Use of desflurane during resection of phaeochromocytoma


SUMMARY

A patient underwent elective removal of a phaeochromocytoma producing extremely high plasma concentrations of catecholamines. The new volatile agent, desflurane, was incorporated, in varying concentrations, into the general anaesthetic regimen. (Br. J. Anaesth. 1994; 72: 707-709)

KEY WORDS


Patients with a phaeochromocytoma have been anaesthetised successfully with many different anaesthetics, including enflurane [1], halothane [2], nitrous oxide together with an opioid [3] and isoflurane [4]. We report our initial experience with the new anaesthetic agent, desflurane. To our knowledge, this is the first case report in which desflurane was administered to a patient with a phaeochromocytoma producing extremely high plasma concentrations of catecholamines. We have demonstrated that desflurane may be used to control hypertensive surges in patients with phaeochromocytoma and that its tendency to sympathetic activation appears to have little clinical relevance in this setting.

CASE REPORT

The patient was a 34-yr-old Caucasian female who was in excellent health until she was noted to have elevated arterial pressure (190/110 mm Hg) during a routine gynaecology appointment in August 1992. She denied any knowledge of familial hypertension. Initial evaluation disclosed normal renal function and the hypertension was thought to be related to oral contraceptive medication which was discontinued without effect. She was given felodipine, a calcium channel blocker, which lowered arterial pressure to 120/84 mm Hg, but she became pregnant and the hypertension worsened (136/92 mm Hg) and the patient was given nifedipine. At the 27th week of pregnancy, gestational diabetes was noted followed by increasingly refractory hypertension (200/110 mm Hg), prompting a tentative diagnosis of pre-eclampsia. She was admitted to hospital and was treated with magnesium sulphate i.v. Intermittent hypertension persisted and the patient was induced, but not successfully, in the 32nd week of pregnancy for presumed evolving eclampsia. She had a Caesarean section under spinal anaesthesia with no complications. She did not manifest a malignant hypertensive episode during the operation and her gestational diabetes resolved.

Subsequent to an uneventful delivery, intermittent hypertension (205/108 mm Hg) persisted with occasional palpitations while she was being treated with several antihypertensive regimens. Biochemical measurements revealed total serum concentration of catecholamines of 17550 pg ml⁻¹ and a noradrenaline concentration of 16700 pg ml⁻¹ (normal 110-700 pg ml⁻¹). Serum concentration of dopamine was 850 pg ml⁻¹ (normal < 85 pg ml⁻¹). Urinary excretion of noradrenaline was 1696 pg/24 h (normal 11-86 pg/24 h), adrenaline < 2 pg/24 h (normal < 15 pg/24 h) and dopamine 358 pg/24 h (normal 100-440 pg/24 h). Measurement of plasma concentrations of catecholamines were repeated and found to be as follows: adrenaline 36 pg ml⁻¹ (normal < 50 pg ml⁻¹) and noradrenaline 13092 pg ml⁻¹ (normal 250-658 pg ml⁻¹). Subsequently a regimen of phenoxybenzamine 10 mg orally and metyrosine 250 mg orally was commenced and the patient maintained an arterial pressure of approximately 130/80 mm Hg. Just before surgery, the patient was receiving a dose of phenoxybenzamine of 50 mg daily and metyrosine 2.0 g daily. An MRI scan disclosed a tumour in the right adrenal gland of approximately 6 x 4 cm.

On the day of surgery, the patient received hydrocortisone 0.2 mg i.m. and diazepam 10 mg orally, 1.5 h before surgery. She arrived in the operating room comfortably sedated at approximately 07:30. The following monitoring systems were applied: Hewlett-Packard ECG (model No. 56), Nellcor pulse oximeter (Model No. NC 100), nerve stimulator and a non-invasive arterial pressure cuff. A Swan–Ganz catheter was placed via the right subclavian vein. Fentanyl 50 µg i.v. had been administered to provide additional sedation at 07:20 before cannulation of the left radial artery under local anaesthesia. Oxygen 8 litre min⁻¹ was given via a face mask during this period. At this time, arterial pressure was approximately 150/80 mm Hg.

