



## OLGU SUNUMU/CASE REPORT

# Anesthetic management of a child undergoing bilateral laparoscopic adrenalectomy

## Bilateral laparoskopik adrenalectomi yapılan çocukta anestezi yaklaşım

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### Abstract

Pheochromocytoma is a rare catecholamine secreting neuroendocrine tumor in children. It is usually localized unilaterally in adults but often bilaterally in children. The symptoms are variable related to the level of secreted catecholamine. The most common symptoms are hypertension, tachycardia and headache. Beta blockers, alcohol consumption, injection of contrast substance and surgical procedures may lead to attacks. The most effective treatment is surgical resection. In recent years, laparoscopic surgery has been more preferred. Anesthetic management is very important in this cases. Especially, sudden hemodynamic changes may be observed during laparoscopic adrenalectomy. In our case, the control of hemodynamic changes with esmolol and norepinephrine infusion were discussed during bilaterally laparoscopic adrenalectomy in a 14-year old child with pheochromocytoma.

**Key words:** Pheochromocytoma, laparoscopy, child, esmolol, norepinephrine.

### Öz

Feokromasitoma, çocukluk çağında nadir görülen ve katekolamin salgılayan nöroendokrin bir tümördür. Erişkinde genellikle tek taraflı yerleşim gösterirken çocuklarda sıklıkla çift taraflıdır. Salgıladığı katekolamin miktarına bağlı olarak semptomlar değişkenlik gösterir. En sık görülen semptomlar; hipertansiyon, taşikardi ve baş ağrısıdır. Beta bloker kullanımı, alkol tüketimi, contrast madde enjeksiyonu ve cerrahi girişim atakları tetikleyebilir. Tedavisi cerrahidir ve son yıllarda laparoskopik yaklaşım daha fazla tercih edilmektedir. Bu olgularda hemodinamik değişiklikler nedeniyle anestezi yönetimi oldukça önemlidir. Özellikle laparoskopik adrenalectomi sırasında ani hemodinamik değişiklikler gözlenebilir. Olgumuzda, feokromasitoma nedeniyle bilateral laparoskopik adrenalectomi planlanan 14 yaşında erkek çocukta cerrahi sırasında gelişen hemodinamik değişikliklerin esmolol ve norepinefrin infüzyonu ile kontrolü tartışılmıştır.

**Anahtar kelimeler:** Feokromasitoma, laparoskopi, çocuk, esmolol, norepinefrin

## INTRODUCTION

Pheochromocytoma is the most common tumor of sympathetic nervous system localized either in the adrenal gland or extra-adrenal<sup>1</sup>. In generally, it is observed in adults and localized unilaterally. However, it is rare and often bilaterally in children. It may be isolated, sporadic or associated with some inherited diseases such as multiple endocrine neoplasia type-2 (MEN 2), von Reclinghausen, Sturge Weber and von Hippel-Lindau disease.

General symptoms are hypertension, tachycardia, headache, palpitations, sweating, orthostatic hypotension related to the level of secreted catecholamine<sup>2</sup>. Magnesium sulfate, sodium nitroprusside, sodium nitroglycerin,  $\alpha$ -blockers, calcium channel blockers and  $\beta$ -blockers are often used to provide hemodynamic stability<sup>2-5</sup>.

The most effective treatment is surgical resection. The anesthetic management is extremely important due to hemodynamic fluctuations. Laparoscopic adrenalectomy was first reported by Ganger et al in 1992. It is a safe and effective approach for the

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treatment of pheochromocytoma although technical difficulties may limit the success especially in small children<sup>3</sup>. Laparoscopic adrenalectomy allows reduction of hospital costs, shorter hospital stay, decreases analgesic requirement compared with open technique<sup>4</sup>. We reported our anesthetic management in 14-year-old boy during laparoscopic adrenalectomy. Our aim is to emphasize the anesthetic management of a child with pheochromocytoma.

## CASE

A 14-year-old boy, weighing 42 kg, had a history of headache, nausea, vomiting, weakness, dyspnea and cold sweating. Physical examination revealed hypertension (170/100 mmHg), sinus tachycardia (92 beats min<sup>-1</sup>) and systolic murmur (1/6). The patient was on nifedipine, captopril, doxazosin 4 mg daily and carvedilol 6 mg twice a day for the relief of symptoms preoperatively. Urinary vanillylmandelic acid levels were 34.2 mg 24 h<sup>-1</sup> and other laboratory parameters were within normal limits. First degree aortic insufficiency and bicuspid aorta were showed by echocardiography. Abdominal magnetic resonance imaging showed masses in both sides (39x33x46 mm in the left and 33x29x36 mm in the right adrenal gland).

