Anesthesia Management of the Premature Newborn with Giant Sacrococcygeal Teratoma

Dev Sakrokoksigeal Teratomlu Prematür Yenidoğanda Anestezi Yönetimi

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ABSTRACT

Sacrococcygeal teratomas originate from the embryonic germ cell layers and are the most common neonatal tumor. The tumor is usually benign and has solid and cystic structures, but may be prone to bleeding due to increased vascularization. The anesthesia management of these patients is challenging due to the risk of bleeding, hemodynamic instability, electrolyte imbalance, hypothermia, and acidosis. Complications may cause serious perioperative morbidity and mortality.In this case report, important steps in the anesthesia management of a female patient, who was born at 29 weeks and 6 days of gestation, weighed 2190 g, and was operated for a mass compatible with sacrococcygeal teratoma on the 3rd day of her life were emphasized.The importance of the close monitoring of the preoperative preparation, invasive artery monitoring, blood, fluid and electrolyte replacement is presented with literature.

Key Words: Anesthesia Management, Giant Sacrococcygeal Teratoma, Premature Newborn

ÖZ

Sakrokoksigeal teratomlar embriyojenik germ hücre katmanlarından köken alan, yenidoğanın en sık görülen tümörüdür. Genellikle iyi huylu olan tümör solid ve kistik yapıya ek olarak vaskülarizasyondaki artış nedeniyle kanamaya eğilimli olabilir. Bu olguların kanama riski, hemodinamik instabilite, elektrolit imbalansı, hipotermi, asidoz riski nedeniyle anestezi yönetimi özelliklidir. Gelişen komplikasyonlar perioperatif ciddi morbidite ve mortaliteye sebep olabilir. Bu olgu sunumunda postnatal 3. gününde opere edilen, 29 hafta 6 günlük, 2190 gr ağırlığında sakrokoksigeal teratomla uyumlu kitlesi olan kız hastanın anestezi yönetimindeki önemli adımlar vurgulanmıştır. Preoperatif hazırlık, invaziv arter monitorizasyonu, kan, sıvı ve elektrolit replasmanının yakın takibinin önemi literatür eşliğinde sunulmuştur.

Anahtar Kelimeler: Anestezi Yönetimi, Dev Sakrokoksigeal Teratom, Prematüre Yenidoğan

INTRODUCTION

Teratomas can be found in sacrococcygeal, gonadal, mediastinal, retroperitoneal, cervical and intracranial regions. Sacrococcygeal teratoma (SCT) is a rare tumor and occurs in 1:35.000 to 40,000 live births.The female-male ratio has been reported as 3:1 to 4:1. Teratomas can be malignant depending on maturity and the cell types.Elevated Alpha fetoprotein (AFP) and beta human chorionic gonadotropin (β-hCG) levels may be predictive for malignancy.The most common presentation in newborns is benign, sacral masses recognized prenatally or at birth (1). The primary treatment for SCT is early surgical resection with complete excision of the coccyx (2). The tumor has both solid and cystic structures. The presence of dense vascularity in solid tumors may cause problems (3).

Teratomas can be divided into 4 groups based on the Altman classification (4).

- **Type I :** Tumors predominantly external (sacrococcygeal) with only a minimal presacral component,
- **Type II :** Tumors presenting externally but with a significant intrapelvic extension,

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- **Type III :** tumors are apparent externally but the predominant mass is pelvic and extended into the abdomen,
- **Type IV :** Presacral with no external presentation.

CASE REPORT

The patient was born at twenty nine weeks and six days of gestation with a birth weight of 2190 g. Her 1st and 5th minute APGAR scores were 5 and 7, respectively. She was consulted at our preoperative anesthesia outpatient clinic for sacrococcygeal teratoma. On physical examination, a pseudoencapsulated solid-cystic mass of 130×110×70 mm was observed in the sacrococcygeal region (Figure 1). Also a nodulation was also present on the surface of mass. Echocardiography revealed secundum atrial septal defect (ASD) (5 mm) with left-to-right shunt, tricuspid regurgitation (TR) grade 1-2 and a 3.5 mm ductus opening with a left-to-right shunt. Her hemoglobin was 15.4 g/dl, hematocrit was 46%, leukocyte count was 7000 (x109/L), platelet count was 209.000 (x 09/L), results of kidney function tests and coagulation tests were normal. Alpha fetoprotein and β-hCG of patient were above 20.000 micro/L and 72 mIU/ml, respectively. Blood products were prepared in the preoperative period. Patient was taken to the operation room on postnatal 3rd day, she came as intubated and with an umbilical vein and artery catheterization. In addition to routine monitoring (oxygen saturation, electrocardiogram, noninvasive blood pressure), blood pressure was monitored continuously from the umblical artery. A urinary catheter was inserted and a nasopharyngeal temperature probe was placed. Arterial blood pressure (ABP) was 65/35 mmHg, heart rate(HR) was 128/min and oxygen saturation was 99 with 50% FiO2. The operating room was heated to 24 degrees and a pediatric heating blanket was placed under the patient (warm touch, Covidien llc, 15 Hampshire Street, Mansfield, MA 02048 USA). Extremities outside of the surgical field and head were wrapped with cotton. The induction was done by adminitering 2% sevoflurane, 50-50 % oxygen-air mixtures,1 mg/kg ketamine, 0.5 mcg /kg fentanyl and 0.5 mg/kg of rocuronium and operation was started in prone position.The dosages of drugs were adjusted according to birth weight. Potassium replacement (4 meq in 250 cc saline, 7 cc/h infusion) was started due to low potassium in the first arterial blood gas. In addition 6 cc/h of 10% dextrose-1/5 saline and 15 cc/h of 0.9% saline was given to patient. As the arterial blood pressure decreased to 24/16 mmHg due to bleeding from leakage, sevoflurane, which has a cardiac depressant effect, has been switched off and has a sempathomimetic effect of 0.5 mg of ketamine administered in every 30 minutes. The infusion rate of 0.9% saline was increased from 15 cc/h to 20 cc/h, and 10 mcg of adrenaline was applied twice.

