Anesthetic Management of Combined Caesarean Section and Pheochromocytoma Removal

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Pheochromocytoma still remains one of the anesthetic challenges of today and the anesthetic management for removal of this tumor will continue to receive much attention. Hypertension is not only the main clinical problem in pheochromocytoma but also presents a major problem in pregnancy. Pheochromocytoma during pregnancy is very rare[1]. This tumor is life-threatening if no antepartum diagnosis is made, while antepartum diagnosis reduces maternal mortality. However, the impact of pheochromocytoma on the fetus is equally ominous and the mortality almost as high, even if the diagnosis is made during pregnancy[2]. The anesthetic management of pheochromocytoma in nongravid patients has been well documented[3,4]. However, there are additional factors that must be addressed in dealing with pregnant patients who have this tumor, such as the effect of drugs and anesthetic agents on the fetus[1]. We present a case in which a combined Caesarean section and removal of pheochromocytoma was undertaken during the 30th week of pregnancy.

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Case Report

A 27-year-old woman was admitted in the 26th week of her second pregnancy due to the sudden onset of headache, flushing and dizziness. Her previous pregnancy, 2 year prior to admission, had been uncomplicated. She had been normotensive in our maternity clinic since the 8th week of pregnancy.

At the time of admission, arterial pressure was 130/80 mmHg, but paroxysmal hypertension (260/100 mmHg) was noted. Screening tests, e.g. for blood count, urinary protein, and electrolytes, showed no special finding. An abdominal ultrasound scan showed a left adrenal mass leading us to suspect the possibility of a pheochromocytoma. A magnetic resonance imaging (MRI) scan confirmed that the left adrenal gland was the sole tumor site and there was no evidence of malignancy. The diagnosis of a norepinephrine-secreting type phaeochromocytoma was made by increased plasma concentrations of norepinephrine, as shown in table 1.

Prazosin was started at 3 mg daily and progressively increased to 7 mg daily. Arotinolol at a dose of 20 mg daily was administered 10 days after starting prazosin. Paroxysmal hyper-

Table 1. Plasma concentration of epinephrine and norepinephrine

		nomarl range	3rd day of admission	
Blood pressure	(mmIlg)		130/70	220/110
Epinephrinc	($ng \cdot ml^{-1}$)	0.12 or less	0.17	0.22
Norepinephrine	($ng \cdot ml^{-1}$)	0.06–0.45	10.27	14.06

Table 2. Changes in hemodynamic data

	Before op	During op		After op	
		tumor manipulatin	tumor removal	1st day	2nd day
BP	121/49	182/82	104/61	108/58	120/74
HR	77	90	87	89	98
CO	5.2	6.1	8.7	7.7	8.5
WP	2	–	0	–	10

BP; Blood pressure (systolic/diastolic, mmHg), HR; Heart rate (beat/min), CO; Cardiac output (liter/min), WP; Pulmonary capillary wedge pressure (mean, mmHg), op; Operation

tension was controlled with nifedipine and with phentolamine at times.

Fetal heart tones were stable at 140 to 160 bpm from the time of admission. However, fetal heart tones showed intermittent decreases and day by day, some deceleration was observed. Furthermore the occurrrence of paroxysmal hypertension became more often. It was therefore decided to conduct a combined Caesarean section and tumor excision 29 days after admission (the 30th week of pregnancy). A 7-french gauge thermodilution catheter was used to cannulate the pulmonary artery via the left subclavian vein. During insertion of the pulmonary artery catheter, systemic arterial pressure increased. Hemodynamic data during operating room procedures are summarized in table 2. Following a rapid sequence induction of anesthesia with intravenous administration of thiamylal 400 mg, vecuronium 4 mg, and lidocaine 100 mg, orotracheal intubation was performed. Blood pressure increased to 240/135 mmHg, quickly settling after a bolus of phentolamine. Ventilation was controlled and anesthesia was maintained with 50% nitrous oxide in oxygen. A 1604g female infant was delivered 4 min after induction with Apgar scores of 8 and 9 at 1 and 5 min, respectively. She was transferred to the neonatal unit and was discharged 64 days after delivery.

