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Case Report

Acute myocardial infarction during pregnancy: A clinical checkmate

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ABSTRACT

Acute myocardial infarction (AMI) in pregnancy is associated with high morbidity and mortality. Management of these patients can be challenging as little is known about the optimal management strategy. Medications routinely used may have harmful effects on the pregnancy outcome. In addition, AMI could occur in the absence of atherosclerotic disease. We describe optimal management strategy by eliciting the management of a 45-year-old female with ST segment elevation myocardial infarction. We recommend early use of coronary angiography to define the pathology in such cases. Radial artery assess should be preferred. Pregnant patients with AMI due to atherosclerotic disease should be given a 325 mg of aspirin and 600 mg of clopidogrel and either balloon angioplasty or bare metal stent should be used for revascularization. Percutaneous coronary intervention with heparin is preferred over bivalirudin and later should be reserved for patients with severe heparin allergy.

1. Introduction

The prevalence of coronary artery disease (CAD) in women increases with age.[1] There is a trend toward women getting pregnant at an older age,[2] which could be attributed to late marriages, improvements in infertility management, life style choices and professional demands. This may result in increased chance of witnessing more pregnant women with acute myocardial infarction (AMI) in near future. To that end, pregnancy itself increases the risk of AMI three to fourfold.[3] Also, preeclampsia[4] and gestational diabetes mellitus (DM)[5] during earlier pregnancies increases the risk of future ischemic heart disease.

Accurate burden cannot be predicted due to lack of systemic studies and national or international registries. The United Kingdom Obstetric Surveillance System (UKOSS) study estimated the incidence of AMI during pregnancy at 0.7 per 100,000 maternities (0.4–1.0 95% CI).[6] The overall incidence has been estimated to be around 1 case per 10,000–24,000 deliveries.[7] Usually multiparas and women with underlying traditional risk factors for cardiovascular diseases are at higher risk. Atherosclerotic disease remains the primary cause of AMI during pregnancy in patients presenting at antepartum period and coronary artery dissection accounts for almost 50% of the cases during peripartum period.[8] Fortunately, the outcome of AMI in pregnancy is improved significantly with decrease in case fatality rate from 30% to 5–10% and fetal fatality from 17% to 9%.[7] Most of maternal fatality happens at the time of infarction or within 2 weeks during labor and delivery.[8] Fetal deaths occur due to

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spontaneous abortion, unexplained stillbirth and elective termination of pregnancy. The low incidence, atypical presentation and difficult pathophysiology of maternal–fetal circulation create a complex clinical scenario. Some of the key questions which remain to be answered are the role of routine coronary angiography, strategies to minimize fetal radiation exposure, optimal antithrombotic and antiplatelet regimen to avoid peripartum bleeding and adverse fetal outcome, revascularization strategy to maximize the benefit without increasing side effects of long-term antiplatelet therapy, and safe drugs during lactation.

2. Case report

A 45-year-old Guyanese female of Indian origin in her twenty-fifth-week of pregnancy presented to the emergency department with acute onset progressive chest pain and diaphoresis. She did not have any documented cardiovascular risk factors and denied any complications during prior normal vaginal pregnancy 15 years ago. She was taking her multivitamin pills and no other prescribed medications. Her parents and sibling did not have CAD and DM.

Initial assessment revealed an afebrile pregnant lady with blood pressure – 117/79 mmHg, pulse – 89 beats per minute, pulse oximetry – 99% on room air. There were no signs of congestive heart failure with clear lungs and no jugular venous distension. The precordial auscultation revealed normal sounds with physiological splitting. Electrocardiography (EKG) showed ST segment elevation in anterolateral leads V1–V4, I and aVL with reciprocal ST depressions in inferior leads II, III and aVF (Fig. 1). Coronary catheterization was performed through right radial artery access after shielding the patient's back and abdomen with lead aprons to minimize fetal radiation exposure. Angiogram showed (Fig. 2) total occlusion of the proximal left anterior descending (LAD) artery with normal right and left circumflex coronary arteries. Left ventricular systolic function was reduced to 45% with severely hypokinetic mid to distal anterior wall. Patient received 325 mg aspirin and loading dose of (600 mg) clopidogrel. Mechanical thrombectomy was performed, and a bare metal stent was deployed in the LAD (Fig. 2). Intra-arterial heparin was used to maintain anticoagulation during coronary intervention. Total fluoroscopy time was 06 min and 42 s. During procedure she complained of increasing shortness of breath and pink frothy sputum production with decreased saturation on pulse oximetry. She improved after receiving diuretics and non-invasive ventilatory support through bilevel positive airway pressure (BiPAP). Post angioplasty EKG showed resolution of ST segments (Fig. 3). She had an uncomplicated hospital course. Pre-discharge transthoracic echocardiography revealed normal left ventricular function without any wall motion abnormality. She was discharged on 81 mg aspirin, 75 mg clopidogrel, 25 mg metoprolol tartrate twice a day regimen. She delivered on due date at 38 weeks period of gestation without any complication, and underwent cesarean section for labor arrest. Antiplatelet regimen was not interrupted during labor and delivery in our patient. She remained asymptomatic during follow up with optimal medical management. Lovastatin was added to her regimen 6 months after pregnancy.

