Clinical reports

Anesthetic management of a parturient with a diagnosis of chronic renal failure for cesarean section

Masako Otani[1,2], Haruhisa Niwa[1], and Yoshikiyo Amaki[1]

[1]Department of Anesthesiology, Jikei University School of Medicine, 3-25-8 Nishi-shinbashi, Minato-ku, Tokyo 105-8461, Japan
[2]Division of Pathology, Tokyo Medical University Hospital, 6-7-1 Nishi-shinjuku, Shinjuku-ku, Tokyo 160-0023, Japan

Introduction

The number of patients treated with hemodialysis for a long period has been increasing recently, and their quality of life must be taken into consideration. Although some women on chronic hemodialysis become pregnant, few achieve successful live births [1], and cesarean section is often performed for delivery.

Anesthesia for such patients entails many risks, such as cardiovascular instability, alteration of drug metabolism, increased gastric acid secretion, and platelet dysfunction [2]. We describe the successful management of a patient with a diagnosis of chronic renal failure for cesarean section under general anesthesia.

Case report

A 41-year-old woman had a 16-year history of hemodialysis for chronic glomerulonephritis. She was on hemodialysis three times a week. Her family history was unremarkable. She was admitted to the hospital at 8 weeks and 2 days of gestation for blood-pressure control. She had not previously given birth or been pregnant. On admission her blood pressure was 156/70 mmHg, and no abnormal changes were seen on her electrocardiogram, in spite of a systolic murmur. At 29 weeks and 4 days of gestation, uterine contraction started and she was transferred to the gynecologic ward.

From that point, she had to receive hemodialysis five times weekly. She was treated with antihypertensive agents combined with an α_1-blocker and a calcium channel blocker because her blood pressure increased from 130/70 mmHg to 230/70 mmHg. At 32 weeks and 3 days of gestation, a cesarean section was planned because loss of variability suggesting fetal distress was noted by the nonstress test. The last hemodialysis was performed 2 days before the cesarean section. Table 1 shows her laboratory data during her admission.

The operation was performed at 33 weeks and 2 days of gestation. Her weight was 50.5 kg, and her height was 152 cm. Gynecologists monitored the fetus, and his condition was not aggravated in the operating room. Premedication consisted of 0.5 mg of atropine orally 1 preoperatively. The anesthetic course is illustrated in Fig. 1. An intravenous line was established via an 18-gauge cannula in her left hand in the operating room. The patient was placed in the left lateral decubitus position, and 2 ml of dibucaine was injected into the subarachnoid space with a 23-gauge lumbar needle. Analgesia was comformed below T10 by the cold test 15 min later. After she was preoxygenated by $6 l \cdot min^{-1}$ of oxygen, rapid sequence induction with cricoid pressure was performed with 1 mg of vecuronium, 200 mg of thiamylal, and 60 mg of succinylcholine. Her lungs were mechanically ventilated until the completion of surgery. Anesthesia was then maintained with $3 l \cdot min^{-1}$ of nitrous oxide plus $3 l \cdot min^{-1}$ of oxygen combined with 1% sevoflurane. The induction-delivery time was about 3 min. After giving birth, the patient received 0.2 mg of methylergometrine maleate and 30 mg of pentazocine intravenously. Oxygen saturation measured by a pulse oxymeter was maintained at 99% during surgery. The estimated blood loss was approximately 1800 ml, including amnionic fluid, which was stained by meconium. The total amount of acetate Ringer's solution transfused was 400 ml. After surgery, the trachea was extubated in the operating room.

Table 1. Laboratory data before, during, and after surgery

Value	33 weeks 0 day	33 weeks 2 days				1 day after birth	2 days after birth
		9:00 am	10:15 am	10:45 am	12:30 am		
Blood							
Hb (g·dl^{-1})	10.9	12	11	11		10	
Ht (%)	30.2		33	32		28.9	
Plt (10^4 mm^{-3})	8						8.2
Blood chemistry							
K (mEq·l^{-1})	3.2	4.2	4.3	4.3	4.3	5.3	4.7
Na (mEq·l^{-1})	141	135	132	134	148	140	137
Blood coagulation test							
PT (%)	100<						100<
APTT (s)	30						27.5
Bleeding time (min)	4						

