Acute Myocardial Infarction During Pregnancy

Yu-Ching Chen[1], Yung-Ming Chang[2], Guang-Perng Yeh[1,3], Horng-Der Tsai[1], Charles Tsung-Che Hsieh[1]*

[1]Department of Obstetrics and Gynecology, and [2]Division of Cardiology, Department of Internal Medicine, Changhua Christian Hospital, Changhua, and [3]Department of Obstetrics and Gynecology, Chung-Shan Medical University, Taichung, Taiwan.

Acute myocardial infarction (MI) is very uncommon in women of reproductive age [1–4]. Pregnant women tend to be relatively young in Taiwan, and the risk of pregnancy being complicated by acute MI is, therefore, very low. Diagnosis of acute MI during pregnancy is difficult because of its low prevalence and consequent low index of suspicion. However, acute MI can occur at any time, including during pregnancy, delivery and puerperium, and can result in maternal and/or fetal mortality. It is, therefore, essential to diagnose MI in time in order to allow adequate medical and obstetric management. Here, we report a case of a woman whose pregnancy was complicated by acute MI, following the use of ritodrine infusion to treat tocolysis.

A 27-year-old, gravida 1, Taiwanese woman with an unremarkable medical history and no risk factors for cardiac disease was admitted to our hospital for tocolysis, under the impression of antepartum hemorrhage, preterm labor, and preterm premature rupture of membranes at 33 weeks 3 days' gestation. Regular uterine contractions were occurring once every 10 minutes, and tocolytic therapy was started with intravenous ritodrine infusion at a dose of 133 μg/minute. During the first 2 days of admission, occasional variable fetal heart beat deceleration was detected by fetal monitoring, but this improved spontaneously. One day later, the dosage of ritodrine was adjusted to 166 μg/minute because of complaints of lower abdominal pain resulting from regular uterine contractions. This dose was maintained for 3 days owing to stable tocolysis. The patient complained of acute onset of chest pain and dyspnea after 4 days of ritodrine infusion. The pain was localized in the retrosternal region, without radiating pain. Her blood pressure was 132/107 mmHg, and pulse rate was 89 beats/minute. Electrocardiographic (ECG) monitoring revealed no significant ST-T changes (Figure 1). Her chest pain was thought to be labor-related, because it improved after an injection of pethidine at 4.5-cm os dilatation with 75% effacement. She was transferred to the delivery room for continuous fetal monitoring under suspicion of tocolysis failure, and the ritodrine infusion was stopped. The chest pain persisted, and there was a new onset of cold sweating. Cardiac enzymes were checked 6 hours after the onset of chest pain and were found to be elevated as follows: creatine kinase, 3,610 U/L; creatine kinase MB (CK-MB) isoenzyme, 337 U/L; troponin I (Tn-I), 69.636 ng/mL. Acute MI was diagnosed 7 hours after the onset of the chest pain. A 12-lead ECG was ordered, and this revealed ST elevation in leads V_2 through V_5 and a pathologic Q wave in leads V_4 and V_5 (Figure 2). These ECG findings were compatible with an acute anterior wall MI. She was transferred to the cardiac care unit (CCU) for further treatment and surveillance. After initial stabilization, echocardiography showed akinesis of the apex and hypokinesis of the anterior wall with left ventricle systolic dysfunction (left ventricle ejection fraction, 45%). Her cholesterol and triglyceride (TG) levels were elevated, with cholesterol of 261 mg/dL, high-density lipoprotein of 75 mg/dL, and TG of 323 mg/dL. These elevations were probably related to the pregnancy and were not abnormal for the third trimester. Inadequate cardiac function was a concern in case the patient was unable to tolerate labor. Previous studies have suggested that most maternal mortality occurs at the time of or within 2 weeks of MI [1,2,5,6]. Based on this, we decided to delay labor until 14 days after the MI event, using an infusion of magnesium sulfate. The patient developed cardiogenic pulmonary edema while in the CCU. Isosorbide mononitrate, low-molecular-weight heparin, and furosemide

