

Case Report

Respiratory arrest in an obstetric patient using remifentanyl patient-controlled analgesia*

J. C. Bonner¹ and W. McClymont²

1 Specialist Registrar, 2 Consultant Anaesthetist, Ninewells Hospital, Dundee, UK

Summary

Remifentanyl patient-controlled analgesia is well established in many centres and provides satisfactory pain relief for many women in labour. We describe a patient using remifentanyl patient-controlled analgesia who suffered a respiratory arrest requiring a brief period of ventilation. In our institution, remifentanyl patient-controlled analgesia has been offered to women in labour since 2009. Up to this point, we had not observed any critical incidents in over 130 patients using this mode of analgesia in our labour suite.

Correspondence to: J. C. Bonner

Email: jbonner@doctors.org.uk

**Presented in part at the Obstetric Anaesthetists' Association Annual meeting, Edinburgh, UK, May 2011*

Accepted: 26 October 2011

Case report

A 17-year-old healthy primiparous woman suffered fetal intrauterine death (IUD) at 26 weeks' gestation; diagnosis was confirmed by abdominal ultrasound. She was admitted to hospital and induction of labour was planned for the following day. Mifepristone 200 mg was given orally the same night, and the next day, misoprostol 200 µg was given per vaginam on three occasions over a 6-h period.

Labour then became well established and oral paracetamol 1 g was given at 15:35. Entonox was also administered. At 15:55 patient-controlled analgesia (PCA) with remifentanyl was requested. A 20-G intravenous cannula was sited on the dorsum of the patient's left hand, solely dedicated for use of the PCA. The remifentanyl bag was prepared as per protocol, which included adding 4 mg remifentanyl to 100 ml of 0.9% sodium chloride 0.9% resulting in a concentration of 40 µgml⁻¹; this was then delivered through a dedicated pump (BodyGuardTM 575, CME McKinley UK, Black-

pool, Lancs, UK). The PCA pump was programmed as per protocol delivering a bolus of 40 µg remifentanyl with a 2-min lockout and no background infusion. The patient's observations including pulse rate, blood pressure, respiratory rate, and pain, sedation and sickness scores were measured at 30-min intervals. Arterial oxygen saturation was measured continuously. At 17:00 it was noted that the patient was coping well with the PCA in combination with the occasional use of Entonox.

At 19:40, the intravenous cannula was resited as the patient complained of pain on use of the PCA. At 21:10, the remifentanyl bag was empty after 5 h of use. There was a delay in replacing the remifentanyl bag as the two duty anaesthetists were otherwise engaged; one was providing emergency anaesthesia in the operating theatre and the other anaesthetist was siting an epidural for labour analgesia in another delivery room. At 21:30, the patient had an urge to push. At 22:00, a new bag of remifentanyl was prepared as before and replaced by an

anaesthetist, and at 22:15 the patient was noted to appear much calmer.

At 22:20, the midwife (who had briefly left the room leaving the patient with her mother and partner) answered the patient's call buzzer, which had been activated by a family member. On entering the room, the midwife noted that the patient was sitting upright in bed, appeared blue and was unresponsive to a 'shake and shout'. The midwife herself activated the emergency buzzer, laid the patient flat and applied high-flow oxygen via a mask with reservoir, and escorted the family from the room as she sought help. A senior obstetrician, senior midwifery staff and an anaesthetist attended promptly. The anaesthetist applied a jaw thrust, which resulted in an initial gasp followed by apnoea. The patient was placed in a full left lateral position and her lungs were ventilated with oxygen using a self-inflating bag/valve/mask with a reservoir bag, and an oxygen flow set at 15 l.min^{-1} . Presence of a carotid pulse was noted. After approximately 30–40 s the patient began to move, raised her arm to push aside the jaw thrust and started breathing. She quickly recovered full consciousness and asked if she could have an epidural. The remifentanil PCA was discontinued and the equipment removed from the room. Her recorded observations immediately after the respiratory arrest included a pulse rate of $39 \text{ beats.min}^{-1}$, which quickly recovered to $59 \text{ beats.min}^{-1}$ within 2 min. The patient's blood glucose was checked using glucose reagent strips and was noted to be 6.3 mmol.l^{-1} . Vaginal delivery occurred at 22:34.

