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Pregnancy-Related Acute Myocardial Infarction: A Review of Epidemiology, Diagnosis, Medical and Surgical Management

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Abstract

Although acute myocardial infarction (AMI) in pregnancy is rare, can result in maternal and/or fetal death and should be carefully managed. The aim of this study is to collect and review the data on the management from numerous articles published since 2000. For literature review we performed a literature search on PubMed that were based on diagnoses and management of myocardial infarction on pregnancy. Atherosclerosis appears to be the most common cause of AMI. Although there are some differences related to pregnancy stage such as thrombosis, coronary artery spasm or dissection that seen more frequently in pregnant women than age-matched nonpregnant women. In addition to traditional risk factors of atherosclerosis in general population, some other risk factors due to physiological or pathological changes in pregnancy and also some drugs can cause AMI. The Presentation and diagnosis of AMI in pregnancy usually is the same as nonpregnant patients but there are some important points. Regardless of some differences, therapeutic option of AMI in pregnant women is the same of nonpregnant patients. Probably primary percutaneous coronary intervention is the optimal medical management of AMI during pregnancy. Use of thrombolytic therapy in pregnancy is prohibited and is very limited. Although there have been many reports of cardiopulmonary bypass surgery during pregnancy, most knowledge is based on anecdotal and old reports. Early detection and multidisciplinary approach and timely delivery can minimize the serious consequences of AMI in pregnancy.

Keywords: Myocardial Infarction, Pregnancy, Diagnosis, Management

Introduction

The prevalence of cardiac disease in pregnancy is about 0.4-4% based on various study (1-3). Although heart disease and thromboembolism are one of the leading causes (about 32%) of maternal death in pregnancy (4), ischemic heart disease (IHD) and myocardial infarction (MI) are uncommon in pregnancy with a rate less than 1/10000 deliveries in western countries (4-9). Studies showed that pregnancy increases the risk of acute myocardial infarction (AMI) up to 3-4 fold compared with nonpregnant reproductive-age women (2,4,5,10) and have poor maternal and fetal outcome (10-12). Maternal mortality rate is about 5-37% and is twice higher with AMI in peripartum in comparison with mortality in antepartum and postpartum (11,12). Fetal mortality is mainly associated with maternal mortality and is about 9-34%. Maternal survival is associated with good fetal prognosis (12). The aim of this study is to collect and review the new data on the diagnosis and management of acute MI in pregnancy from numerous articles published since 2000.

Materials and Methods

For literature review we performed a literature search in Medline/Pub Med electronic database in the internet for original articles on this topic since 2000. our key words was " myocardial infarction", "pregnancy", "diagnosis", and "management". In some issue if there was not new study, we looked older studies too.

Results and Discussion

There is no epidemiological study about pregnancy related AMI in Iran, but the incidence may be lower in Iran as in other Asian study (13). AMI has traditionally been considered a disease affecting mostly men, yet women are increasingly at risk and some previous studies showed a delay in the diagnosis of AMI and an increase risk of death of the women, but in a new study in Iran, there were no difference in admission, indication for coronary angiography (CAG) and death compared with men (14).
AMI in pregnancy is reported ranging from 19-44 years, but the incidence is higher after 30 years of age with odds ratio of 6-7 (5) and the peak incidence of AMI reported in multigravida older than 33 year of age (11) and most commonly occur during 3th trimester or peripartum(9). If AMI occur during delivery or within two weeks of labor, mortality may be as high as 45% of patients (9,11). Most patient presenting with AMI in post partum period are

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younger than patient presenting with AMI in antepartum or peripartum periods (15). Traditional risk factors of atherosclerosis in general population are related with increased risk of pregnancy related AMI (8).

The pathophysiology of AMI in pregnancy is the same as nonpregnant patients, although there are some differences related to pregnancy stage such as thrombosis, coronary artery spasm or dissection that are more frequent in pregnant women than aged matched nonpregnant women (16,17). Rupture of atherosclerotic plaque is the most common cause of AMI in pregnant patients especially in antepartum period (17). Coronary artery dissection is an important cause of MI with a rate of 50% in peripartum period (11,18,19).