*Correspondence to: Dr Charles Tsung-Che Hsieh, Department of Obstetrics and Gynecology, Changhua Christian Hospital, 135, Nanhsiao Street, 500, Changhua, Taiwan.
E-mail: 40129@cch.org.tw
Accepted: May 9, 2008

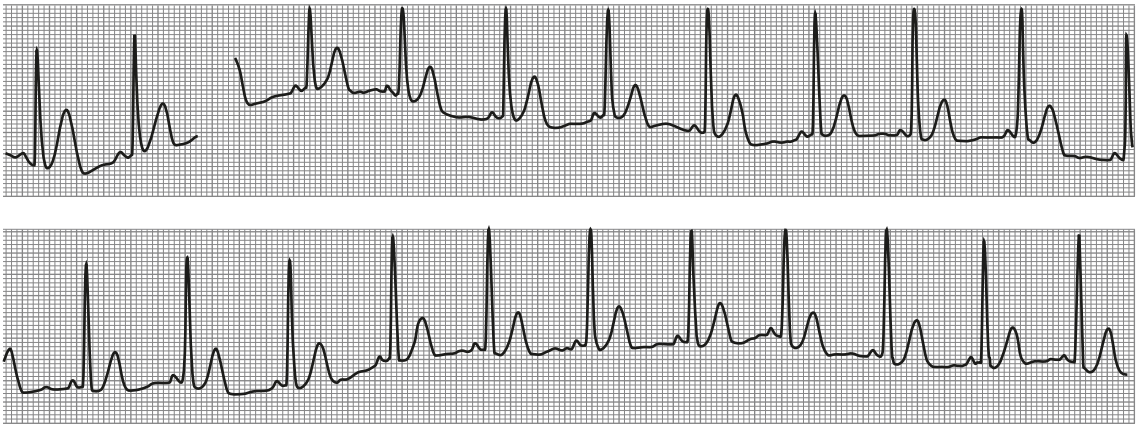

Figure 1. The bedside electrocardiogram monitor failed to reveal significant ST elevation.

