General anesthesia for caesarean delivery in a pregnant woman affected by acute myocardial infarction

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ABSTRACT. – Acute myocardial infarction rarely occurs in women during childbearing age (1:20,000), but maternal mortality rate is high (11%). Management of pregnant woman affected by myocardial infarction could be a challenge for obstetricians, cardiologists and anesthetists.

In this report, we present the management of a 36 years-old nulliparous woman affected from hypertension and dyslipidemia, who experienced acute myocardial infarction at 25th gestational week and was scheduled for caesarean delivery at 35th week.

General anesthesia for cesarean section was conducted using sevoflurane and remifentanil target controlled infusion (TCI); the patient was monitored with ECG, pulse oximetry, invasive blood pressure, haemodynamic measurement by lithium dilution cardiac output (LiDCO plus) and bispectral index.

The titrated use of remifentanil and the close control of hemodynamic parameters by LiDCO plus monitoring may contribute to improve maternal outcome and newborn well-being in the management of general anesthesia for caesarean section.

Key words:

Acute myocardial infarction, Pregnancy, Haemodynamic monitoring, LiDCO, Remifentanil TCI.

Introduction

Acute myocardial infarction (AMI) rarely occurs in women during childbearing age. Pregnancy, however, has been shown to increase the risk of AMI 3- to 4-fold[1]. Management of AMI in pregnancy could be a challenge for obstetricians, cardiologists and anesthetists, and the risk of an adverse cardiovascular event during delivery with an untreated acute coronary syndrome is high[2].

In this report, we present the management of a parturient affected from hypertension and dys-lipidemia, who experienced AMI at 25th gestational week, and was scheduled for caesarean delivery at 35th week.

Case Report

A 36 year-old nulliparous woman affected by hypertension, hypercholesterolaemia, and with a family history of cardiac disease, suffered of an anterior myocardial infarction. She was treated with percutaneous coronary angioplasty and insertion of a bare-metal stent into the left anterior descending artery (LAD). Twenty days later she experienced persistent ischemia of the interventricular septum and left ventricular apex, as well as a 70% stenosis of the circumflex artery and restenosis of LAD. A drug-eluting stent was then inserted into LAD. She was discharged after 6 days and was prescribed clopidogrel 75 mg, aspirin 75 mg, metoprolol 100 mg, telmisartan 20 mg, and rosuvastatine 20 mg daily.

The patient became pregnant 6 months later: clopidogrel and telmisartan were interrupted. At the 25th gestational week she experienced a new episode of angina at rest and dyspnoea, and presented to the Obstetric Unit. Alpha metildopa 1500 mg, aspirin 75 mg, and clopidogrel 75 mg daily were administered. A cardiac ultrasound scan showed inferior hypokinesia suggestive for necrosis, maintained systolic function and an ejection fraction of 57%. At the 35th week the patient had an hypertensive crisis (180/120 mmHg) with chest pain: an ECG revealed signs of lateral ischemia, and high troponin I value (0.4 pg/L) was found. She was treated with i.v. labetalol 100 mg, followed by infusion of 5 mg per hour. The doppler ultrasound of umbilical vessels revealed an uterine artery pulsatility index of 1.5. Then, the patient was scheduled for caesarean delivery under general anesthesia for the following day.

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The patient was monitored with ECG, pulse oximetry and invasive blood pressure. A lithium dilution cardiac output measurement (LiDCO plus, London, UK) was used for monitoring of stroke volume (SV), cardiac output (CO), and systemic vascular resistance (SVR). A bispectral index (BIS® Sensor; Aspect Medical Systems, Natick, MA, USA) was positioned to control the depth of anesthesia.

After 3 minutes pre-oxygenation, anesthesia was induced using thiopental sodium 2.5 mg/kg plus remifentanil target control infusion (TCI-Orchestra pump from Fresenius Kabi, Germany) with a target concentration of 6 ng/ml. The trachea was intubated by using a rapid sequence induction, after rocuronium 1 mg/kg. The lungs were ventilated with an inhalatory mixture of oxygen, air ($FiO_2 = 0.5$) and sevoflurane 1.2%. The target concentration of remifentanil was reduced to 4 ng/ml, while the infusion of labetalol was maintained. During the operation the heart rate decreased from 90 beats/min to 65 beats/min, the blood pressure was kept between 150/85 and 110/70 mmHg, O_2 saturation was maintained over 99%, and CO ranged from 8.5 to 5.9 L/min, SV ranged from 127 to 110 ml, SVR from 1210 to 618 dyn/s/cm^{-5} (Figure 1). As rec-

ommended BIS values were kept between 40 and 60 to reduce the risk of awareness[12]. After 7 minutes a 2915-g male baby was born (Apgar scores of 9-10 at both 1 and 5 min).