Figure 1: Preintervention view of the mass.

Afterwards, blood (warming) transfusion was started at a rate of 10 ml/kg/45 minutes. Mean arterial pressure (MAP) was maintained about 25 mmHg. The operation, simultaneously with the end of the blood transfusion, was completed at 2.5 hours. 15 mg/kg paracetamol was administered for postoperative analgesia. The mass that was compatible with Altman type 1 sacrococcygeal teratoma was excised together with coccyx and its capsule while its integrity was preserved. There was a total of 25-30 ml bleeding throughout the entire operation, with the lowest Hb was 10.3 g/dL and hematocrit was 31%. Since the intraoperative potassium value was determined as 3.17 mmol/l in the blood gas, the potassium infusion was stopped. Urine output was approximately 4-5 ml throughout the case. At the end of the surgery, the patient's blood pressure values were at the lower limit (42/20 mmHg) according to corrected gestational week specific reference values so dopamine infusion (5 mcg/kg/min) was started (Table I) (5). The intubated patient was transferred to neonatal intensive care unit with no acidosis, hypothermia, or hypoglycemia. The patient, whose weight was 1120 g on the postoperative 1st day, was extubated on the 2nd day and discharged on the 49th day.

DISCUSSION

Sacrococcygeal teratomas are the most common congenital tumors in newborns and can be treated with surgical intervention (6). In cases where surgical intervention is not possible, the tumor may transform into malignant within months, or it may continue to grow and reach gigantic dimensions, as is often the case with postsacral teratomas (4). In addition, they can cause hemorrhagic complications and coagulopathies (7).

Surgical interventions in newborns, especially in preterm infants, have very important effects including creating a catabolic response, transfer of fluid to the interstitial space sodium and free water retention due to increased capillary permeability. Perioperative fluid management, which may seriously affect the infant's prognosis, should be aimed at preserving intravascular volume, renal and cardiovascular functions (8). Our patient is in the risk group because of her low birth weight prematurity and low infant / mass weight ratio.

The aim of intraoperative fluid management is to replace the preoperative fasting deficit and losses from surgical field, prevent

Table I: Normal blood pressure values in newborns according to corrected gestational week (5).

Gestational week	Highest systolic	Mean	Lowest systolic	Highest diastolic	Mean	Lowest diastolic	Calculated average highest	Mean	Calculated average lowest
24	68	49	33	46	29	14	53	36	20
25	69	51	36	47	30	15	54	37	22
26	70	52	38	48	31	17	55	38	24
27	71	54	40	49	32	18	56	39	25
28	72	55	41	50	33	19	57	40	26
29	73	56	42	51	34	20	58	41	27
30	78	59	43	52	35	21	60	43	28
31	78	61	46	53	36	22	61	44	30
32	80	62	48	54	37	23	63	45	31
33	81	63	50	55	38	24	64	46	33
34	83	66	51	56	39	25	65	48	34
35	84	69	52	57	40	26	66	50	35
36	87	71	55	58	41	27	68	51	36
37	89	72	57	59	42	28	69	52	38
38	90	75	59	60	43	29	70	54	39
39	91	78	60	60	44	30	70	55	40

electrolyte disturbances, prevent hypo- and hyperglycemia, while maintaining the maintenance fluid requirement. The maintenance fluid requirement is replaced at a constant rate, but the rate of replacement fluids, which may vary according to the amount of losses, must be adjusted separately. Since our case did not have night fasting, replacement was performed considering the maintenance and losses throughout the operation. The maintenance of losses to the third spaces is 15-20 mL/kg/hour for major surgical interventions. These losses should be covered with crystalloid solution, but blood losses should be covered with blood or colloid solution (5% albumin) at a ratio of 1:1. Heart rate, blood pressure, and capillary refill time should be closely monitored (8).