Hb, hemoglobin; Ht, hematocrit; Plt, platelets; PT, prothrombin time; APTT, activated partial thromboplastin time
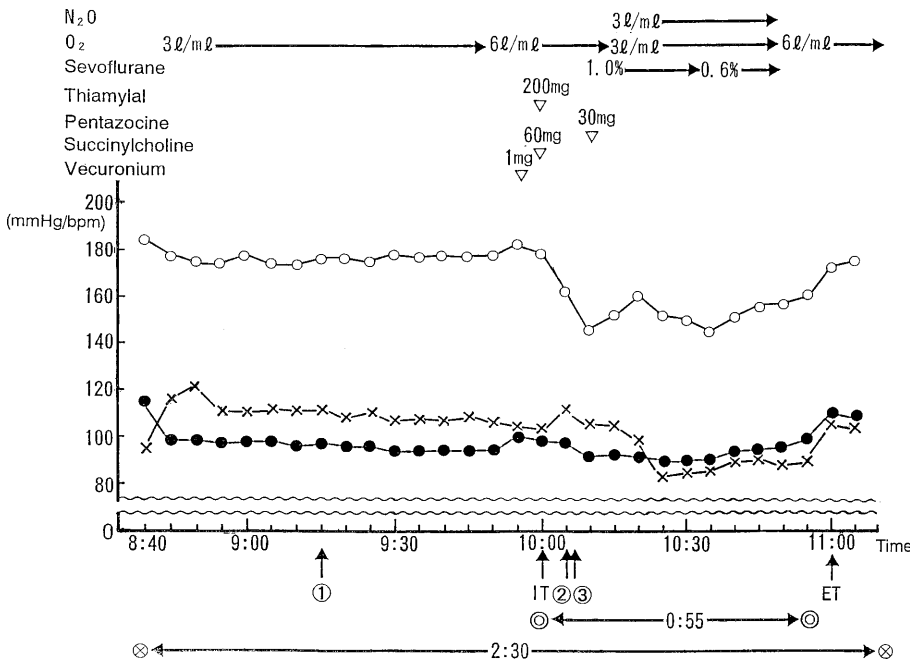

Fig. 1. Patient's hemodynamic changes during anesthesia. *Open circles*, systolic blood pressure; *closed circles*, diastolic blood pressure; *X*, heart rate; $\otimes$, anesthesia; $\circledcirc$, operation; *IT*, intubation; *ET*, extubation; ① spinal anesthesia; ② birth; ③ placenta removal

Hemodialysis was started the next day. The patient developed intraabdominal hematoma. The Apgar score of her baby was 8 points at 1 min and 9 at 5 min, and respiratory distress syndrome and hyperbilirubinemia developed.

Discussion

The number of patients receiving chronic hemodialysis in Japan is over 130 000 [3], and their quality of life is improving because of improvement in hemodialytic techniques. In women undergoing chronic hemodialy-sis, erythropoietin has improved anemia and enabled regular menorrhea, and therefore pregnancy is not con-sidered impossible [4]. However, maintenance of preg-nancy may be difficult. Serum levels of blood urine nitrogen and creatinine increase until late gestation. Thus, frequent hemodialysis may be necessary for the gestational period. Apart from the above consider-ations, conception may cause hypertension as a con-sequence of increasing circulating blood volume [5]. Twenty-five patients on chronic hemodialysis success-fully delivered infants by 1995 in Japan [4].

In cesarean section, the first choice is mainly regional anesthesia using a spinal or epidural cannula to mini-

mize the risk of fetal depression and aspiration pneumonia in the mother. With spinal anesthesia, local anesthetics, per se, have been reported to exert no influence upon the baby [6]. However, 50% to 60% of cases of spinal anesthesia experience hypotension followed by decreased uterine blood flow [7]. General anesthetics, on the other hand, are transferred to the fetus, especially barbiturates', resulting in "sleeping baby" [6,8]. Satoh et al. measured concentrations of placental transfer of inhalational agents, such as halothane, enflurane, sevoflurane, and isoflurane in patients undergoing cesarean section [9]. They reported, however, no influence on the fetus when the maximum alveolar concentration was less than 1 minimum alveolar concentration (MAC) [9], concluding that low concentrations of volatile agents are useful and acceptable for cesarean section.