No ischaemic signs were recorded by ECG. Because of poor uterine contraction after delivery, oxytocin was administered as infusion (20 U/h). During the infusion CO increased from 7.1 to 8.5 L/min, SVR slightly decreased to 618 dyn/s/cm^{-5}. The total volume of crystalloids administered during the procedure was 1500 mL. Blood loss at the end of caesarean delivery was about 400 mL.

The remifentanil infusion was reduced to 3 ng/ml and a 5 mg morphine bolus was administered 5 minutes before the end of surgery. The patient was awakened and her trachea was extubated in the operating room. She was admitted to the Intensive Care Unit with a morphine patient-controlled analgesia pump. She was monitored for 48 hours postoperatively, without bleeding, anginal symptoms or ECG modifications. Postoperative troponin levels were < 0.2 pg/L; a cardiac ultrasound scan did not show new alterations.

At 3 months since delivery she still experienced no recurrence of angina, and a Bruce protocol exercise test was negative at high workload.

Figure 1. Haemodynamic variables trend as shown by LiDCOPlus Monitor.

Discussion

Prevalence of AMI during pregnancy and puerperium varies between 1:35,700 and 1:16,000 pregnancies[1,2]. Maternal mortality rate is 11%, fetal mortality 9%, and most fetal deaths are associated with maternal mortality[1]. Several Authors revealed a relatively high frequency of known risk factors in these patients: smoking, hyperlipidemia, family histories of myocardial infarction, hypertension, diabetes, advanced maternal age, preeclampsia-eclampsia, thrombophilia, transfusion, and post-partum infections[1,2].

There is no general consensus on the appropriate mode of delivery for pregnant patients with AMI. Gil et al[3] described a case of a pregnant patient presented with septal AMI treated with caesarean section. Smith et al[4] reported a series of 5 women with ischaemic heart disease, four of whom were submitted to caesarean delivery. According to Roth and Elkayam[1], only 10 of the 103 reviewed patients with pregnancy-related AMI delivered by cesarean section. These data, therefore, suggest that vaginal delivery can be accomplished relatively safely in the patient with AMI when measures aimed to reduce cardiac workload and oxygen demands are taken. In fact labour pain and labour-induced increase in blood pressure and peripheral vascular resistance may be controlled with epidural analgesia. Nevertheless, hypotension associated with epidural blockade is usually treated by administration of fluids, which may overload a heart with limited reserves, and by drugs with positive inotropic action that increase myocardial oxygen consumption[3]. The advantages of elective caesarean section include control of the time of delivery and avoidance of a long or stressful labour. In the case reported here, a caesarean delivery was decided, because doppler ultrasound of umbilical vessels of the foetus was altered.

Although evidence supports the use of neuraxial anesthesia with singly administered aspirin and low-molecular-weight heparin, use of clopidogrel before delivery precluded regional anesthesia in our case due to the potential risk of spinal or epidural haematoma[5,6]. Moreover, it has been shown that a decline in blood pressure >30% after regional anesthesia is usually associated with a fall in cardiac output, potentially life-threatening in a patient with critical coronary stenosis[7]. In addition, it has been suggested that sevoflurane during general anesthesia may provide a degree of myocardial protection[8].

The standard practice for general anesthesia during the caesarean delivery is to withhold opioid analgesia and to use low minimal alveolar concentrations of volatile anaesthetic until the delivery of the baby. However, this practice may cause maternal tachycardia and hypertension, both detrimental for coronary oxygenation[2,3,7,9]. The administration of remifentanil before peritoneal incision partially obtunds the neuroendocrine response to tracheal intubation and surgery with minimal neonatal depression[9,10]. To our knowledge, this is the first case which described the use of remifentanil TCI infusion for caesarean delivery. TCI allows the infusion of a calculated amount of drug. Therefore, permits a rapid and controlled adjustment of plasmatic concentration[11].

The LiDCO plus is a minimally invasive monitoring technique of CO based on a continuous arterial waveform analysis system (PulseCO) associated with a single-point lithium indicator dilution calibration system[13,14]. The lithium dose has no pharmacologic effect on the woman nor to the foetus[15]. This technique may be potentially useful and suitable for high-risk pregnant women, in order to guide therapy with fluids and vasoactive drugs[15,16]. In line with previous report[16] we also observed an increase in CO and a reduction of MAP and SVR after the administration of oxytocin. The use of oxytocin in pregnant women with cardiac disease is controversial[6]. In the present case, oxytocin was administered until uterine tonus was sufficient, in order to minimize the risk of bleeding caused by uterine atony.

Conclusions

The safe management of a parturient with coronary heart disease is challenging and there is still no general consensus on the best way to proceed. Our case suggests that the titrated use of remifentanil and the close control of hemodynamic parameters may contribute to improve maternal outcome and newborn well-being during general anesthesia for caesarean delivery.

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