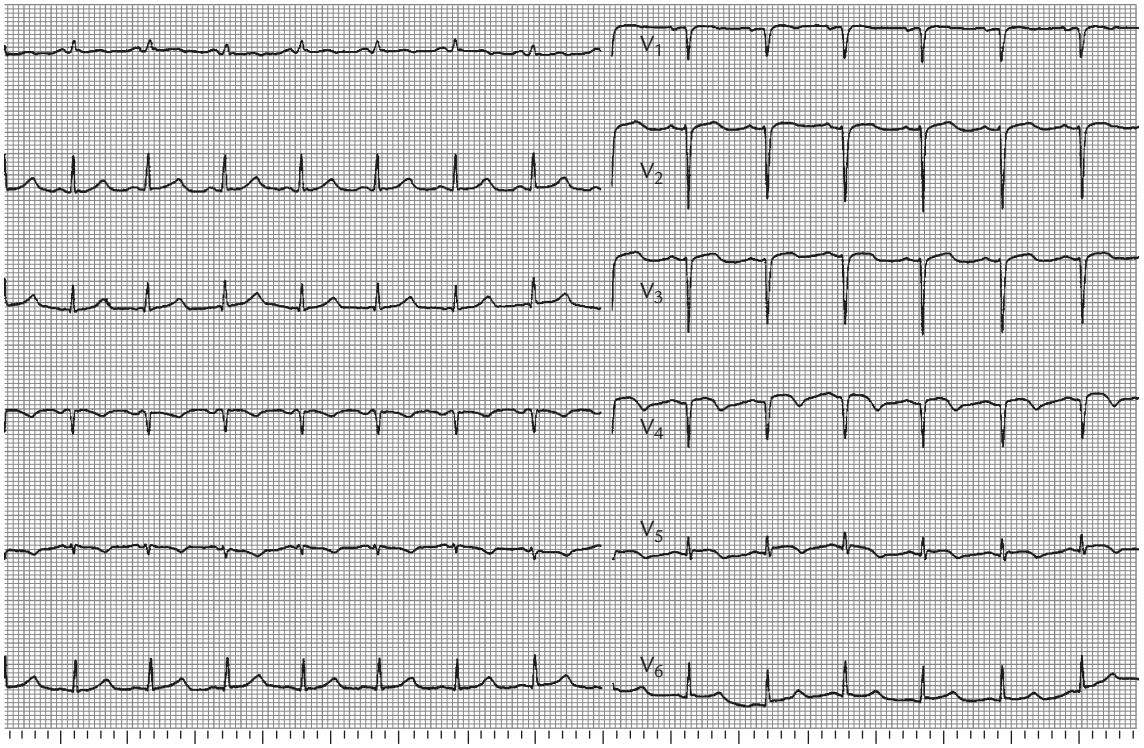

Figure 2. A 12-lead electrocardiogram revealed ST elevation in leads V_2 through V_5, Q wave in leads V_4 and V_5, and small R waves in leads V_2 and V_3.

were administered. Dyspnea and chest tightness gradually subsided after medication. Her condition stabilized and cardiac monitoring became unnecessary after 3 days, and she was transferred to our obstetric ward to continue tocolysis. She went into spontaneous labor at 36 weeks 6 days' gestation. She was transferred to the CCU for continuous monitoring of blood pressure, pulse, oxygen saturation, ECG, and fetal heart rate during labor. Epidural analgesia and oxygen supplementation were provided during labor. A male baby, weighing 3,950 g, was born by vacuum extraction because of a prolonged second stage of labor. The baby's Apgar scores were 3, 5 and 7 at 1, 5 and 10 minutes, respectively, which were consistent with mild neonatal asphyxia. The woman recovered well and was discharged 3 days later. The neonate required neonatal intensive care for 7 days because of intrapartum asphyxia, but showed no evidence of neurologic sequelae. Although the patient complained of exertional dyspnea, no effort angina could be identified after discharge. Cholesterol and TG levels had returned to normal at 2 months after delivery (cholesterol, 128 mg/dL; TG, 102 mg/dL). A gated technetium Tc 99m sestamibi myocardial perfusion scan at 2 months after delivery revealed an extensive transmural infarction with minimal peri-infarct ischemia involving the apex, anterior wall, and septum