The patient was scheduled for the bilateral laparoscopic excision of the masses. After written informed consent was obtained from his parent, the patient was premedicated with midazolam and ranitidine intravenously (iv) 30 min before surgery. First intravenous access was applied under local anesthesia with lidocaine-prilocaine cream. Standard monitoring including electrocardiography (ECG), pulse oximetry and noninvasive blood pressure (NIBP) was applied. Anesthesia was induced with 5 mg kg<sup>-1</sup> pentothal sodium, 0.1 mg kg<sup>-1</sup> vecuronium bromide and 0.1 mg kg<sup>-1</sup> morphine sulfate. Anesthesia was maintained with 1.5-2% sevoflurane in O<sub>2</sub>-air mixture and bolus doses of vecuronium bromide was used when needed. Right radial artery and right jugular vein catheter were placed. Laparoscopic surgery was applied in the left side. Pneumoperitoneum was standardized at 12 mmHg. When the mass was being touched, the arterial pressure increased (160/110 mmHg). We administered sodium nitroglycerin infusion 0.5-2 µg kg<sup>-1</sup> min<sup>-1</sup> but we could not control the arterial blood pressure and we started esmolol infusion (500 µg kg<sup>-1</sup> min<sup>-1</sup> loading,

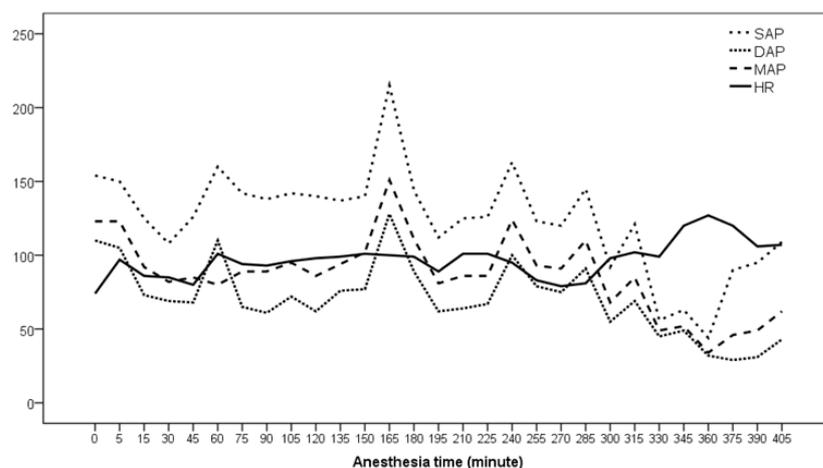
200 µg kg<sup>-1</sup> min<sup>-1</sup> for maintenance). Hemodynamia remained stable with esmolol infusion until the end of the left adrenalectomy and esmolol infusion was stopped after removing the mass.

In the right side, esmolol infusion was used to control hypertension again. The mass was observed to be very near the vena cava inferior after beginning of laparoscopy. During surgery, arterial blood pressure decreased suddenly (63/49 mmHg). We stopped esmolol infusion and we observed serious bleeding in surgical field due to vascular injury. Laparoscopy was converted to open surgery via right subcostal incision. Two units of erythrocyte suspension and 500 mL<sup>-1</sup> colloid were given to the patient and hemodynamic control was provided with the fluid resuscitation. The mass was removed totally, but the arterial blood pressure was observed to be 51/40 mmHg after removing the mass. We infused additional 250 mL<sup>-1</sup> Ringer Lactat to increased fluid infusion rate (15 mg kg<sup>-1</sup> h<sup>-1</sup>) and started dopamine infusion (10 µg kg<sup>-1</sup> min<sup>-1</sup>). However fluid resuscitation and dopamine were not effective to control of hypotension. Norepinephrine infusion (1 µg kg<sup>-1</sup> min<sup>-1</sup>) was added to dopamine infusion. Hemodynamic parameters are shown at Fig 1.

The surgery was ended at 405th minutes and 2-15 mL kg<sup>-1</sup> h<sup>-1</sup> Ringer Lactate, totally 3200 mL, were infused to the patient during surgery. Urine output was 800 mL, totally. Arterial blood gas analysis and blood glucose levels remained within normal limits (Table 1). We terminated vasoactive drugs by reducing until the end of the surgery. The patient was extubated after residual neuromuscular block was reversed with neostigmine (0.05 mg/kg) and atropine (0.015 mg/kg) and postoperative analgesia was provided with iv 15 mg kg<sup>-1</sup> paracetamol. The patient was discharged from the hospital without any problems at 6 days after surgery.

## DISCUSSION

Hemodynamic fluctuations are most frequently encountered problems in the patients with pheochromocytoma. The main objectives of preoperative medical therapy are to provide optimal blood pressure and heart rate. In our case, blood pressure was stabilized with nifedipine, captopril, doxazosin and carvedilol before surgery.



