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Case Report

Anaesthesia for Caesarean Delivery in a Pregnant with Acute Type B Aortic Dissection

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Abstract

About 50% of aortic dissections in women younger than 40 years occur during pregnancy; mostly in the 3rd trimesters and postpartum period. Aortic dissection in pregnancy creates a serious mortality risk for both mother and the foetus. The ultimate goal is to ensure the safety of both the mother and the foetus. In such cases, the best method of anaesthesia for caesarean delivery is still controversial. The first aim of anaesthetic management is to reduce the effect of cardiovascular instability on the dissected aorta. Here, we report the anaesthetic management of a 36 year-old pregnant woman who developed acute type B aortic dissection in the 30th gestational weeks and scheduled for caesarean section. Since hemodynamic stability could not be achieved despite nitro-glycerine and esmolol infusions, together with invasive arterial monitoring, the decision for caesarean delivery was taken. A team of Cardiovascular Surgeons and an operating room were prepared because of the risks of aortic rupture and hemodynamic collapse during operation. Combined-spinal epidural anaesthesia was administered using 5 mg hyperbaric bupivacaine and 20 µg fentanyl given at the L3-4 spinal level in the side lying position. After achieving T4 sensory block level, the operation proceeded and a baby weighing 1432 grams was delivered in 4 min with a median subumbilical incision. Epidural patient controlled analgesia was applied to the patient during follow-up with medical treatment at postoperative period. In pregnant women with acute Type B aortic dissection, if adequate sensory block level cannot be achieved despite using a combination of low dose local anaesthetic (spinal use) and opioids, we are in the opinion that combined spinal-epidural anaesthesia, which allows the use of additional doses can be a decent choice.

Key Words: Caesarean section, combined-spinal epidural anaesthesia, aortic dissection

Introduction

Aortic dissection is formation of a tear in aortic intima, resulting in the development of a hematoma and dissection in the arterial wall. It is a life-threatening condition with a mortality rate of 50% during the first 48 hours and 90% in 3 months (1). Aortic dissection can be classified in two different ways according to the classifications of DeBakey (Type I, II, IIIA, IIIB) and Stanford (Type A and B) (Table 1) (2). Involvement of the ascending aorta, aortic arch and descending aorta is observed in 60%, 10% and 30% of the cases, respectively.

Dissection type is important in the approach to the patient. Patients with acute type A dissection generally require emergency intervention. In case of Type B dissection, if there is no rupture or circulatory disorder, medical approach is generally recommended (3).

Acute aortic dissection is a rare condition in young females (3, 4). About 50% of aortic dissections in women younger than 40 years of age occur during pregnancy, mostly in the third trimesters and postpartum period (3). Konishi et al. (5) reported that 70% of the patients who developed aortic dissection in gestation and postpartum period had De Bakey Type I dissection (involvement of the aortic root, aortic arch and descending aorta). In pregnant women, aortic dissection, poses serious risk for the mother and the foetus and the mortality rates for both the mother and the foetus are high. The ultimate goal is to ensure the safety of the mother and the foetus (6).

There are a few data on the management of anaesthesia in these patients in the literature. Primary goal in anaesthesia management was reported to be "reducing the probable effects of cardiovascular instability on the dissection or abnormal aorta". Anaesthesia technique for caesarean section in these patients is controversial (6).

Therefore, we aimed to present a case of a pregnant woman 36 years of age, who had developed acute Type B aortic dissection at 30 weeks of gestation and underwent caesarean section under regional anaesthesia and followed up with medical treatment.

Case Report

A pregnant woman at 36 years of age, (gravida 4, parity 3) at 30 weeks of gestation, was admitted to the emergency service of a hospital, complaining of a sudden onset back pain. In her history, the patient had asthma for 5 years and hypertension for 2 years and as distal pulses of the left lower extremity could not be palpated, she was transferred to our hospital with a pre-diagnosis of aortic dissection.