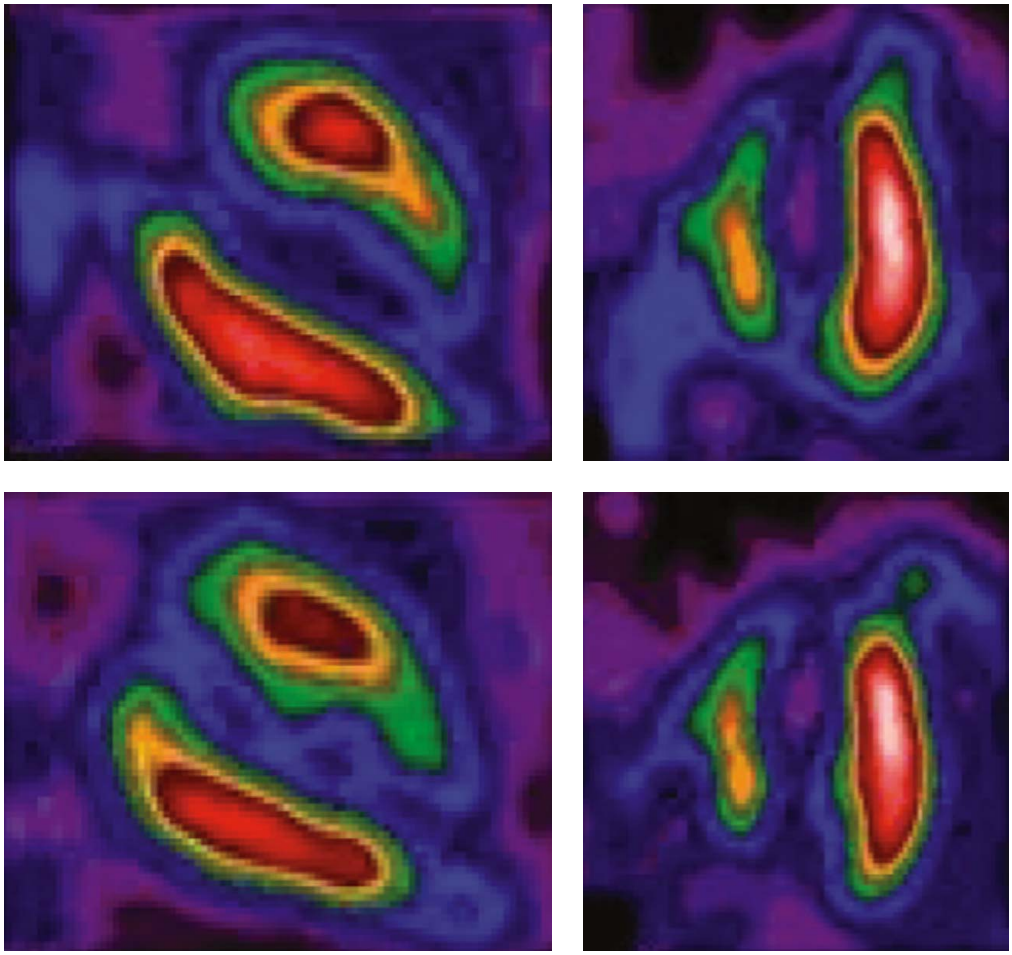

Figure 3. A gated technetium Tc 99m sestamibi myocardial perfusion scan 2 months after delivery revealed an extensive transmural infarction with minimal peri-infarct ischemia involving the apex, anterior wall, and septum.

(Figure 3). Cardiac catheterization was performed 2 months after delivery. A left ventriculogram showed an apical aneurysm with thrombus content. Coronary angiograms showed patent coronary arteries without significant stenosis (Figure 4). The apical thrombus was also confirmed by chest computerized tomography. The patient was treated with anticoagulant therapy for 6 months. Other laboratory examinations included antinuclear antibody, antithrombin III, protein C and protein S functions, all of which were normal, except for a borderline decrease in protein C function (90%).

MI during pregnancy is rare but is often associated with significant maternal mortality [1–4,6]. The estimated incidence of MI during pregnancy has been reported to be between 3 and 10 cases per 100,000 deliveries [1–4]. Maternal mortality after MI has been estimated to be 19–37% [1,2], although reported maternal mortality has recently declined to 5.1–7.3%, owing to improvements in diagnosis and treatment [3,4]. Nonetheless, MI remains a threat to maternal and fetal welfare.

There are several risk factors associated with acute MI during pregnancy, including a history of cardiovascular disease, familial hyperlipidemia, diabetes mellitus, hypertension, smoking, and advanced maternal age [1–4]. However, our patient did not have any of the risk factors identified above. The occurrence of MI in our case may have resulted from physiologic changes during pregnancy and the use of ritodrine. There is a 30–50% increase in both cardiac output and blood volume during normal pregnancy; this, together with the increased heart rate, leads to an increased myocardial oxygen demand. Dilutional anemia and a decreased diastolic pressure may reduce the myocardial oxygen supply. Pregnancy-related elevations in cholesterol and TG might also have a detrimental effect on the coronary blood flow, further reducing the myocardial oxygen supply. Ritodrine, a β_2-adrenoceptor agonist, is widely used for tocolysis in many countries. However, tachycardia, which is a well-known side effect of ritodrine, can cause deterioration in oxygen consumption. The combination of pain due to preterm labor, increased myocardial oxygen consumption and a decreased