Some physiological changes during normal pregnancy and also some pathological events during complicated pregnancy and some drugs can cause AMI or worse the prognosis of AMI in pregnancy (10,20). The normal hemodynamic changes in pregnancy such as increased heart rate and cardiac output, physiological anemia, increased stress, anxiety, pain, uterine contraction and blood loss during delivery that can increase oxygen demand during artery spasm can reduce coronary supply (10,11). Underlying causes include enhanced vascular response to angiotensin II and noradrenalin and reduce response to vasodilators (endothelial dysfunction) in gestational hypertension and preeclampsia, increased rennin level in response to uterine hypoperfusion in supine position (21). Also some drugs such as administration of Ergotamine to control of hemorrhage or use of Bromocriptine to suppress lactation can induced coronary artery spasm and reduce coronary supply in peripartum and postpartum period (22-26).

Normal pregnancy is a hypercoagulable state due to decreased protein S level and tissue Plasminogen Activator (tPA) level specially during placenta separation, so thromboembolic events increase during pregnancy and labor and rarely coronary thrombosis is a course of AMI in pregnancy (27,28).

Clinical Presentation and Diagnosis: Presentation of AMI in pregnancy usually is the same as nonpregnant patients with typical anginal chest pain, ST-T changes and Q wave in electrocardiography (ECG) and elevated cardiac enzymes, but several important points must be noted (17). Normal pregnancy can mimic some of cardiac disease symptoms, making it difficult to diagnose of true cardiac disease. For example, dizziness, fatigue, dyspnea, palpitation, tachypnea or tachycardia, pedal edema, decreased exercise tolerance and even syncope may be seen in normal pregnancy due to physiological changes. Also some of cardiac signs can be found in normal pregnant patients such as elevated jugular vein pressure, apical point displacement, parasternal lift, increase S1 or S2 heart sounds and even extra heart sounds such as S3 or systolic ejection murmur (17). During normal pregnancy creatine kinase (CK) concentration can increase and then specificity of CK-MB is lower (29,30). Cardiac specific troponin I (cTnI) is more specific than CK-MB, because cTnI level does not increase above normal limit during uncomplicated pregnancy, delivery, or surgical cesarean section (CS) but can be elevated in gestational hypertension or preeclampsia (29-31).

ECG changes in pregnancy associated AMI is the same as nonpregnant patients, but some pregnancy-related changes can be seen in normal uncomplicated women such as left axis deviation due to diaphragmatic elevation by fetus or Q wave and T inversion in lead III (8,17,32). Also in pregnant patients, CAG can be helpful in diagnosis of AMI, but radiation exposure is the main concern and CAG have to be used in the definite AMI for therapeutic means by primary percutaneous coronary intervention (PCI) (18,33-35). By using of the abdominal shield, fetal radiation exposure will be less than one rad and termination of pregnancy is not necessary until radiation exposure exceeds 10 rads (36,37).

In one study, coronary artery morphology of acute MI in pregnancy was reported as atherosclerotic plaque rupture in only about 43%, coronary thrombosis about 21%, dissection 16% and spasm in 1%. Normal CAG may be seen in 29% of patient with several explanations such as repeated coronary dissection, vasospasm or clot autolysis (10). The important differential diagnosis of chest pain in pregnant women is hemorrhage, sickle cell anemia crisis, preeclampsia, pulmonary embolism and aortic dissection (10).

Treatment (Medical and Surgical Management): Regardless of some minor differences, therapeutic option of AMI in pregnant women is the same of nonpregnant patients. Recommended pharmacological therapies are beta blockers, heparin or enoxaparin, ASA, nitrates, clopidogrel. If necessary, non dihydropyridine calcium channel blockers may be used (38-41). Angiotensin receptor blockers and angiotensin convertase enzyme inhibitors are contraindicated after first trimester, but they are not major teratogens when used in the first trimester (42,43). Statins should be avoided, because their safety have not been proved (44). Among beta blockers, labetalol and metoprolol have lower teratogenicity and are safer than others (45). Nitrates are safe in pregnancy but dosage should be carefully titrated to avoid maternal hypotension and consequent uterine hypoperfusion (46). Unfractionated heparin (UFC) and low molecular heparin (LMWH) are safe in pregnancy but anticoagulation should be discontinued 12-24 hours before induction of labor (47,48). Antiplatelet therapy is essential in AMI. Also use of ASA in first trimester is associated with fetal defects, but low dose ASA is safe in 2nd and 3th trimester (49,50) and breastfeeding (51). Safety of thienopyridines such as clopidogrel is not clearly defined during pregnancy but breastfeeding is not recommended in this patients (52). Among calcium channel blockers , nifedipine may be safe but data about the other nondihydropyridines are limited. Diltiazem and Verapamil are prohibited in pregnancy and breastfeeding (51-53).

