ANAESTHETIC MANAGEMENT OF MYOCARDIAL INFARCTION IN A PARTURIENT

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SUMMARY

Myocardial infarction is encountered rarely during pregnancy, but when it occurs the event is life-threatening to both mother and fetus. Data on maternal and fetal outcome are limited, but overall maternal mortality approaches 35%, and 40% of deaths occur during the third trimester. We present a case of myocardial infarction occurring at 38 weeks gestation, and discuss the anaesthetic management of the problems encountered during labour and delivery.

KEY WORDS


Myocardial infarction (MI) is a rare complication of pregnancy. However, when it occurs the event is life-threatening to both mother and fetus. We present a case of MI occurring at 38 weeks gestation.

CASE REPORT

An obese, 26 yr-old gravida 2, para 1 woman at 38 weeks gestation noted the acute onset of precordial chest pain radiating to her left arm accompanied by sweating, nausea and vomiting. She presented to a local hospital approximately 3 h after the onset of pain. On admission, she denied shortness of breath, palpitations, abdominal pain, vaginal bleeding, premature contractions or rupture of membranes. ECG demonstrated anterolateral ST elevation associated with right bundle branch block and left posterior hemiblock. A diagnosis of acute MI was confirmed, with a maximum serum concentration of creatine kinase of 638 iu litre⁻¹. She was treated with i.v. nitroglycerin and oral diltiazem. Chest x-ray revealed no signs of congestive heart failure. Her condition remained stable and she was transferred to the Brigham and Women's Hospital Coronary Care Unit 48 h after the onset of symptoms.

The patient was a cigarette smoker and had a 6-month history of hypertension controlled with a low sodium diet. Her past obstetric history included spontaneous normal vaginal delivery at 42 week gestation after a 6-h labour. The current pregnancy had been uncomplicated and the estimated gestational age was believed to be accurate.

On admission the heart rate was 120 beat min⁻¹, arterial pressure 115/80 mm Hg, ventilatory frequency 20 b.p.m. and oral temperature 36.5 °C; body weight was 105 kg, height 155 cm. Jugular venous pressure and heart sounds were normal. Auscultation of the chest revealed diffuse expiratory rhonchi. The abdomen was soft and nontender, with a gravid uterus. Repeat chest x-ray showed no signs of congestive heart failure and ECG was unchanged.

In anticipation of possible premature delivery, a pulmonary artery catheter was inserted. Right atrial pressure initially was 8 mm Hg and pulmonary capillary wedge pressure (PCWP) 12 mm Hg. Two-dimensional echocardiography revealed extensive anteroapical and anteroseptal akinesia, with moderate impairment of left ventricular function, traces of mitral and tricuspid insufficiency and a minor pericardial effusion. The obstetric ultrasound examination was consistent with a single fetus of approximately 32 weeks gestation in vertex position with a heart rate of 140 beat min⁻¹. Estimated fetal weight was 3580 g.

Because of the uncertain aetiology of the MI, initial management included oral diltiazem and
i.v. heparin (because of the possibility of a procoagulant state). She had no further chest pain, in spite of persistent tachycardia. On the 3rd day in hospital, the patient developed proteinuria accompanied by impaired liver function tests suggestive of pre-eclampsia. The 24-h urine protein output was 961 mg in 2175 ml and creatinine clearance was 154 ml min$^{-1}$. Proteinuria resolved spontaneously and liver function tests returned to normal 3 days later.

During the hospital stay, signs of labour were absent. Twelve days after diagnosis of the acute MI (at 39 and 5/7 weeks), pelvic examination revealed a soft cervix at 2 cm dilatation with 80% effacement. The probability of spontaneous labour in the succeeding few days was believed to be approximately 50%, and it was decided to attempt to induce labour. Heparin was discontinued (activated clotting time 128 s (normal = 80–120 s)) and the patient was transferred to an operating room while receiving 40% oxygen by face mask. Monitoring comprised intra-arterial pressure, pulmonary artery pressure, finger pulse oximetry and ECG.

An extradural catheter was sited via a 17-gauge Weiss needle inserted by a midline approach at the L3–4 interspace using the hanging drop technique. An initial test dose of 2 ml of 2% plain lignocaine was injected and the catheter was directed 2 cm cephalad. The patient was placed supine with a wedge under the right hip. When bilateral sensory analgesia had been demonstrated by pinprick, 3-ml aliquots of 2% plain lignocaine were given. A total of 18 ml was given to obtain a level of anaesthesia to T6.

An i.v. infusion of nitroglycerin was commenced at 0.5 μg kg$^{-1}$ h$^{-1}$ and ECG leads II and V5 were monitored continuously. Vaginal amniotomy was performed and i.v. oxytocin given by infusion to initiate labour. An extradural injection of fentanyl 50 μg in normal saline 10 ml was given at induction. Anaesthesia was maintained with a continuous infusion of 2% lignocaine with fentanyl 2 μg/ml of lignocaine, at a rate of 10 ml h$^{-1}$.

After 5 h, labour had progressed to 4 cm dilatation. PCWP was 10 mm Hg at induction and, despite judicious administration of nitroglycerin i.v., had increased to 27 mm Hg after 8 h. Extradural anaesthesia was extended to T4 and Caesarean delivery was performed with a vertical skin incision and a vertical uterine incision. A male infant was delivered, weighing 3.15 kg with Apgar scores of 8 and 9, umbilical vein pH of 7.34 and umbilical artery pH of 7.30. Estimated blood loss was 700 ml. The patient was transferred directly to the Coronary Care Unit, where her condition remained stable. Haemodynamic monitoring was continued for 48 h and the extradural catheter was left in place for administration of fentanyl.