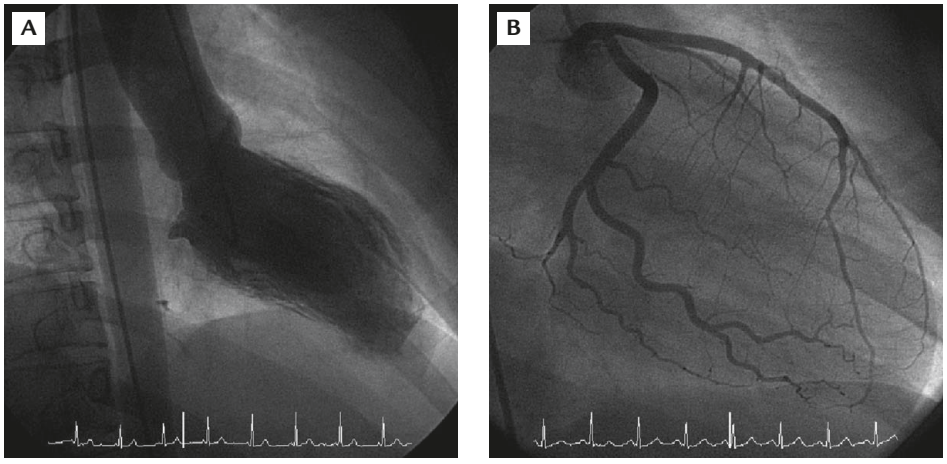

Figure 4. (A, B) Cardiac catheterization produced a left ventriculogram showing an apical aneurysm with thrombus content. Coronary angiograms showed patent coronary arteries without significant stenosis.

myocardial oxygen supply might have resulted in the acute MI in our patient. A case report in 1999 [7] also reported tocolysis-related MI during pregnancy. The authors initially used ritodrine for tocolysis, but this was substituted by nifedipine after the patient complained of chest pain after 30 hours of ritodrine infusion. The authors suggested that the short interval between the cessation of ritodrine and the start of nifedipine could have played a role in the development of hypotension and MI, and they speculated that nifedipine may have contributed to the acute MI more than ritodrine. However, the complaint of chest pain in their patient occurred before the administration of nifedipine. It was possible that acute MI had already occurred during the infusion of ritodrine. In our case, however, no other tocolytic was used before the occurrence of acute MI, and we can, therefore, assume that the ritodrine played a causative role in precipitating the acute MI in our case.

The diagnosis of acute MI during pregnancy is the same as in nonpregnant women. It typically presents with chest pain in the presence of an abnormal ECG and elevated cardiac enzymes. The symptom of chest pain in pregnant women may not be as clear as in nonpregnant women, as the etiologies of chest pain in pregnant women vary from benign to life-threatening [8,9]. The pain could also be masked during labor and misdiagnosed as labor pain, as in our case. A complaint of chest tightness is not unusual in a patient who is receiving an infusion of ritodrine. The differential diagnosis of benign conditions and potentially fatal acute MI during pregnancy is highly dependent on the results of ECG and measurement of cardiac enzymes. Bedside ECG monitoring is a convenient modality that can be used to observe the vital signs in an unstable patient, but it is not a standard method for diagnosing acute MI. We were unable to recognize any significant ST elevation in our patient using the available ECG monitoring. The diagnosis was confirmed only when a possibility of acute MI was established and a 12-lead ECG and cardiac enzyme measurements were ordered. Traditional cardiac enzymes, such as creatine kinase and CK-MB, are not necessarily sensitive as indicators of MI in pregnancy owing to their increased levels during normal labor, but a new biochemical marker, Tn-I, has been shown to be a sensitive and specific indicator of acute MI during pregnancy [10]. Although levels are increased in women with preeclampsia and gestational hypertension, the level of Tn-I is not affected by labor or delivery, and it is thus more sensitive than creatinine kinase or CK-MB for the diagnosis of acute MI during pregnancy [10]. Coronary artery catheterization is helpful for determining the type of coronary disease, as well as offering the possibility of definitive treatment (angioplasty). Although such an approach is considered to be safe for the fetus, we did not use it in this case because the catheterization might not change our management strategy. Furthermore, postpartum cardiac catheterization failed to identify any significant coronary stenosis or other coronary disease, suggesting that the acute MI in our patient was unlikely to be a result of atherosclerosis.