Maurice Lippmann, M.D., Michael Ford, M.D., Chingmuh Lee, M.D., Richard Ginsburg, M.D., Wayne Foran, M.D. (Department of Anaesthesiology); William Raum, M.D. (Department of Medicine (Endocrinology)); Stanley Klein, M.D. (Department of Surgery); Harbor-UCLA Medical Center, 1000 West Carson Street, Torrance, California 90509, U.S.A. Accepted for Publication: January 20, 1994.
155/80 mm Hg, heart rate 79 beat min⁻¹ and ventilatory frequency 20 b.p.m. The Swan–Ganz catheter was connected to the Hewlett-Packard monitor and initial baseline variables were as follows: central venous pressure (CVP) 12 mm Hg, mean cardiac output (CO) 8.2 litre min⁻¹ and pulmonary arterial pressure (PAP) 26/17 mm Hg. Pulmonary capillary wedge pressure (PCWP) was unobtainable because of inability to wedge the catheter.

At approximately 08:15, vital signs were stable with arterial pressure 110/60 mm Hg, heart rate 78 beat min⁻¹ and oxygen saturation 100%. Fentanyl 50 µg i.v. was given and anaesthesia was induced with thiopentone 200 mg i.v., vecuronium 6 mg i.v. and 50% nitrous oxide in oxygen. Desflurane 3% (inspired concentration) was commenced. When adequate neuromuscular block was present, lignocaine 100 mg i.v. was given and arterial pressure after intubation decreased to 70/40 mm Hg and heart rate increased to 115 beat min⁻¹. Ephedrine 5 mg i.v. was given to increase arterial pressure and esmolol 10 mg i.v. to decrease tachycardia. Desflurane was discontinued and Plasma-Lyte 500 ml was infused rapidly. Arterial pressure increased to 110/60 mm Hg and heart rate decreased from 115 to 80 beat min⁻¹ in 20–30 s. When vital signs were judged to be stable, 3% desflurane was commenced. Surgical incision was made at 08:45. Vital signs were: arterial pressure 110/70 mm Hg and heart rate 80 beat min⁻¹. At 09:30 the patient had a urine output of 80 ml, CVP of 10 mm Hg and PAP of 28/18 mm Hg. The concentration of desflurane was increased from 3 to 4% and i.v. fluid replacement was provided with Hetastarch for intravascular expansion. Fentanyl, in 50-µg increments, was given i.v. periodically. Manipulating the tumour caused an increase in arterial pressure from 110/70 to 140/85 mm Hg and the inspired concentration of desflurane was increased from 4 to 5%, causing a decrease in arterial pressure to 125/80 mm Hg. The increased arterial pressure which occurred each time the surgeons attempted to ligate the vessels to the tumour was controlled easily by increasing the concentration of desflurane from 3 to 5%. Occasionally, the concentration of desflurane was increased to 6%, if the changes in arterial pressure increased to more than 140 mm Hg (systolic).

The patient remained stable until 11:30, at which time the surgeon attempted to remove the tumour, causing an increase in pressure from 120/90 to 190/120 mm Hg and an increase in heart rate from 80 to 110 beat min⁻¹. The concentration of desflurane was increased from 5 to 8% and arterial pressure returned slowly back to baseline (120/80 mm Hg); the concentration of desflurane was then decreased to 3%. No other drugs were administered during this acute hypertensive episode. During all transient episodes of hypertension, there were no cardiac arrhythmias. After the tumour was excised, the concentration of desflurane was decreased from 3 to 2% without any further changes. Subsequent management of the patient and recovery from anaesthesia were uneventful and the patient was taken to the post anaesthesia care unit (PACU) in a stable condition, rousable and responsive to command; here she had an arterial pressure of 183/114 mm Hg, heart rate 114 beat min⁻¹ and PAP 21/4 mm Hg. We had expected to see hypotension because of decreased concentrations of catecholamines, although these increases in arterial pressure and heart rate may have been because of postoperative pain and she was given morphine 2 mg i.v. An infusion of sodium nitroprusside 1 µg kg⁻¹ min⁻¹ was commenced and labetalol 20 mg i.v. was also given. These interventions decreased arterial pressure to 121/86 mm Hg, heart rate to 90 beat min⁻¹ and PAP to 19/2 mm Hg. The infusion was discontinued after 15 min and arterial pressure was stable at 120/80 mm Hg (heart rate 88 beat min⁻¹) for the 2-h stay in the PACU.

