal bradycardia and to safeguard fetoplacental circulation. Early second trimester is the optimum surgical period to CABG in pregnant women. In first trimester there is some risk of fetal malformation and in late second and early third trimester there is risk of initiation of preterm labor. Cardiac surgery can be safely done after 28 weeks of gestational age and immediately after cesarean section.[42-44]

Cardiopulmonary bypass during pregnancy has been associated with a fetal mortality rate of 16% to 33%. During CPB decreasing of maternal mean arterial pressure may cause uteroplacental hypoperfusion, can precipitate uterine contractions. In this connection, Off Pump CABG (OPCAB) may be preferred than On Pump CABG for not requiring use of CPB and hypothermia. However, various positioning of the patient to ease OPCAB may be challenging. This contraction after CPB can be managed successfully with intravenous magnesium tocolysis. But, if the contraction occurs just before starting CPB, or fetal distress of any kind, elective cesarean section can be done before CPB and coronary bypass. Additional strategies to minimize fetal and maternal risks include minimizing intraoperative blood loss, avoid aortocaval compression, normothermic CPB, minimize CPB times, maintaining high flow rate of pump (>2.4 L/min/m2), and mean arterial pressures >70-75 mm Hg. Serum potassium concentration should be closely monitored (<5 mmol/L), as cardioplegia solution may increase serum potassium level. Maternal oxygen saturation should be optimized and avoid maternal hypoglycemia, are important to prevent fetal bradycardia.[42] When gestational age (GA) more than 24 weeks, fetal heart rate during CPB should be 110-160 beats per minute. If possible, attempting to delay surgery until an advanced GA would also minimize the risks associated with prematurity and fetal death.[43]

Most adverse maternal and fetal outcomes from cardiac surgery during pregnancy as a result of CPB and the underlying cardiac condition of the mother, not the anesthetic agent used. Sympathomimetic agents such as ephedrine and phenylephrine can be used to maintain perfusion pressure, although increasing CPB flow rates are preferable and will also result in increasing placental perfusion. Antifibrinolytic agents like tranexamic acid are generally not recommended as pregnancy is an intrinsically hypercoagulable state. Use should be confined to those patients with bleeding concerns.[42]

Delivery:

The decision about mode of delivery is grounded on patient's clinical estimation and obstetrical indications.[13] Timing of delivery should be individualized according to the is the cardiac status, Bishop Score, fetal well-being and lung maturity.

The best approach is to postpone the delivery for at least 2 to 3 weeks after AMI.[6,13] Majority of patients with history of AMI can tolerate vaginal delivery with optimum labor analgesia, but sometimes cesarean sections are preferred in hemodynamically unstable patients.[13] There is no clear difference of mortality between doing cesarean section or allowing vaginal delivery. But definitely cesarean section poses risk of anesthesia, surgical induced hemodynamic alterations, profuse bleeding and increased risk of respiratory complications and infections.[6,13] Whereas, during trial of vaginal delivery, more sympathetic release occurs due to labor pain and hemodynamic changes that can cause worsening of ischemia.[7] If vaginal delivery is allowed, labor induction should be avoided with use of misoprostol and dinoprostone, particularly in SCAD as these increase the risk of coronary spasm. During labor left lateral positioning of patient can minimizes aortorenal compression and therefore optimizes cardiac output and placental perfusion.[13] Maternal cardiac strain can be minimized by cutting short the 2nd stage of labor by using forceps or ventouse. Minimum pushing is allowed if ejection fraction is above 40% and there are no signs of heart failure.[13] Oxytocin infusion should better to be avoided to counteract coronary spasm and myocardial ischemia. Meticulous monitoring of heart rate, blood pressure, ECG and monitoring of rhythm should be mandatory. Supplementary oxygen, Pulse oximetry, Swan-Ganz catheter, and some routine drugs like beta blockers, nitroglycerines, antihypertension medications should be ready to tackle any emergency. Optimum labor analgesia should be liberally used and attempts should be taken to cut short the 2nd stage of delivery. Slow infusion of oxytocin and prostaglandin F analogues should be reserved for treating postpartum hemorrhage but methyl ergot derivatives are contraindicated. During postpartum period close hemodynamic monitoring is recommended for at least first 24 hours. Cardiologists and neonatologists should be available during labor to tackle any emergency. After delivery, the patient should be under close supervision of cardiologists to review cardiac symptoms and to adjust physical activities.

Subsequent Pregnancy

History of previous myocardial infarction is not an absolute contraindication to pregnancy. But patient should be advised to delay pregnancy for about one year after treatment of residual ischemia and revascularization as well as to minimize the risks of recurrent ischemia and restenosis.[45] Following myocardial infarction, the associated risks are determined by a number of factors like coronary anatomy, ongoing myocardial ischemia, residual left ventricular function and the window period between myocardial infarction and previous pregnancy.[46] During preconceptional period, complete cardiac evaluation should be done by electrocardiogram, exercise tolerance test, echocardiography and assessment of the coronary arteries. During preconception counseling patients should be thoroughly explained about the cardiac risks associated with pregnancy, labor and delivery. Once pregnancy is confirmed, patients should undergo a meticulous checkup of their physical activities and cardiac symptoms. Throughout pregnancy, the patient should be frequently monitored jointly by cardiologists and expert obstetricians, who have vast experience in dealing high-risk pregnancy, preferably in a tertiary health care center. In spite of adequate supervision with the advancement of pregnancy period, patients are at continued risk of ischemia followed by subsequent complications due to progressively increasing myocardial demand.

Conclusion:

Although rare, myocardial infarction and coronary artery disease in pregnancy can have a significant impact on maternal and fetal outcome. The accurate diagnosis and prompt management of acute myocardial infarction is very challenging in pregnancy, and requires a high index of suspicion. Survival is the primary concern and treatment should never be delayed because the patient is pregnant. Early detection, a multidisciplinary approach and timely interventions must be considered to minimize the serious consequences of acute myocardial infarction and coronary artery disease in pregnancy as well as for optimal decision making resulting in better obstetric outcome.

Conflict of Interest - None.

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