

# USE OF REMIFENTANIL IN A PATIENT WITH EISENMENGER SYNDROME REQUIRING URGENT CESAREAN SECTION

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## Abstract

We describe a case of 41 yr old multigravida at 35 weeks gestation, with a diagnosis of Eisenmenger syndrome, requiring urgent Cesarean section. The parturient had signs and symptoms of respiratory distress due to high pulmonary artery pressure, and the pregnancy was complicated by preeclampsia. A general anesthetic consisting of ketamine and etomidate and an intravenous infusion of remifentanyl were used to provide stable anesthesia and analgesia for a successful delivery. The baby was delivered with high Apgar scores. The potential benefits and safety of the use of remifentanyl in parturients with high pulmonary artery pressures are discussed.

**Key Words:** Cesarean section; Eisenmenger's syndrome; remifentanyl.

## Introduction

Eisenmenger syndrome occurs when a congenital or surgically created shunt between the left and right sides of the heart causes an increase in pulmonary vascular resistance (PVR) that surpasses systemic vascular resistance (SVR) resulting in a reversal of left to right shunt to right to left shunt or bidirectional shunt. Maternal mortality rate in Eisenmenger syndrome is reported to be 50-65% with Cesarean section<sup>1,2</sup>. For successful outcome, factors that increase PVR or decrease SVR should be avoided during the anesthetic management. Together with appropriate vasoactive or inotropic drugs, opioids are useful for controlling hemodynamic fluctuations during induction of general anesthesia in cardiac patients. Unfortunately, however, opioids are generally omitted during induction of general anesthesia in patients undergoing Cesarean sections because of risk of neonatal respiratory depression.

There are a number of case reports in literature describing the successful use of remifentanyl for high-risk cardiac patients undergoing Cesarean delivery<sup>3-7</sup>. In two recent randomized, controlled, blind studies Draisci et al.<sup>8</sup> and Bouattour et al.<sup>9</sup> showed that remifentanyl ( $0.5 \mu\text{g}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ ) can be used safely during anesthesia induction without subsequent neonatal depression whilst providing stable hemodynamics in healthy elective parturients<sup>8,9</sup>.

Data in the literature are incomplete on the use of remifentanyl in parturients with high pulmonary artery pressures such as in Eisenmenger syndrome. In this case report we used remifentanyl as a part of induction and maintenance of general anesthesia in a parturient with Eisenmenger syndrome undergoing emergency Cesarean section.

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## Case Report

A 41-year-old female, 35 weeks gestation, recently diagnosed as Eisenmenger syndrome due to atrial septal defect, was admitted to our Cardiac Anesthesia Department for emergency Cesarean section due to fetal distress. She had four prior normal vaginal deliveries. During this pregnancy she was diagnosed with serious cardiac disease and preeclampsia. On admission she was dyspneic and cyanosed with clubbing. The electrocardiogram (ECG) demonstrated sinus tachycardia with right bundle branch block and non specific ST segment and T wave changes.

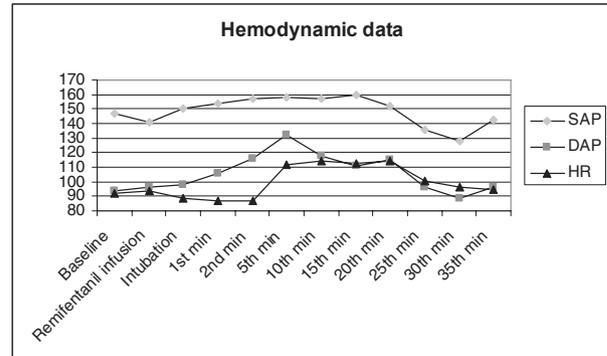
Preoperative echocardiography showed; prominent right-to-left shunt with an estimated systolic pulmonary artery pressure of 114 mmHg, ejection fraction of 48%, moderate mitral regurgitation and moderate to severe tricuspid regurgitation.

No premedication was given. On arrival to the theatre, two peripheral venous and one radial artery catheters were inserted. Oxygen saturation (SpO<sub>2</sub>) on arrival was 79% on room air and 96% after pre-oxygenation. Her baseline systemic blood pressure was 147/94 mmHg and her heart rate was 92 per min.