3. Discussion

Pertinent issues that are germane for timely diagnosis and effective management of AMI in pregnancy include the following: role of routine coronary angiography, strategies to minimize fetal radiation exposure, optimal antithrombotic and antiplatelet regimen to avoid peripartum bleeding and adverse fetal outcome, revascularization strategy to maximize benefits, and safe drugs during lactation.

Diagnostic evaluation includes clinical history, EKG changes in conjunction with cardiac biomarkers. Interpretation of biomarkers can be difficult as levels are influenced by pregnancy, labor and delivery. This is due to release of enzymes from the uterus and placenta, which embody substantial amounts of these enzymes.[9] A definitive diagnosis can only be made after coronary angiography.

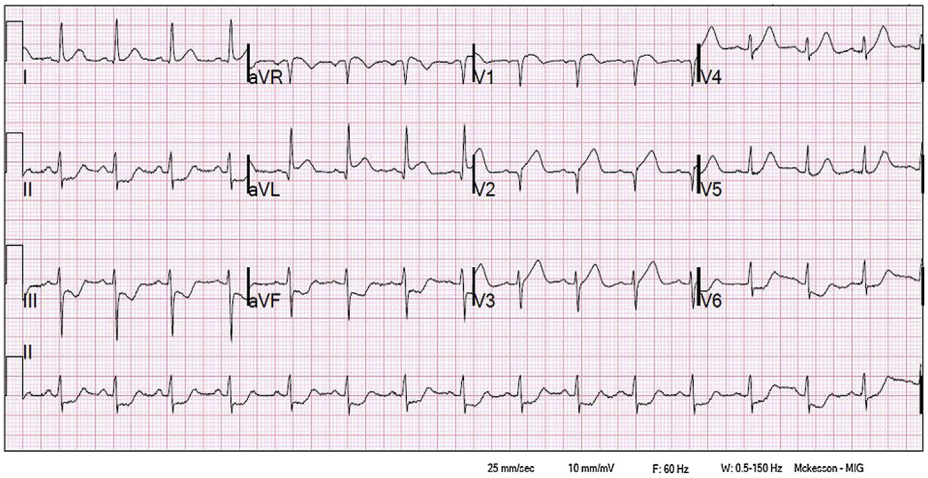

Fig. 1 – EKG showing ST elevation in precordial leads V1–V4, lateral leads I, aVL with reciprocal ST depression in inferior leads II, III and aVF.

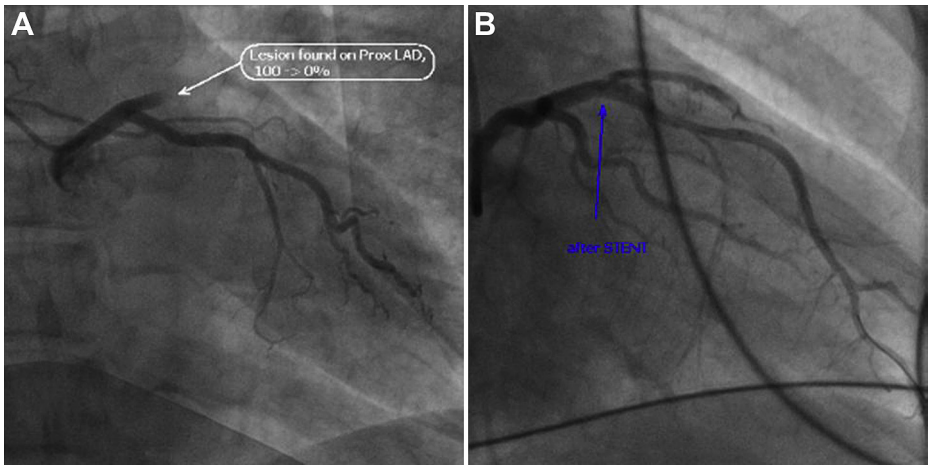

Fig. 2 – Right Anterior Oblique view with caudal rotation showing complete occlusion of proximal left anterior descending coronary artery (Panel A) and post stent deployment angiogram showing re establishment of blood flow across left anterior descending coronary artery with guidewire in distal segment (Panel B).