General anesthesia was maintained with enflurane and 66% nitrous oxide in oxygen for the tumor excision. Neuromuscular block was facilitated with vecuronium. Estimated blood loss was approximately 550 ml during the whole surgical procedure. Blood pressure fluctuations during tumor manipulation and dissection were controlled using bolus injections of phentolamine. The tumor adjacent to the left adrenal was removed entirely. Following tumor removal, systolic arterial blood pressure fell temporarily from 130 mmHg to 70 mmHg, but was reversed by administration of 600 ml of blood and 0.3 mg of norepinephrine. During the 3 hrs and 16 min procedure, 3650 ml of lactated Ringer's solution was infused with a urine output of 1000 ml. The patient was extubated in the operating room. After the surgery, antihyper-

tensive drugs were discontinued. The patient was discharged on the 14th day following surgery.

Discussion

Preoperative alpha-adrenergic blockade has been used widely with reduced surgical morbidity and mortality in patients with pheochromocytoma[1-5]. Prazosin, which is a selective alpha-1 competitive adrenergic blocking agent, has also been used successfully[3,4,6,7] and was used in this case. This drug has the advantage of allowing released norepinephrine to exert negative feedback. Therefore, the release of norepinephrine is inhibited and tachycardia is moderate or absent. Arotinolol is one of the drugs with both an alpha and beta blocking activity such as labetalol. Since the ratio of the alpha- and beta- blockade potency is approximately 1:8, the beta effects predominate[8]. Nifedipine is a calcium channel blocker that inhibits the transmembrane influx of calcium into smooth muscle. Calcium channel blocking agents such as nifedipine have been quite efficacious in the treatment of acute hypertension with toxemia[9,10] and has been shown to block cardiovascular responses to catecholamine surges[3]. Nifedipine therefore was also administered to our patient.

It has generally been reommended that if diagnosis is made late in pregnancy, the patient should be medically controlled until fetal maturity. The patient should then undergo Caesarean section and excision of the tumor in one operation[5]. Hewever, this patient showed marked blood pressure fluctuations even after pretreatment with antihypertensive drugs and the fetal biophysical profile showed some acute decelerations at the 29th day of admission (the 30th week of pregnancy). We presumed this was due to compression of the tumor by fetal motion. It was decided to immediately combine Caesarean section and tumor removal, although fetal maturity was insufficient.

Recently, the use of epidural block has been advocated since it interrupts the innervation of the adrenal gland and obtunding neurogeic stimulation of the tumor[11,12]. However, this technique remains controversial[3]. Postsynaptic alpha-adrenergic receptors can still respond directly to sudden increases in circulating catecholamines. A specific disadvantege of this technique is the absence of sympathetic nervous system response to hypotension after tumor removal. Since pharmacological protection from catecholamine excess with preoperative therapy may still be insufficient in this patient, we presumed that blood volume was still decreased. Therefore, general anesthesia was employed in our patient with consideration of achieving a safe operation.

When general anesthesia is employed, as recently reviewed by Hull[3] and Marschall[4], 1. Drugs that release histamine such as morphine, curare, metocurine and atracurium must be avoided, 2. Drugs that are vagolytic or sympathomimetic such as atropine pancuronium and, gallamine must be avoided, 3. Drugs that sensitize the myocardium to catecholamine such as halothane should be avoided, and 4. Drugs that have been reported to cause pressor responses in patients with pheochromocytoma such as droperidol, tricyclic antidepressants, chlorpromazine, glucagon, metaclopramide and ephedrine must be avoided. Furthermore, succinylcholine may stimulate sympathetic ganglia and also provoke catecholamine release from the tumor by muscle fasciculation[3,4], although succinylcholine has been used for intubation in literature[1,7]. Thus, we chose to induce anesthesia with thiamylal, do a neuromuscular block with vecuronium, and maintain anesthesia with enflurane and nitrous oxide.

Laryngoscopy and intubation may also compromise uterine blood flow and increase circulating norepinephrine[13]. Intravenous administration of lidocaine has been used at induction to prevent this reflex[14]. Since it was essential to avoid acute fluctuation in cardiovascular function in our patient, we employed this technique. Lidocaine may not only attenuate blood pressure responses to intubation of the trachea, but also may reduce the likelihood of cardiac dysrhythmias. In this case, however, intravenous administration of lidocaine might have prevented dysrhythmia, but failed to prevent an increase in blood pressure at induction.

In summary, combined Caesarean section and pheochromocytoma removal during the 30th week pregnancy was successfully performed under general anesthesia. Surgical pretreatment was conducted with oral prazosin and nifedipine. Peri-operative management enabled maintenance of the patients in a good condition in a relative stable hemodynamic state. Post-operatively, both mother and baby followed a stable course.

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