Induction agents were administered intravenously using, remifentanyl 0.5 µg.kg<sup>-1</sup> infused in 60 sec followed by slow boluses of ketamine 75 mg and etomidate 10 mg. Tracheal intubation and intermittent positive pressure ventilation were facilitated with suxamethonium 80 mg. Sevoflurane to an end-tidal concentration of 1.2% and remifentanyl 0.2 µg.kg<sup>-1</sup>min<sup>-1</sup> in 100% oxygen were administered for maintenance

of anesthesia. She remained cardiovascularly stable during induction and surgery (Fig. 1).

Fig. 1  
Hemodynamic data of the parturient during anaesthesia.  
SAP: systolic artery pressure (mmHg), DAP: diastolic artery pressure(mmHg), HR: heart rate (beat/min)



Baby was delivered 6 min after induction with an Apgar scores at 1<sup>st</sup> and 5<sup>th</sup> min of 7 and 9 respectively. After delivery, intravenous oxytocin 20 units was administered over 20 min. Duration of surgery and anesthesia were 27 min and 35 min respectively. Mother was extubated in the theatre and remifentanyl was discontinued after extubation. umbilical cord arterial pH was 7.4 (Table 1).

Pediatricians commented on the lack of respiratory depression in view of the opioid given to the mother and no naloxone was given to the baby. The baby was transferred to the neonatal ward for routine care and the mother was moved to the Cardiac Intensive Care for further management.

The mother's initial blood gas measurement showed hypoxemia. Her arterial oxygen saturation

Table 1  
Arterial blood gas measurements of the parturient and the newborn

	Maternal preoperative (in room air)	Maternal after intubation (100% oxygen)	Maternal after extubation (100% oxygen)	Fetal umbilical cord
Blood gases				
pH	7.47	7.43	7.39	7.40
PO <sub>2</sub> (mmHg)	36	49.5	80.6	36.1
PCO <sub>2</sub> (mmHg)	27	25.9	32.8	36.9
SpO <sub>2</sub> (%)	74	87	95.6	69.5
HCO <sub>3</sub> (mmol/L)	22	20.2	21	22.2
BE (mmol/L)	-4	-5	-4	-1.8

improved after induction and ventilation (Table 1).

Postoperative analgesia was managed with intravenous 4 mg morphine and 1 g paracetamol. Regular antibiotic therapy was continued according to microbiological advice. The mother's stay in the ICU was uneventful. Her postoperative echocardiography showed diminished and persistent right to left shunt with moderate mitral and tricuspid regurgitations. Systolic PAP was 85 mmHg. The mother was discharged to the cardiology ward the following day.

## Discussion

Although there are reports of successful use of remifentanil in Cesarean deliveries for compromised cardiac patients<sup>10</sup>, our case is the first case report describing the use of remifentanil during general anesthesia for emergency Cesarean section, in a patient with Eisenmenger syndrome. The anesthetic technique of induction and maintenance used was safe for the neonate and the hemodynamically compromised mother.

The incidence of congenital heart disease is approximately 1%. About 8% of patients with congenital heart disease and 11% of those with left-to-right intra-cardiac shunting develop Eisenmenger syndrome if untreated<sup>11</sup>.

Eisenmenger syndrome is characterized by elevated pulmonary vascular resistance and right-to-left shunting of blood through a systemic-to-pulmonary circulation connection. Patients diagnosed with Eisenmenger syndrome in adulthood, have high perioperative mortality rates<sup>1,12</sup>. Eighteen percent of anatomic defects of Eisenmenger syndrome reported by Weiss et al consisted of isolated atrial septal defects<sup>1</sup>. Our patient was diagnosed as Eisenmenger syndrome due to isolated atrial septal defect by angiography and echocardiography shortly during the third trimester of her pregnancy.