4. Medications

Federal Drug Administration (FDA) has categorized drugs based on pregnancy risk categories and selection should be done in conjunction with the recommendations. High dose aspirin (ASA) is associated with fetal hemorrhage, perinatal mortality, intrauterine growth restriction and teratogenic effects.[10] Low dose ASA is safe in pregnancy during second and third trimesters.[7] ASA is secreted in breast milk in low concentrations without any adverse effect. Heparin (unfractionated heparin category C, low-molecular weight heparin (LMWH) category B) use is safe in pregnancy. It is recommended to stop a day prior to delivery and monitor anti-Xa levels if LMWH is used.[11] At the time of coronary intervention, heparin should be dosed to target an activated clotting time of at least 200 s, but not exceeding 300 s.[12] During spontaneous labor, protamine sulfate might be required to reduce the risk of bleeding, and to allow safe local and epidural anesthesia. Bivalirudin (Category B), a parental direct thrombin inhibitor, should be limited to those who have severe allergic reactions to heparin, including heparin-induced thrombocytopenia, and who cannot receive danaparoid.[13]

Thienopyridines (Ticlopidine, Clopidogrel, Prasugrel and Ticagrelor) have limited data in pregnancy. There are only a handful of case reports, which used dual antiplatelet agents using ASA and Clopidogrel (category B) during pregnancy. It is desired that Clopidogrel be stopped a week prior to any regional anesthesia procedures. Ticagrelor is only recommended for use during pregnancy when there are no alternatives and benefit outweighs risk. Excretion into human breast milk is unknown; use is not recommended.

Glycoprotein IIb/IIIa inhibitors, e.g. Eptifibatide, Tirofiban and Abciximab, have not been studied in pregnant patients and randomized trials excluded pregnant patients. FDA has assigned pregnancy risk Category B to Eptifibatide and Tirofiban; and category C to Abciximab. These drugs should be best avoided in pregnant patients, however, if these agents are used, a cesarean section is recommended to decrease the potential for fetal intracranial hemorrhage during vaginal delivery.

Angiotensin-converting enzyme inhibitors (ACEI) and angiotensin receptor blockers (ARB) (category C) are

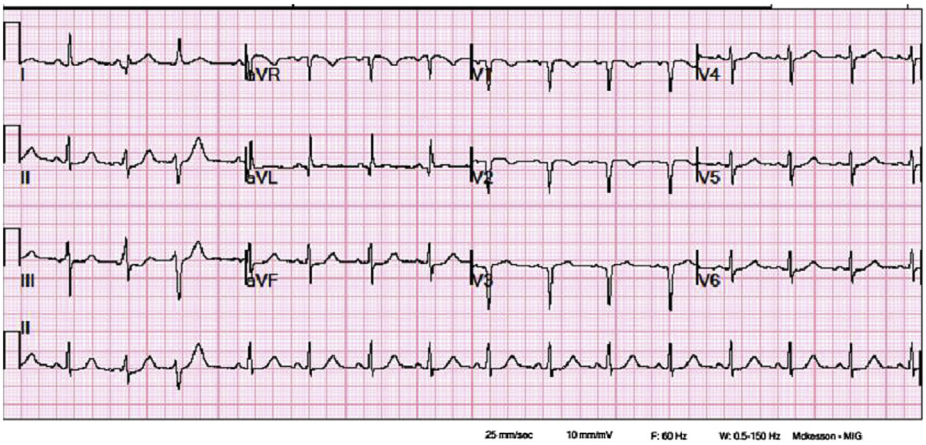

Fig. 3 – Subsequent EKG showing resolution of ST segments.

contraindicated due to their teratogenic effects.[7] ACEI are excreted in breast milk and thus breastfeeding should be discontinued in patients requiring ACEI/ARB. Hydralazine with or without nitrates is generally the vasodilator of choice during pregnancy.[14] Statins are contraindicated during pregnancy. In patients developing heart failure, Furosemide (category C) and Hydrochlorothiazide (HCTZ) (category B) have been safely utilized during pregnancy.[14] Spironolactone (category C) should better be avoided during the antepartum period.[15] Despite no evidence of teratogenic effects, Morphine (category C) should be avoided during pregnancy for the risk of fetal respiratory compromise and neonatal respiratory depression.