Revascularization is principle of treatment in AMI in pregnant women As others nonpregnant patients (17).

Primary PCI or coronary artery bypass graft (CABG) and rarely thrombolysis has been performed successfully during pregnancy and may be the best therapeutic option in pregnancy. In most clinical trials, pregnant women have been excluded and there is little data about efficacy and safety of primary PCI in pregnant women with AMI (54-56). Main concern in primary PCI is radiation and need to dual antiplatelet therapy at least for one month after bare metal stents (BMS) or 12 months after drug eluted stents (DES) use, and for this reason BMS is preferred during pregnancy (57-59). In dual antiplatelet therapy period, epidural anesthesia for labor is contraindicated (60).

Experience in thrombolytic therapy for AMI in pregnancy is limited. Some time it may be considered when primary PCI is not available. Streptokinase is prohibited during pregnancy (61,62) but thrombolysis with tPA, is theoretically possible. The large molecular weight of tPA makes it impossible to cross the placenta, but there is an increased risk of catastrophic hemorrhage (63,64).

CABG: Although successful CABG in pregnant women has been reported before 1960, over time, significant technical improvement has been caused improvement in maternal and fetal outcomes. Based on recent studies, the maternal mortality is about 1.7 to 3%, as the same of non pregnant women.

Fetal mortality is based on time of surgery and several technical consideration such as left lateral recumbent positioning of mother in gestational age after 20th week to reduce aortic and caval compression, preserving maternal mean arterial blood pressure about 70 mmHg or more throughout surgery and as possible, normothermic or mild hypothermic condition and high flow extra corporeal circulation and also monitoring of fetal heart rate and prevention of fetal bradycardia to preserve fetoplacental circulation.

The best surgical time to CABG in pregnant women is early second trimester. In first trimester there is increased chance of fetal malformation and in late second and early third trimester there is increased chance of preterm labor. After 28 weeks of gestational age, immediately after CS, cardiac surgery can be done (65-69).

Delivery: The method of delivery is based on obstetrical indications and patients clinical status (17). If it is possible, the best way to reduce the risk of delivery is postponed about 2-3 weeks after AMI (10,17). There is no clear advantage in terms of mortality between CS or vaginal delivery. CS has risk of anesthesia, surgical induced hemodynamic changes, more bleeding and reduction in hemoglobin and more risk of respiratory complications such as infections (10,17). But On the other hand, in vaginal delivery, there is more sympathetic release due to labor pain and hemodynamic changes that can lead to inducing or worsening of ischemia (11).

Positioning the patient in left lateral position can reduces aortorenal compression and therefore optimizes cardiac output and placental perfusion (17). Assistance and shortening of the 2nd stage of labor can reduce maternal cardiac strain. Limited pushing is eligible if there are no heart failure signs and ejection fraction is over 40% (17). Oxytocin infusion should be avoided to prevent coronary spasm and heart ischemia. Monitoring of heart rate, blood pressure, ECG, and monitoring of rhythm, pulse oximetry, and sometimes arterial line or swan-ganz catheter if necessary, and also use of routine drugs in acute cardiac ischemia such as beta blockers, nitroglycerines, antihypertension medications and supplementary oxygen during labor will be eligible. With adequate attention and medication, good controlling of pain and reducing 2nd stage of delivery, most patients with AMI can tolerate vaginal delivery with acceptable risk, but sometimes CS is necessary in hemodynamically unstable patients (17,60). After pregnancy, the patient should be followed closely by cardiologist to adjust physical activity and review cardiac symptoms. History of MI is not absolute contraindication of pregnancy but patient should be advised to delay pregnancy about one year after complete treatment of remnant ischemia and revascularization (70).

Conclusions

Although MI is uncommon in pregnancy but pregnancy increases the risk of AMI up to 3-4 fold and increase risk of maternal and fetal mortality.

Early detection and multidisciplinary approach and timely delivery can minimize the serious consequences of AMI in pregnancy. There is some differences in medication of AMI in pregnant patient compared with nonpregnant patients such as limitation of thrombolytic therapy or use of Angiotensin receptor blockers, angiotensin convertase inhibitors and statins. CABG is possible in early second trimester in pregnant patients.

Ethical issues

The local ethics committee approved the study.

Conflict of interests

Authors declare that they have no conflict of interests.

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