**DISCUSSION**

Correct preoperative preparation of a patient with pheochromocytoma is important. Volume expansion, administration of an alpha adrenergic blocking agent, such as phenoxybenzamine or prazosin for 7 to 14 days before surgery, not only restores plasma volume but also controls hypertension and minimizes fluctuations in arterial pressure during induction of anaesthesia and throughout surgery. Raum [5] suggested that the combination of metyrosine with phenoxybenzamine had important advantages: good control of hypertension could be obtained with a lower dose of phenoxybenzamine and postoperative hypotension was diminished partly by the short duration of action of metyrosine. Phenoxybenzamine, used alone, antagonizes both pre- and postsynaptic alpha receptors and blocks reuptake also. These actions enhance neuronal release of catecholamines and may produce tachycardia from unopposed beta adrenergic stimulation. By adding metyrosine, which reduces the content of catecholamines in both the tumour and sympathetic neurons, reflex tachycardia is attenuated.

It is often desirable to use an anaesthetic agent that suppresses ventricular ectopic beats associated with endogenous release of catecholamines. The use of metyrosine may minimize this requirement by reducing outflow of catecholamines. Isoflurane does not sensitize the human heart to adrenaline, but desflurane may do so as it has a propensity to activate the sympathetic nervous system and its use must be weighed carefully against this risk.

Helman and colleagues [6] suggested that desflurane was safe during maintenance anaesthesia in cardiac patients. We did not use large concentrations of desflurane and high-dose opioids were not indicated. In our patient, we did not detect any ischaemic episodes on the ECG during induction or maintenance of anaesthesia, despite increased plasma concentrations of catecholamines and several episodes of hypertension. Any increase in arterial pressure was easy to control by manipulating the concentration of desflurane up or down. We did not observe hypertension or increased heart rate, except for that caused by manipulation of the tumour. It has been observed that desflurane itself may cause hypertension and tachycardia. Eger [7] suggested that by causing sympathetic activation, larger concentrations of desflurane may increase heart rate and
increases in the concentration of desflurane may transiently increase both heart rate and arterial pressure. Yli-Hankala and colleagues [8] have also shown that sudden increases in isoflurane concentration are associated with a transient but clinically significant increase in heart rate, arterial pressure and noradrenaline concentration.

In anaesthetizing patients with desflurane for excision of phaeochromocytoma, the following should be noted. (1) Desflurane shares many of the characteristics of isoflurane. Its propensity for sympathetic nervous system activation may be thought to contraindicate its use in phaeochromocytomas. Ebert and Muzi [9] have demonstrated recently how desflurane, in concentrations of 1.0–1.5 MAC, causes significant sympathetic stimulation, a property which could be highly undesirable in the presence of this pathology. (2) Our patient had a successful outcome, partly because of the use of varying (and occasionally high, albeit briefly) concentrations of desflurane to treat haemodynamic changes. We must emphasize, however, that successful outcomes are dependent more on preoperative preparation than choice of anaesthetic technique. Our patient was well prepared for surgery, using the combination of volume replacement, alpha block and metyrosine, an agent which reduces biosynthesis of catecholamines, often to normal levels; all of these were continued to the morning of surgery. (3) It is the unprepared (i.e. lack of adequate alpha block) patient who is most at risk. If desflurane enhances the catecholamine surges which tend to occur at specific stages during phaeochromocytoma surgery (intubation, incision, tumour handling, etc.), this agent should probably not be used in the unprepared (i.e. unblocked) patient with phaeochromocytoma.

REFERENCES