4.1. *Thrombolytics vs coronary angiography*

Thrombolytics should be avoided during AMI in pregnancy without knowledge of coronary anatomy, as it may potentially complicate coronary dissection cases by increasing the risk of hemorrhage and further progression of the dissection.[7] Coronary angiography is underutilized for this patient population due to radiation safety concerns. This not only helps in differentiating coronary spasm and coronary artery dissection from atherosclerotic disease but also provides a therapeutic tool. The amount of fetal exposure to radiation during coronary intervention is estimated to be between 0.02 and 0.1 mSv.[16] These radiation exposures are well below the threshold for teratogenicity at any gestational age.[16] Radiation can be further reduced by the use of appropriate protection shields. Covering patient's abdomen and back by lead might protect the fetus from excessive radiation. Radial artery approach has logistic advantage over femoral artery access in these cases, as it minimizes abdominal/fetal radiation. The concern over more radiation exposure due to more fluoro time required to perform coronary intervention utilizing radial approach is theoretical, operator dependant and has been recently challenged by Kuipers et al.[17] Bare metal stents (BMS) still remain preferred choice over drug eluting stents (DES) in these patients. DES is generally avoided due to necessary long-term need for dual antiplatelet therapy with Aspirin and Clopidogrel. The duration of dual antiplatelet therapy after stent placement when the pregnancy continues and results in labor and delivery is not well established. We recommended continuation of Aspirin and Clopidogrel for at least 4 weeks (for bare metal stents) unless there is a bleeding complication.

In patients developing ventricular tachycardia without spontaneous resolution, Lidocaine is considered safe at clinically recommended doses.[18] Amiodarone is associated with a significant incidence of fetal hypothyroidism (9% of newborns of mothers on chronic amiodarone therapy), hyperthyroidism, and goiter. Although Amiodarone is effective in virtually all maternal and fetal tachycardias, its use is recommended only in life-threatening cases where other therapies have failed due to high incidence of serious adverse effects. Its use during lactation is discouraged.[18] Emergency and elective cardioversion are safe at all stages of pregnancy.

4.2. *Labor and delivery*

Due to the increased hemodynamic stress associated with labor, it has been recommended that induction of labor or scheduled cesarean delivery should be delayed, if possible, for at least two to three weeks afterward.[7] The mode of delivery after AMI should be individualized based on clinical and obstetric factors. In most cases, cesarean section is opted for obstetric reasons. As discussed earlier, it should be preferred in patients on Clopidogrel and patients with intractable heart failure as well. Most patients with CAD can tolerate vaginal delivery.[7] Early continuous epidural anesthesia is recommended to minimize pain, which can increase maternal heart rate and myocardial oxygen demand. Episodes of tachycardia and hypertension should be minimized. Ephedrine is usually the vasopressor agent of choice for hypotension associated with regional anesthesia because it helps maintain placental perfusion.[19] Ergot alkaloids immediately after delivery should be avoided because of the risk of coronary artery spasm. Patient should be monitored for 48 h postpartum in a coronary care unit as significant hemodynamic changes occur during this time, which warrants close monitoring and early action in case of any instability.

CAD or prior myocardial infarction is not an absolute contraindication to pregnancy and associated risk depends on factors such as LVEF, active myocardial ischemia, and the time between myocardial infarction and planned pregnancy. Ideally, a pregnancy should be planned only a year after revascularization/myocardial infarction.[8] An ischemic evaluation should be pursued preconception after patient is taken off the medications that are contraindicated during pregnancy.

5. Summary

Early use of coronary angiography is helpful in making a diagnosis of coronary artery dissection, coronary spasm as well as atherosclerotic disease. This information is crucial in the management as medicines used to treat atherosclerotic disease could potentially harm patients with coronary artery dissection. Radial artery approach is associated with less radiation exposure, better mobility and access site related complications. After coronary angiogram, patients with AMI due to atherosclerotic disease should be given a 325 mg of aspirin and 600 mg of clopidogrel and either balloon angioplasty or bare metal stent should be used for revascularization. Percutaneous coronary intervention with heparin is preferred over bivalirudin and later should be reserved for patients with severe heparin allergy. Statins should not be used pending further studies.

Conflicts of interest

All authors have none to declare.

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