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On admission to our hospital, her arterial blood pressure (ABP) was 175/90 mmHg and heart rate (HR) was 72 beats min^{-1}. Distal pulses of the left lower extremity could not be palpated but the skin was not cold, and there was no pallor, heat loss or motor loss. Transthoracic echocardiography revealed normal left ventricular systolic functions and no visible dissection flap in the ascending aorta (diameter of the aorta= 3.4 cm). Computed tomography scans of the abdomen showed fusiform aneurysmal dilatation, 4 cm in diameter at the largest site, of the proximal abdominal aorta and aortic dissection extending from the descending aorta to the level of aortoiliac bifurcation. After these examinations, the patient was admitted to close follow-up in the intensive care unit of the cardiovascular surgery with a diagnosis of Stanford Type B (De Bakey Type III) aortic dissection. As a serious increase was observed in ABP, invasive arterial blood pressure monitoring was performed along with nitroglycerin and esmolol infusions in order to regulate blood pressure. No heart rate changes were recorded due to esmolol use in the foetus. A single dose of 12 mg betamethasone was injected for foetal lung maturation. As the ABP levels remained high, a decision was taken to perform emergency caesarean section and perform aortic repair on the following days, if required.

Before surgery, the anaesthesia team evaluated the patient and informed consent was obtained. Blood loss was anticipated and blood products were cross-matched. In the preoperative analysis, haemoglobin was 12.6 g dL^{-1}, platelet count was 170.10^3 mL^{-1}, INR was 0.8, fasting glucose 122 mg dL^{-1} and ECG was normal. The patient was taken to the surgery with an ASA score of III-E. Owing to the risk of a probable rupture and hemodynamic collapse in the perioperative period, a team of Cardiovascular Surgeons and an operating room were made available. In the operating room, the measured ABP was 190/91 mmHg and HR was 96 beats min^{-1}. After the patient was taken into the operating room, antihypertensive infusion was discontinued. After invasive ABP, ECG and pulse oximeter monitoring, colloids and crystalloids were infused via two wide bore IV cannulas. Oxygen was administered via a face mask. Meanwhile, foetal heart rate was re-evaluated using an ultrasound by the gynaecology team.

Positioned in the lateral position, an 18 G epidural needle was placed at L3-4 level using a loss of resistance technique, and spinal space was entered with a 27 G spinal needle using needle-through-needle technique, combined spinal epidural anaesthesia was performed using 5 mg of hyperbaric bupivacaine and 20 µg of fentanyl. After the intervention, blood pressure and block level was closely followed. As the arterial blood pressure decreased to 98/57 mmHg, 10 mg of ephedrine was given. When a T4 sensory block level was achieved, after an epidural test dose of 5 mL of lidocaine, surgery was commenced. The drug mixture (9 mL 2% lidocaine+1 mL sodium bicarbonate) used in conditions when a sufficient sensory block level could not be achieved, was prepared and it was planned to give 5 mL additional doses at 5 minute-intervals, but no additional dose was required during the intervention. After performing a median subumbilical incision, a baby weighing 1432 g was delivered in 4 minutes (Apgar scores at 1 and 5 min were 8 and 10, respectively). Thereafter, 5 units of oxytocin was slowly infused at 5 minutes and during the intervention 20 units of oxytocin infusion was continued. No additional ephedrine was required during the surgery and ABP remained stable. A total of 1000 mL of colloids and 1000 mL of crystalloids were infused. Postoperative pain treatment was provided using epidural patient controlled analgesia (500 µg fentanyl, 200 mg bupivacaine/200 mL; 10 mL loading dose, 10 mL bolus dose, with a lockout interval of 20 minutes). The patient was transferred to the intensive care unit of cardiovascular surgery for postoperative follow-up, as the ABP increased again nitroglycerin, sodium nitroprusside and esmolol infusion was applied. It was observed that there was no change in the dimensions of the dissection in the aortography performed after surgery. The baby was taken to the neonatal intensive care unit, on oxygen, was intubated for surfactant treatment and was extubated at 4 days, then nasal continuous positive airway pressure (CPAP) was started.

Discussion

The reasons for the development of aortic dissection at high frequencies in pregnancy can be listed as follows: increased sex hormones, impaired elastic properties of the aorta, pathological changes in the arterial wall due to the increase in distal flow resistance caused by compression of the aorta and distal iliac arteries by uterus (3).