The following day, the PCA pump and the bag of remifentanil were examined by a consultant anaesthetist not involved in the patient's care. The history of drug administration in the pump's software was found to be consistent with the written record. The controlled drug cupboard stock was examined and cross-referenced against the controlled drug record book. The correct number of remifentanil ampoules were present. The pump was further examined by medical physics technicians the following day, and was deemed to be functioning properly, appearing to deliver the preset 1-ml bolus with a 2-min lockout.

Before the patient's collapse, the pump had delivered 7 ml ($40 \mu\text{g.ml}^{-1}$) over the preceding 20 min, which was consistent with the rate of use before the bag

change. The rate of use before and after the bag change was within the programmed parameters.

Discussion

Remifentanil is a synthetic phenylpiperidine and a pure μ agonist. It is a derivative of fentanyl with similar potency, but with a more rapid onset and offset of action. Remifentanil PCA has become a popular choice for labour analgesia in some centres [1, 2]. However, it must not be forgotten that side-effects such as respiratory depression, bradycardia and sedation can occur and there are reported cases of arterial oxygen desaturation [3, 4]. It remains unclear whether the remifentanil was the main factor in this critical incident, and the reason for it to occur after hours of satisfactory use is also unclear. We propose that other factors may have contributed to the situation including dehydration, exhaustion, increased pain stimulation in the second stage and the upright position of the patient. The lack of the need for fetal heart rate monitoring (because of the IUD) may have been a factor in failure to detect the effects of these problems earlier.

The patient was noted to have vomited on at least three occasions during labour, with recorded volumes of 314, 840 and 300 ml. No oral intake was documented on the fluid chart. It is possible therefore that a combination of dehydration, the upright position and the raised intra-thoracic pressure from pushing during the second stage of labour may have reduced cardiac preload and hence cardiac output. A compensatory increase in heart rate may not have occurred, or indeed there may have been bradycardia, because of the influence of remifentanil, the Valsalva effect of pushing and/or as a variant response to the increased intensity of pain in the second stage. The resultant reduced cerebral blood flow may have caused our patient to 'faint' although exhaustion and the sedative effects of remifentanil may have contributed to the reduced conscious level and the inability to compensate for the cardiovascular changes. The rapid full recovery was reassuring although events were alarming for the patient's relatives.

The patient's partner and mother were present in the room during this incident and assured staff that they did not assist in the delivery of remifentanil by pressing the button for the patient. It is unlikely that the patient had taken any non-prescription medication as she was

coping before the midwife's brief absence, and she had no history of illicit drug use.

Arterial oxygen saturation monitoring has been recommended to detect potential desaturation when using remifentanil PCA, and indeed was used in this patient. She also had the recommended 'one to one' care, although her attendant had briefly left the room. In discussion with the midwives, it is clear that where there is no live fetus, there is felt not to be the need for the same level of monitoring. Indeed, many midwives feel intrusive and try to minimise their involvement.

We propose that for any patient using a remifentanil PCA, continuous pulse and oxygen saturation monitoring should be employed with defined alarm limits set, that a constant midwifery presence be mandatory, and that all patients receive adequate fluid and electrolyte replacement throughout labour.

Acknowledgement

Published with the written consent of the patient.

Competing interests

No external funding or competing interests declared.

References

1. Blair JM, Hill DA, Fee JP. Patient-controlled analgesia for labour using remifentanil: a feasibility study. *British Journal of Anaesthesia* 2001; **87**: 415–20.
2. Hill D. Remifentanil patient-controlled analgesia should be routinely available for use in labour. *International Journal of Obstetric Anesthesia* 2009; **17**: 336–42.
3. Dourma MR, Middeldorp JM, Verwey RA, et al. A randomized comparison of intravenous remifentanil patient-controlled analgesia with epidural ropivacaine/sufentanil during labour. *International Journal of Obstetric Anesthesia* 2011; **20**: 118–23.
4. Dourma MR, Verwey RA, Kam-Endtz CE, et al. Obstetric analgesia: a comparison of patient-controlled meperidine, remifentanil, and fentanyl in labour. *British Journal of Anaesthesia* 2010; **104**: 209–15.