Although no randomized controlled trials comparing the safety of general and regional anesthesia for non-cardiac surgery in exist this group of patients, both techniques have been used successfully in patients Eisenmenger syndrome<sup>13,14</sup>. If general anesthesia is to be used, the anesthetic technique least likely to decrease the patient's systemic blood

pressure and vascular resistance, should be chosen because such changes increase the magnitude of right-to-left shunting and cyanosis. Many agents used for induction and maintenance of general anesthesia do depress myocardial function and reduce systemic vascular resistance<sup>15</sup>. Opioids are effective in blunting sympathetic discharges during anesthesia and surgery with minimal or no myocardial depression<sup>16,17</sup>. We decided to use ketamine together with etomidate in order to preserve peripheral vascular resistance and cause minimal myocardial depression during induction.

The main concern with opioids for Caesarean section is placental transfer. Remifentanil, a short acting opioid has similar properties to other semi-synthetic opioids in preventing maternal vasopressor responses. Remifentanil is known to be rapidly metabolized by non-specific plasma esterases, therefore it has a very short context-sensitive half life. Remifentanil has been described to provide safe anesthesia in Eisenmenger syndrome patients undergoing non-cardiac surgery<sup>13</sup>.

Although remifentanil is rapidly metabolized and/or redistributed by the newborn<sup>18</sup>, it seems not to be devoid of side effects. In a study which compared remifentanil with placebo for general anesthesia in patients undergoing Cesarean delivery, Draisci et al. demonstrated that there were significant differences in the mean Apgar score and umbilical cord pH values, indicating depression in the remifentanil group. The authors stated that neonates of remifentanil treated mothers had a greater need for resuscitation in the first minutes after birth, but no case showed evidence of prolonged insult and damage<sup>7</sup>. Recently in 2008 Palacio et al<sup>19</sup>, published the utility and safety of 1 µg.kg remifentanil bolus for hemodynamic control during cesarean section in 12 high-risk patients ineligible for spinal anesthesia. Patients were undergoing surgery because of placenta abruptio, subarachnoid hemorrhage, HELLP syndrome, or preeclampsia. Palacio encountered no cases of neonatal rigidity and there was no need for naloxone. The authors concluded that, because of potential risk of neonatal depression, remifentanil should be used selectively and the means for neonatal resuscitation should be available.

the main concern in our case, was to provide a smooth induction and stable hemodynamics for the

mother. In view of Palacio's result on and consideration of the risk/benefit ratio, remifentanyl was used, provided resuscitation measures for the newborn were available.

Earlier case reports on the use of remifentanyl for Cesarean section in cardiovascularly compromised parturients report different patient and neonatal outcomes. The remifentanyl infusion rate in the case reports varied from 0.2  $\mu\text{g}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$  to 2  $\mu\text{g}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ <sup>3-6</sup>. Wadsworth et al. used 0.5  $\mu\text{g}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$  remifentanyl for two high risk cardiac patients. First case was 36 weeks gestation, left ventricular failure due to severe aortic regurgitation with stenosis and the second case was 28 weeks gestation hypertrophic obstructive cardiomyopathy. Both neonates required short term respiratory support after delivery<sup>6</sup>. In a patient with recurrent aortic coarctation, Manullang et al. started remifentanyl infusion at 0.05 to 0.1  $\mu\text{g}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$  before induction and increased it to 0.2  $\mu\text{g}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$  for

induction. The patient was hemodynamically stable and the newborn was in excellent condition at delivery<sup>3</sup>. Likewise, no respiratory depression occurred in the baby when Scott et al. used 2  $\mu\text{g}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$  remifentanyl in a 38 weeks gestation parturient diagnosed as mixed mitral valve disease<sup>2</sup>. In our case the baby was born with excellent Apgar scores and umbilical blood gas results, despite continuing remifentanyl infusion until clamping of the cord.

Results of this and previous cases lead us to consider that remifentanyl is effective in controlling hemodynamic fluctuations during induction and maintenance of general anesthesia of parturients with Eisenmenger syndrome and high pulmonary artery pressures. Although previous reports suggest a potential requirement for neonatal resuscitation, remifentanyl may be useful in cases when maternal risk exceeds the concern of neonatal respiratory depression.

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