It was reported that the diagnosis could be made by imaging modalities without radiation risk such as echocardiography and magnetic resonance imaging. If these modalities are not available, computed tomography as well be used and this modality can be safely performed in the last weeks of gestation (3). Similarly, Ray et al. (6) reported that diagnosis could be made using transesophageal echocardiography or computed tomography. As transesophageal echocardiography was not available, the diagnosis of our patient was established using computed tomography and transthoracic echocardiography and the aortic dissection was classified.

The first treatment option in acute dissection is providing adequate hemodynamic control (7). Additionally, it is recommended that surgical repair of the aorta should be accomplished before the foetus is delivered if gestation is <28 weeks, however if gestation is >32 weeks caesarean section should be performed together with aortic repair (3, 6). It was reported that type B dissections could be followed-up with success until term, and dissection repair could be made after birth. However, there are conflicting opinions about pregnant women, especially at 28 to 32 weeks of gestation, and it is emphasized that intervention decision should be made according to the state of the mother and the foetus. It is advocated that emergent caesarean section and operative repair should be made in case of cardiovascular instability, end organ or uterus ischemia or foetal distress (6). As hemodynamic instability was observed in the patient during follow-up, the second dose of betamethasone used for foetal maturation was not applied, and emergent caesarean section decision was made.

The optimal anaesthesia method that should be used in such patients during caesarean section is not clear. The patients on anticoagulant medication may receive general anaesthesia; however, it was reported that this might increase cardiovascular stress associated with hypertensive response due to intubation and surgical stimuli, and rupture risk (3). Haas and colleagues (8) performed deep general anaesthesia for caesarean section, along with high dose opioids in a pregnant hypotensive woman at 34 weeks gestation, who developed Stanford Type A dissection. After anaesthesia induction the patient required norepinephrine, and underwent aortic repair using extracorporeal bypass after caesarean section. The neonatal team had been informed about the case, and as the Apgar score after birth was 3, the baby was intubated and was extubated at 12 hours in the maternity ward without any problem. Haas et al. (8) reported that although deep anaesthesia induction along with opioids leads to respiratory depression in the neonate, it is a method that can be used in this life-threatening condition.

There are case reports indicating the successful use of epidural, combined spinal epidural and continuous spinal anaesthesia in pregnant women with serious cardiovascular disease (7, 9, 10). It was reported that epidural anaesthesia effectively decreases birth-associated cardiac output increase and vascular wall tension (6). As it can produce a rapid sympathectomy and a sudden decrease in the systemic vascular resistance, single dose spinal anaesthesia is not recommended. As the ABP levels of our patient remained high despite antihypertensive treatment, we preferred to perform regional anaesthesia in order to avoid the hemodynamic effects that might develop due to rapid sequence intubation.

Jayaram et al. (7) followed-up a pregnant woman with aortic dissection at 26 weeks of gestation until 36 weeks gestation, and performed epidural anaesthesia with slow titration of local anaesthetics for caesarean section, at 36 weeks of gestation. After delivery, as the patient's ABP level dropped to 70/40 mmHg, they infused fluid and phenylephrine in order to regulate ABP. They attributed this sudden drop in the ABP to weak compensation caused by the use of sympathetic block and β blockers during acute blood loss. However, different from their patient, hypotension developed before the surgery in our patient. The different anaesthesia technique we used, patient being hypertensive and having received antihypertensive treatment before intervention in the intensive care unit, might have accentuated this hypotension that might be seen after the block.

Hönig and colleagues (9) in a pregnant woman with high cardiovascular risk reported that they used continuous spinal block, and achieved a sensory block level of T8 with titration of a total of 2.2 mL 0.5% bupivacaine, and they did not encounter any problems. As we did not have the necessary equipment for continuous spinal anaesthesia application, we could not use this anaesthesia technique.