Eighteen days after MI, radionuclide ventriculography revealed a left ventricular ejection fraction of 40%. Cardiac catheterization revealed a filling defect compatible with thrombus in the proximal left anterior descending artery, with 70% stenosis. Ventriculography demonstrated anterior wall hypokinesis, apical dyskinesis and intraventricular mural thrombus. The patient was treated initially with heparin i.v. followed by oral coumarin for 6 month, and discharged 21 days postpartum receiving oral atenolol 50 mg daily.

**DISCUSSION**

Myocardial infarction during pregnancy, described first in 1922 [1] is rare, with an incidence estimated at 1 in 10000 pregnancies [2, 3]. To date, 82 cases have been reported [1–11]. The greatest incidence is in the third trimester in women older than 35 yr. Hankins and colleagues [12] emphasized that most maternal deaths occur either at the time of infarction, with an undeliverable child, or within 2 weeks of MI. Postpartum MI is associated with a high mortality, tending to occur in young primigravidae with pre-eclampsia [5].

Among the 82 reports, 52 patients delivered vaginally with a maternal mortality rate of 12%, while 14 underwent Caesarean delivery with a mortality of 21%, although the two groups were not strictly comparable. In general, fetal outcome correlated with maternal outcome. Of 75 fetuses, 23 died, and 65% of these deaths occurred at the same time as maternal death.

Approximately 30% of parturients had coronary artery morphology defined either by angiography or at postmortem, as follows: significant coronary atherosclerosis was found in approximately 40%; definite coronary thrombus with "normal" coronary arteries was present in 30%; probable coronary thrombus (angiographic evidence of total occlusion of a coronary vessel but with otherwise normal vessels) was diagnosed in 10–15%; coronary aneurysm/dissection appeared in 10%, and normal coronary arteries were found in approximately 10%.
It has been suggested that coronary artery spasm in pregnancy may result from a transiently ischaemic chorion [13], as the human chorion contains 160 times more renin than maternal plasma [14, 15]. Formation of intracoronary thrombi, as a result of the potentially procoagulant state of pregnancy, may play a role [15, 16]. In addition, pregnant women who smoke are at increased risk of thrombus formation because of enhanced platelet aggregation [17]. Abnormalities of the coagulant and fibrinolytic systems which increase throughout pregnancy may contribute [15, 16].

In pregnancy numerous cardiovascular changes occur. Diaphragmatic elevation causes leftward deviation of the heart. An innocent grade I–II systolic murmur may be heard as a result of increased blood flow and vasodilatation. The ECG may show reversible ST, T and Q-wave changes. These normal findings must be differentiated from those indicating heart disease.

Cardiac output increases 15% during the latent phase of labour, 30% during the active phase, and 45% during the expulsive stage, in comparison with pre-labour values [18]. This increase in cardiac output is a result of increase in both heart rate and stroke volume [19, 20]. Each uterine contraction increases cardiac output by an additional 10–25% [19]. The greatest increase occurs immediately after delivery, when the cardiac output is, on average, 80% above pre-labour values [20]. This is attributed to autotransfusion associated with uterine contraction.

Choice of anaesthesia and method of delivery in a parturient with acute MI are controversial. Cohen reviewed the advantages and disadvantages of Caesarean vs vaginal delivery, with no convincing support for either [21]. Advantages of elective Caesarean delivery include ability to control the time of delivery, avoiding an unpredictable, stressful labour (table I). While vaginal delivery eliminates the stress of surgery, prolonged labour itself is stressful.

Hankins and colleagues advocated vaginal delivery [12], neglecting, however, to define the differences in patient populations between Caesarean and vaginal delivery: those undergoing Caesarean deliveries were at greatest risk, which would account for a poorer outcome. In the case reported here, Caesarean delivery was required after failed induction of labour and a prolonged course, resulting in an increase in PCWP. The increase in PCWP was presumed to reflect deteriorating left ventricular function. There was no change in the strength of uterine contractions and i.v. fluid volume was kept to a minimum.

No single method of anaesthesia is exclusively indicated. From experience in this department, we prefer extradural anaesthesia, and data from reported cases support this approach. Laughlin and associates used a modified Cleland two-catheter extradural technique [22]. During the first stage of labour, pain was controlled effectively by repeated injections of bupivacaine through the upper catheter and, for the second stage, lignocaine was injected through the lower catheter.

### Table I. Advantages and disadvantages of different modes of delivery of cardiac parturients. (Modified from [21] and [22])

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<th>Advantages</th>
<th>Disadvantages</th>
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<td><strong>Caesarean section</strong> (elective)</td>
<td>Eliminates the stress and unpredictability of labour. Time of delivery can be planned. Control of cardiopulmonary status.</td>
<td>Surgical stress. Increased cardiorespiratory and metabolic demands. Potential for increased blood loss. Postoperative infection.</td>
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<td>Pain relief. Haemodynamic stability.</td>
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After delivery, the parturient should undergo cardiovascular evaluation to provide diagnostic and prognostic information, thereby aiding further management. This should include two-dimensional echocardiography and radionuclide ventriculography to assess left ventricular function. Holter monitoring and exercise tolerance testing should be performed. With this information, recommendations can be made for subsequent management and future pregnancies.

Among the cases reported during a pregnancy subsequent to that when MI occurred, there were no maternal deaths [23]. The only fetal death occurred at 22 weeks, as a result of an incompetent cervix. However, the data should be evaluated cautiously, as the numbers are small and the details often are not available. A previous MI, although not an absolute contraindication to future pregnancy, carries undoubted risk.

REFERENCES