Cardiac Arrest During Resection of a Sacrococcygeal Teratoma in a Premature Neonate with a Large Patent Ductus Arteriosus

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Objectives:

1. To understand the physiological and pathophysiological consequences of sacrococcygeal teratomas in infants.

2. To comprehend the causes of intra-operative hypotension in these infants and appreciate the significance of shunting through a large patent ductus arteriosus.

3. To appreciate the potential complications of different types of blood products available for the managememt of massive hemorrhage in these neonates and their treatment.

4. To understand the need for multidisciplinary specialty communication and participation in the perioperative period to ensure proper preparation and availability of interventions.

Case History:

The patient is a 32 week infant with a prenatally diagnosed type 2 sacrococcygeal teratoma(SCT) measuring 2000ml from prenatal fetal echo, for resection.

Questions:

You hear you are doing this case tomorrow! What is a sacrococcygeal teratoma? When you hear of a neonate with this tumor, what are your primary concerns? What about the physiology of these specific teratomas worries you? What are some prenatal ultrasonographic signs concerning of cardiac failure in these patients?

Case History:

Fetal echo showed a combined ventricular output of >700ml/min/kg, presence of fetal hydrops, and an enlarged IVC measuring 8 mm. Prenatal cardiac echo also shows a large patent ductus arteriosus.

Questions:

What are the anesthetic implications of these findings? Is it normal for a neonate of this age to have a large ductus arteriosus? When do PDA's typically close? What physiological parameters affect closure of the PDA? For patent PDAs, what therapeutic options are available? When is surgical intervention appropriate or necessary?

Case History:

No other information is available for this patient at this time. The plan is for a cesarean delivery.

Questions

What is your anesthetic plan? Should we involve other health care members in this plan? Should there be a multidisciplinary team meeting prior to surgery? If so, who should be present at this meeting?

Case History:

The mother undergoes cesarean delivery. The infant is transferred to the infant stabilization unit where the neonatologists work hard to assess the patient. They seem to be having difficulty in ventilating the patient.

Questions:

What would you do? Should surfactant be administered? Should the patient be intubated? What would be your threshold for intubation? Who should attempt the intubation- you, the neonatology attending, or the neonatology fellow? What would be your threshold to jumping in and intubating? What are your SpO2 goals in this premature neonate with a large PDA?

Case History:

The patient is now intubated after second attempt by the neonatology attending. One PIV is in place. Attempts at placing an umbilical vein and arterial line are unsuccessful.

Questions:

What would you do now? Would you jump in and attempt placing the line? Or would you proceed to taking the patient to the operating room and plan to place a line on the operating room table? If you are unable to place an umbilical artery line, would you attempt to place a radial arterial line? If that attempt is unsuccessful, would you proceed without an arterial line? Would you like a central line? Where would you place a central line? Access to the internal jugular vein is limited secondary to tumor size. Should a subclavian line be placed?

Case History:

During the procedure, massive hemorrhage required administration of packed red blood cells. Following clamping of tumor vessels, marked hypotension resulted with new onset of peaked T waves with subsequent cardiac arrest.

Questions:

What is the differential diagnosis? Is this secondary to cardiac failure or hemorrhage or hyperkalemia? Say this is secondary to hemorrhage- what are your options for transfusion? Would you give whole blood or packed red blood cells? If you choose red blood cells, would you give fresh or stored red cells? What are your concerns with administration of stored red blood cells? What advantages does whole blood offer over red blood cells? How does hyperkalemia manifest? What if most concerning of hyperkalemia? How do you treat hyperkalemia? What is the dose of glucose and insulin you would administer? What about calcium gluconate?

Case History:

The patients is resuscitated with pRBCs. Calcium gluconate and bicarbonate are administered. Once hemodynamic stability is attained, surgery resumes.

Discussion:

Sacrococcygeal teratoma is a form of germ cell tumor and happens to be the most common germ cell tumor of childhood. SCT is the most frequently recognized fetal neoplasm, with an estimated incidence of 1 in 27,000. SCTs are most common in females than males with a 3 to 4:1 ratio. Most typically in infants, SCTs are benign; their malignant potential increases with age. SCTs that present in utero present as a mass extending off the caudal end of the fetus. With advances in prenatal ultrasound, many SCTs are not identified in utero with an antenatal diagnosis rate of 44 percent.

It is crucial to identify fetuses that are at high risk for demise. These include fetuses with hydrops. Rapidly enlarging tumors place fetus at risk for vascular steal and high output cardiac state. A fetal cardiac profile including assessment of combined ventricular output and valve regurgitation can be used to identify fetuses with a poor prognosis. A tumor volume to fetal weight ratio >0.12 on ultrasound before 24 weeks gestation is a poor prognostic indicator

Prenatal diagnosis and close monitoring has improved outcomes for fetal SCT but overall perinatal mortality remains high ranging from 25 to 50%. Generally, most high risk fetuses with high-risk SCT and hydrops need delivery. Specialized centers may be able to do this in utero during mid gestation. Alternatively an EXIT procedure may be possible for high risk SCT after 27 to 28 weeks. Fetuses with low risk SCT are typically delivered by cesarean after 36 weeks of gestation.

Infants with high risk SCT are considered high risk for intra-operative complications. This necessitates careful preoperative multidisciplinary meeting and planning. Typical anesthetic risks may be secondary to hemorrhage, cardiac failure, and hyperkalemic reactions from blood product transfusion. Optimum invasive monitoring in these patients includes arterial line and central venous access for continuous monitoring blood pressure and volume status.

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