**Figure 1. Peroperative changes in hemodynamic parameters.**

0: before induction, 5 min: after intubation, 45 min: surgery started, 60 min: nitroglycerine infusion started, 165 min: nitroglycerine infusion stopped and esmolol infusion started, 195 min: esmolol infusion stopped, 240 min: esmolol infusion started, 300 min: esmolol infusion stopped, 345 min: dopamine infusion started, 360 min: noradrenalin infusion started, 390 min: noradrenalin stopped, 405 min: dopamine stopped, after extubation; SAP: Systolic arterial pressure, DAP: Diastolic arterial pressure, MAP: Mean arterial pressure, HR: Heart rate.

**Table 1. The patients' arterial blood gas analysis and CVP values**

	0th min	60th min	120th min	180th min	240th min	300th min	360th min	420th min
PaO <sub>2</sub> (mmHg)	112	189,6	262,1	261,3	259	243,5	259,1	268,8
PaCO <sub>2</sub> (mmHg)	38,7	38	40,6	40,9	40,5	42,8	39	40,4
pH	7,39	7,340	7,38	7,38	7,38	7,35	7,34	7,33
BE(mmol/L)	-1,8	-1,7	-1,7	-1	-1,7	-2,3	-5	-4,5
Hct(%)	30,5	30,4	29,4	29,5	26,6	26,9	22,7	25,7
Hb (g/dL)	8,9	8,9	8,6	8,6	8,1	8,1	7,5	8,7
HCO <sub>3</sub> (mmol/L)	21,8	22,9	22,9	23,4	22,9	22,4	20,2	20,7
CVP (mmHg)	11	10	12	12	10	14	3	9

Tracheal intubation, surgical stimulus and manipulation may cause catecholamine release. Excessive catecholamine surges can lead to hypertensive crisis, stroke, cardiomyopathy and arrhythmia<sup>2</sup>. Anxiolytic agents may be beneficial to reduce preoperative stress. We applied midazolam to our patient for premedication but we did not perform epidural catheterization because the parent refused it. Pentothal sodium can be used safely for anesthesia induction and opioids may be added<sup>2</sup>. Sevoflurane is one of the most preferred inhalation agent have a good hemodynamic profile<sup>6,7</sup>. We used pentothal sodium for anesthesia induction and we preferred morphine as opioid to provide intraoperative hemodynamic stabilization. We did not observe hypertensive response after intubation.

Generally, intraoperative hypertensive episodes are treated by antihypertensive drugs and increasing the depth of anesthesia. Antihypertensive agents may be used alone or combination according to the severity of clinical situation. Sodium nitroglycerin is often used for hypertensive episodes but it may be insufficient as in our case. Esmolol has a ultra-short elimination half-life and it may be particularly advantageous due to this characteristic. In several studies, esmolol has been used successfully to control of hypertension in the patients with pheochromocytoma<sup>8-10</sup>. In our case, we could not decrease blood pressure with sodium nitroglycerin and we provided better hemodynamic stability with esmolol.

Hypotensive attacks can occur after adrenal vein ligation due to a decrease in the catecholamine plasma concentrations. This condition was tolerated by volume administration and discontinuation of antihypertensive agents<sup>11</sup>. Epinephrine, norepinephrine, phenylephrine, dopamine or vasopressin infusions are rarely required<sup>8</sup>. We did not observe any hypotensive attack during the left adrenalectomy. However, in the right side, we observed sudden hypotension due to vascular injury and removal the mass. In this period, we required open surgery, termination of antihypertensive agent and volume expansion. We performed fluid and blood replacement therapy according to the patients' hemodynamic parameters (blood pressure, heart rate, central venous pressure, hemoglobin, etc.). This applications did not increase blood pressure and we started inotropic agent.

Laparoscopic surgery has a number of advantages compared with open surgery such as shorter hospital stay, faster recovery, decreased analgesic consumption<sup>4</sup>. However, it leads to increased intraabdominal pressure and may cause catecholamine release by the adrenal lesion<sup>8</sup>. Sudden hemodynamic change is more common than open technique and manipulation can be difficult especially in children. It may require open approach at the same time or afterwards. Our patient was scheduled for the laparoscopic excision of the masses. Left laparoscopic adrenalectomy was applied successfully, but in the right side, we observed sudden hypotension due to vascular injury and we required open surgery. Therefore we did not observe the advantages of laparoscopy completely.

Pretorius et al. reported that the level of catecholamine increases at intubation and during pneumoperitoneum<sup>11</sup>. We could not evaluate catecholamine levels during surgery and it was a limitation of our study but during the manipulation of the tumor severe hypertension occurred.

Laparoscopic adrenalectomy is associated with sudden hemodynamic changes. Therefore, anesthetic management is very important in this cases. Esmolol infusion was used safely to provide hemodynamic stability. Norepinephrine infusion

may provide better inotropic support than dopamine in case of hypotensive episodes in children. It should be noted that laparoscopic surgery may convert to open technique due to vascular injury or difficult manipulation.

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