Solanki et al. (10) in a pregnant woman with cardiovascular risk, performed combined spinal epidural anaesthesia for caesarean section using 0.5 mL 0.5% hyperbaric bupivacaine and 25 μg fentanyl. As the level of sensory block remained at T10, an additional dose of 3 mL and 2 mL of 0.5% bupivacaine and 100 μg fentanyl was infused from the epidural catheter intermittently; they reported that the patient's hemodynamic status, who was given prophylactic phenylephrine infusion, remained stable. Similarly, using combined spinal epidural technique and a total drug dose of 5 mg applied to the spinal space, provided us to achieve the required levels of sensory and motor block more rapidly. We could not use prophylactic phenylephrine, as it is not available in our country. However, we used a single treatment dose of ephedrine and got a very rapid response.

Table 1. De Bakey and Stanford Classifications (2)

De Bakey	
Type I	Intimal tear in the ascending aorta and dissection extending along the whole aorta.
Type II	Intimal tear in the ascending aorta and dissection limited to the ascending aorta
Type III A	Intimal tear in the proximal descending thoracic aorta and dis section limited to the thoracic aorta
Type III B	Intimal tear in the proximal descending thoracic aorta and dissection in the abdominal aorta or dissection extending to the aortoiliac bifurcation
Stanford	
Type A	Intimal tear in the proximal descending thoracic aorta and dis section limited to the thoracic aorta.
Type B	Intimal tear in the proximal descending thoracic aorta and dissection in the abdominal aorta or dissection extending to the aortoiliac bifurcation

It was reported that oxytocin use is associated with important side effects such as maternal arrhythmia, hypotension and tachycardia and excessive doses should be avoided (11). Johnston and colleagues (12) in a patient with Type A aortic dissection, performed caesarean section and aortic repair, and used oxytocin at a bolus dose of 5 units and 10 units/hr infusion. Similarly, we infused 5 units of oxytocin slowly, in 5 minutes. However, it was reported that a ceiling effect of 5 units of oxytocin was seen and even in elective caesarean section cases, a lower dose was sufficient for uterine contraction (11). An evidence-based oxytocin application protocol known as "rule of threes" recommends, an IV loading dose of 3 units, 3 min assessment interval and, if required, a maintenance dose of 3 units (maximum 3 doses), the infusion of 3 units/L at 100 mL/hrs (11).

Besides, considering that postoperative pain control and follow-up is important regarding cardiovascular stability, with a local anaesthetic and opioid combination, epidural patient controlled analgesia was used for providing good analgesia.

In these cases, if the diameter of the aortic root>4 cm or if it is gradually increasing, β blocker treatment should be given, however, it is emphasized that the effects of β blockers on the mother and the baby should be taken into consideration (3). It was reported that uterine contractions might decrease the flow in the umbilical cord, and might lead to bradycardia and hypoglycaemia in the neonate (3, 7). The use of esmolol, a short acting β blocker, in pregnant women is controversial (13). Nitroglycerin, labetalol and hydralazine are being mentioned among the antihypertensive agents that can be used; however, sodium nitroprusside is not recommended as it can lead to cyanide toxicity in foetus (7). Our patient had been started on nitroglycerin by the cardiovascular surgery team, but as it was not sufficient, esmolol was added in order to regulate blood pressure. Nevertheless we did not encounter any problem regarding the foetus.

Conclusion

Primarily, meticulous blood pressure control is mandatory in these cases. It should be kept in mind that pre-existing hypertension, hypovolemia and decreased compensation due to β blockade, might manifest hypotension secondary to sympathetic blockade. In cases, in which cardiovascular stability cannot be achieved and a decision of caesarean section is made; multidisciplinary approach and good preoperative preparation is required. In pregnant women with acute Type B aortic dissection, if adequate sensory block level cannot be achieved despite using a combination of low dose local anaesthetic (spinal use) and opioids, we are in the opinion that combined spinal-epidural anaesthesia, which allows the use of additional doses can be a decent choice.

Conflict of Interest
No conflict of interest was declared by the authors.

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Informed Consent: Written informed consent was obtained from patients who participated in this case.

Author Contributions

Concept - G.E.K.; Design - G.E.K.; Supervision - N.G.; Materials - Ü.Ö.; Data Collection and/or Processing - G.E., N.G., M.Ş.; Analysis and/or Interpretation - G.E.K.; Literature Review - T.Ş., Ü.Ö.; Writer - G.E.K., N.G.; Critical Review - M.D., M.Ö.E. A.T., A.E., M.N.D.

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