Newborns have insufficient vasoconstriction and adrenergic response, so they are at high risk for hypotension and shock. As bleeding increases during surgery, mortality and morbidity rates increase.The mortality rate of hemorrhage was 3.8 % in a previous study (9). It is important to make a detailed evaluation with the surgical team in the preoperative period for the type of the mass and the expectation of bleeding. Gümüş et al. (10) reported management of bradycardia, hypotension and circulatory collapse in a 3420 g preterm infant who underwent excision of a giant sacrococcygeal teratoma at 32 weeks of gestation .In our case due to closed follow up of the intraoperative monitorization we did not encounter the bradycardia and hypotension.

Since the mass in our case was compatible with Altman type 1 sacrococcygeal teratoma, we thought that the expected blood loss could be replaced in a more controlled manner. Hypotension arose due to approximately 25-30 cc of bleeding and loss of 1000 g mass in the intraoperative period, and normotension was regained with erythrocyte replacement and positive inotropic support. The amount of blood volume lost, the rate of loss, the patient's total blood volume, preoperative hematocrit value, presence of cardiac or lung disease, the nature of the surgery, and the benefit-harm ratio of transfusion are taken into consideration for determining the need for transfusion in preoperative period.

Acute massive transfusion may lead to complications such as increased intracranial pressure and cardiac overload (11). In our case, we maintained the hemodynamic stability by replacing the losses over time and adding inotropic support. In our case, we started erythrocyte suspension replacement and dopamine intraoperatively and these supports were terminated in accordance with the hemogram, blood gas and vital follow-ups in the postoperative ICU.

Two points are very important in preventing intraoperative shock, arrest and transfusion complications in hemorrhagic surgery of premature newborns: instant hemodynamic monitoring with arterial moniterization and well-known of guidelines that approaching hypotension according to the week and weight of preterms (5). In our case, blood pressure values of the patient were evaluated according to the gestational week through artery monitoring during surgery; treatment and supports were applied accordingly (Table I). We did not experience shock or arrest in our case.

The glucose content of intraoperative fluids has also been re-evaluated in recent years. It has been understood that not only long-term hypoglycemia but also transient hypoglycemia can cause neurological damage during surgery. However, the risk factors of perioperative hyperglycemia are well known. Stress-induced insulin resistance is a factor contributing to the development of hyperglycemia during surgery. Osmotic diuresis caused by hyperglycemia can lead to dehydration, electrolyte disturbance and increased lactate. However, it is suggested that slightly elevated blood glucose levels in newborns protect the brain against ischemic damage and that they are protected from lactic acidosis because of their high lactate clearance. In cases where SCT equisation has been conducted so far, glucose infusion has been done by checking intermittent blood glucose in the blood gas. However, we have taken into account the glucose dose recommended by the nutritional guides as our case is more sensitive to hypoglycemia due to prematurity and low birth weight. According to the Nutrition Guidelines for Premature and Sick Term Infants that were updated in 2018, it is appropriate to start with a glucose infusion rate of 4-6 mg/kg/min in term and >1000 g of premature babies (12). We also applied glucose infusion at 5 mg/kg/min in our case and we did not observe hypoglycemia in our follow-ups.

It is known that pediatric patients are at higher risk of hypothermia during surgical procedures than adults. Although studies showing the frequency of hypothermia in pediatric patients are limited, it has been reported between 4.2% and 60% (13). Pediatric patients tend to develop hypothermia higher in the perioperative period (core temperature ≤36°C) than adults due to decreased weight-body surface area ratio, increased heat loss from the head region, and insufficient subcutaneous adipose tissue. Anesthesia induction during surgical procedures is also an important risk factor for hypothermia. Anesthetic agents used in the perioperative period inhibit thermogenesis, create vasodilation and muscle relaxation and prepare the ground for the formation of hypothermia (13,14). In our premature newborn patient, we preferred a blanket with blown heating in addition to preoperative room temperature adjustment and heating of replacement fluids in order to maintain intraoperative body temperature. Although the body is not in full contact with the blanket due to the chest supports in prone position; we created a heated area (like a bathtub) between the blanket and the upper surgical cover by blowing hot air from the bottom. In this way, we kept the body temperature at 36-37°C.

CONCLUSION

Preoperative surgical prediction and preoperative close hemodynamic follow-up are very important in large and hemorrhagic surgeries of low birth weight premature newborns. Replacement treatments should be planned in appropriate amounts and in a way that does not harm the patient, accompanied by invasive monitoring and in accordance with the guidelines. More than one effective precaution must be taken for heat loss.

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