Maternal mortality has been reported to be as high as 45% if the patient gives birth at the time of, or within 2 weeks of, the infarction [1,2,5,6]. Therefore, any attempts should be made to postpone delivery following an acute MI, to allow for improvements in cardiac function. We did not perform an emergency cesarean section at the time of the acute MI and were able to manage the medical problems and complications of acute MI. Cesarean section is associated with significant hemodynamic changes, including increased

cardiac output, and increased arterial and central venous pressure [11]. It, therefore, carries an additional risk of subsequent cardiac decompensation that will affect the newly injured heart. Although there are some controversies concerning the preferred mode of delivery [1,2], vaginal delivery is thought to be superior to cesarean section in pregnant women with acute MI because vaginal delivery avoids surgical morbidity, decreases hemodynamic fluctuations, and usually results in less blood loss [1,5]. Most authors recommend epidural analgesia during labor [11,12]. Our patient tolerated the labor course well with continuous monitoring of blood pressure, ECG, oxygen saturation and fetal heart rate in CCU. Cesarean section is only recommended based on obstetric indications and in patients with unstable ischemic or hemodynamic conditions [1,5,11].

In conclusion, although acute MI in conjunction with pregnancy is rare, it is occasionally encountered during pregnancy or puerperium. Diagnosis of acute MI during pregnancy is usually delayed, because the symptoms and signs can be mistaken for the normal manifestations of pregnancy and labor, and because there is a low index of suspicion. All health care providers should be aware of this rare potential complication of long-term use of ritodrine for tocolysis. If women undergoing treatment with ritodrine or any other β-mimetics complain of chest pain, acute MI should be included in the list of differential diagnoses. In the absence of fetal distress, initial management should focus on the patient's medical problems or the complications caused by the MI. Safe vaginal delivery is possible if maternal cardiac function is adequate.

References

1. Roth A, Elkayam U. Acute myocardial infarction associated with pregnancy. *Ann Intern Med* 1996;125:751–62.
2. Badui E, Enciso R. Acute myocardial infarction during pregnancy and puerperium: a review. *Angiology* 1996;47:739–56.
3. Ladner HE, Danielsen B, Gilbert WM. Acute myocardial infarction in pregnancy and the puerperium: a population-based study. *Obstet Gynecol* 2005;105:480–4.
4. James AH, Jamison MG, Biswas MS, Brancazio LR, Swamy GK, Myers ER. Acute myocardial infarction in pregnancy: a United States population-based study. *Circulation* 2006; 113:1564–71.
5. Baird SM, Kennedy B. Myocardial infarction in pregnancy. *J Perinat Neonatal Nurs* 2006;20:311–21.
6. Ray P, Murphy GJ, Shutt LE. Recognition and management of maternal cardiac disease in pregnancy. *Br J Anaesth* 2004; 93:428–39.
7. Oei SG, Oei SK, Brolmann HA. Myocardial infarction during nifedipine therapy for preterm labor. *New Engl J Med* 1999; 340:154.
8. Nallamothu BK, Saint M, Saint S, Mukherjee D. Double jeopardy. *New Engl J Med* 2005;353:75–80.
9. Iadanza A, Del Pasqua A, Barbati R, Carrera A, Gentilini R, Favilli R, Pierli C. Acute ST elevation myocardial infarction in pregnancy due to coronary vasospasm: a case report and review of literature. *Int J Cardiol* 2007;115:81–5.
10. Shade GH Jr, Ross G, Bever FN, Uddin Z, Devireddy L, Gardin JM. Troponin I in the diagnosis of acute myocardial infarction in pregnancy, labor, and post partum. *Am J Obstet Gynecol* 2002;187:1719–20.
11. Epslin S, Clark SL. Ischemic heart disease and myocardial infarction during pregnancy. *Contemp Ob Gyn* 1999;44: 27–44.
12. Gil S, Atienzar C, Filella Y, Fernandez M, Borras R, Miranda A. Anaesthetic management of acute myocardial infarction during labour. *Int J Obstet Anesth* 2006;15:71–4.