In the present case, spinal anesthesia was attempted because the patient did not have a hemorrhagic tendency, but the spinal anesthesia failed technically. Hematoma was noted after surgery, possibly as a consequence of low platelet count. Atropine was administered to avoid bradycardia as a result of possible high spinal anesthesia. However, it is known that gastric motility is decreased and stomach emptying time is prolonged in pregnancy. In addition, atropine decreases gastroesophageal tone, which further increases the risk of aspiration pneumonia. An H_2-blocker and/or a prokinetic drug, such as metoclopramide, would have been a reasonable alternative.

For patients with renal failure, hyperkalemia during surgery is the main problem. Hyperkalemia is often induced by insufficient hemodialysis before surgery, acidosis, hypercapnia, hypoxemia, decreased body temperature, blood transfusion, and administration of succinylcholine [10]. Succinylcholine is known to induce $0.5–0.7\,mEq\cdot l^{-1}$ increase in serum potassium in the patients with chronic renal failure [11]. On the other hand, inhalational agents are known to decrease serum levels of potassium [11,12]. In our case, although succinylcholine was used for rapid sequence induction, the potassium level did not increase significantly. However, vecuronium may have been a better choice in a patient with chronic renal failure with possible hyperkalemia. If vecuronium was to be used for rapid sequence induction, a minimal effective dose of $0.15\,mg\cdot kg^{-1}$ would be necessary [13].

We restricted the total amount of fluid, considering the refilling after surgery. Although volume control in patients with chronic renal failure may be achieved easily by postoperative hemodialysis, it is better not to perform hemodialysis soon after surgery to avoid bleeding tendency. However, we must also consider hypotension after spinal anesthesia was attempted. The crystalloid transfusion free of potassium combined with administration of pressor agents must be useful to avoid hypotension in such a patient.

In conclusion, we used general anesthesia for cesarean section in a patient with chronic renal failure on hemodialysis with minimal fluctuations of serum potassium concentrations.

References

1. Nageotte MP, Grundy HO (1998) Pregnancy outcome in women requiring chronic hemodialysis. Obstet Gynecol 72:456–458
2. Tighe KE, Smith ID, Bogod DG (1995) Caesarean section in chronic renal failure. Eur J Anesthesiol 12:185–187
3. Ishikawa H, Kawano I (1996) Problems on pregnancy and labor of patients with chronic hemodialysis (in Japanese). Rinsho-Touseki (Jpn J Clin Dialysis) 12:459–463
4. Sakai R (1996) Questionnaire data to patients with chronic hemodialysis (in Japanese). Rinsho-Touseki (Jpn J Clin Dialysis) 12:411–418
5. Cheek TG, Gutshe BB (1987) Maternal physiologic alterations during pregnancy. In: Shnider SM, Levinson G (eds) Anesthesia for obstetrics. Williams & Wilkins, Baltimore, 1987, pp 3–13
6. Kazushige M (1991) Placental transfer and fetal virulence of drugs (in Japanese). Rinsho-Masui 15:984–992
7. Asada A (1991) Anesthesia for pregnant women on non-obstetrical surgery (in Japanese). Rinsho-Masui 15:978–983
8. Warren TM, Datta S, Osteimer GW, Naulty JS, Weiss JB, Morrison JA (1983) Comparison of the maternal and neonatal effects of halothane, enflurane and isoflurane for cesarean delivery. Anesth Analg 62:516–520
9. Satoh D, Iwatsuki N, Naito M, Sato M, Hashimoto Y (1995) Comparison of the placental transfer of halothane, enflurane, sevoflurane and isoflurane during cesarean section. J Anesth 9:220–223
10. Yukioka H, Fujimori M (1993) Plasma potassium concentrations during N_2O-enflurane anesthesia in patients on chronic hemodialysis (in Japanese with English abstract). Masui (Jpn J Anesthesiol) 42:402–405
11. Koide M, Waud BE (1972) Serum potassium concentrations after succinylcholine in patients with renal failure. Anesthesiology 36:142–145
12. Stovner J, Endersen R, Bjelke E (1972) Suxamethonium hyperkalaemia with different induction agents. Acta Anaesthesiol Scand 16:46–50
13. Silverman SM, Culling RD, Middaugh RE (1990) Rapid-sequence orotracheal intubation: a comparison of three techniques. Anesthesiology 73:244–248