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Surgical Management of Type A Aortic Dissection During the Second Trimester: A Case Report

Zhenqing Z*

Senior Lecturer, Yantai Yuhuangding Hospital, Yantai, China.

Corresponding Author: Zhenqing Z

Senior Lecturer, Yantai Yuhuangding Hospital, Yantai, China.

Email: dr_zhao1988@126.com

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Abstract

A 29-year-old pregnant woman was referred to our center at gestational week 21 because of "sudden onset of chest pain for 15 hours"; she experienced retrosternal tearing pain with no radiation, accompanied by vomiting for three times, and the pain had no relief. Ultrasonography revealed aortic root dilatation with aortic regurgitation. Aortic Computed Tomography (CT) scan with contrast administration confirmed the diagnosis of type a Aortic Dissection (AD). Under emergency Cardiopulmonary Bypass (CPB), ascending aortic replacement, total arch replacement using a prosthetic graft combined with stented elephant trunk implantation (Sun's procedure), and aortic valvuloplasty were performed. On Postoperative Day (POD) 9, she was discharged from the hospital, and the fetus survived. In addition, a caesarean section was performed at 26 weeks of gestation due to "cervical insufficiency", and the baby remained alive without any adverse events.

Conclusion: Although AD during pregnancy is relatively rare, clinicians need a high clinical index of suspicion for pregnant women presenting with chest pain. Early diagnosis and adequate treatment are essential for favorable outcomes.

Keywords: Aortic dissection; Pregnancy.

Introduction

Acute Aortic Dissection (AD) during pregnancy is a relatively rare but typically life–threatening condition. A prior study has suggested that the overall incidence of this disease in the female population aged 15-45 years is approximately 4/1,000,000 [1]. Theoretically, hormonal and hemodynamic changes during pregnancy are the contributor to aortic intimal tear. These changes may begin in the first and second trimesters but are most notable in the third trimester and peripartum period (approximately 50% and 33%, respectively [2]. Moreover, some hereditary disorders such as Marfan syndrome may be strongly associated with AD during pregnancy [3]. The present study reported a pregnant woman with acute type A AD during the second trimester who was successfully treated by surgical procedures, and the fetus survived. She then underwent caesarean section at 26 weeks of gestation due to "cervical insufficiency", and the baby remained alive without any adverse events.

A 29-year-old pregnant woman (gravida 1, para 0) was referred to our center from another hospital at gestational week 21 because of "sudden onset of chest pain for 15 hours"; she experienced retrosternal tearing pain with no radiation, accompanied by vomiting for three times, and the pain paroxysmally worsened with no relief. Ultrasonography at another hospital revealed aortic root dilatation with aortic regurgitation. Aortic CT scan with contrast administration confirmed the diagnosis of type A AD. On admission, blood pressure was 122/48 mmHg (right upper extremity) and 120/56 mmHg (left upper extremity). Breath sounds in both lungs were clear, and no dry or moist rales were heard. Cardiac rhythm was regular with heart rate of 73 beats/min, and no pathological murmur was heard. Moreover, the patient had no uterine contraction, vaginal bleeding, amniotic fluid leakage, etc. The fetus was in good condition on bedside ultrasonography, with fetal heart rate of 154 beats/min. Red blood cell count was 3.3×10^{12}/L, hematocrit 30.4%, white blood cell count 14.96×10^{9}/L, and neutrophil percentage 83.3%. Blood gas analysis and electrolytes: serum sodium was 176 mmol/L, chloride 110 mmol/L, free calcium 1.376 mmol/L, oxygen saturation 85%, partial pressure of oxygen 45.9 mmHg, and base excess -4.46. High-sensitivity cardiac troponin was

15.8 pg/ml, and B–type natriuretic peptide 241 pg/L. Four indices (PT, APTT, TT, and FIB) on coagulation tests were roughly normal, and results of renal function test were unremarkable. An electrocardiogram showed sinus rhythm.

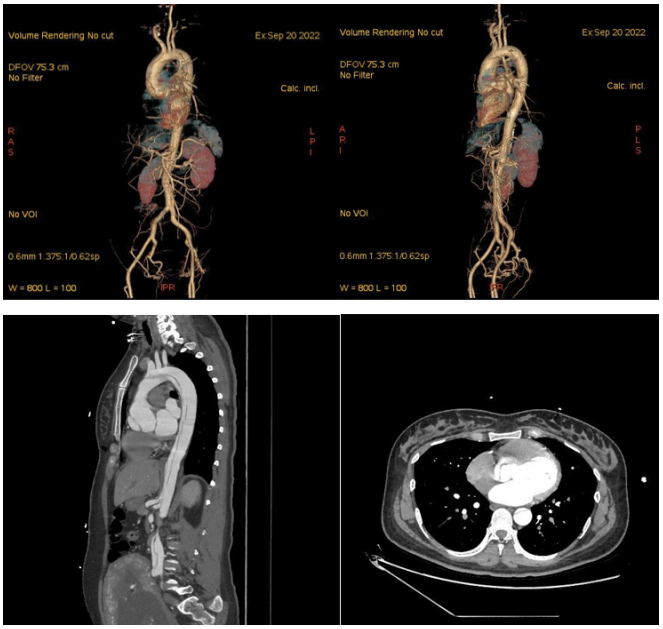

Figure 1: CTA image showing aortic root dilation. The diameter of the aortic annulus was 44 mm **(a)**, the valsalva sinus was 55 mm **(b)**, and sinotubular junction was 44 mm **(c)**.

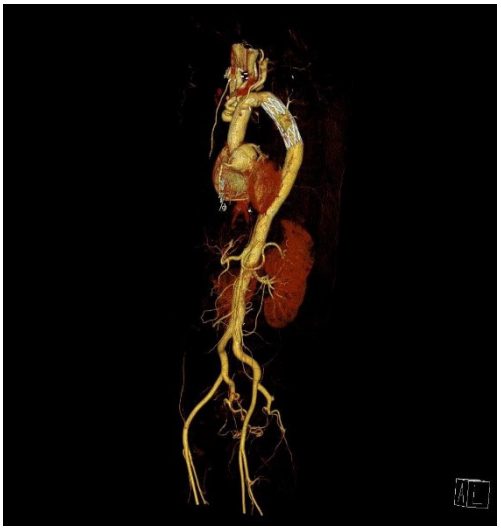

Figure 2: CTA was reviewed after surgery.

Treatment

The patient and her family members were informed of the conditions; after the Obstetrics and Gynecology Department was consulted, termination of pregnancy was recommended. However, the patient refused it after being informed of potential risks. Thus, after obtaining the written informed consent, total arch replacement using a prosthetic graft combined with stented elephant trunk implantation (Sun's procedure) plus ascending aortic replacement plus aortic valvuloplasty were performed under general anesthesia and emergency hypothermic Cardiopulmonary Bypass (CPB).

Outcome and follow-up

Postoperatively, the patient was transferred to cardiac surgery Intensive Care Unit (ICU) for routine monitoring and treatment, and the Pharmacy, Obstetrics and Gynecology, and other related departments were consulted to assist in diagnosis and treatment. On Postoperative Day (POD) 1, findings of ultrasound examination showed an intrauterine pregnancy and a single live fetus. On POD 9, she was successfully discharged from the hospital. During the follow–up, the pregnant woman underwent a caesarean section due to "cervical insufficiency" at 26 weeks of gestation, and the baby remained alive with no adverse events.

Discussion

Most dissections occur in the third trimester and peripartum period. In the third trimester, caesarean section is a preferred option, while maternal safety and fetal prognosis should be a high priority in the second trimester.

Possible risk factors for severe chest pain include acute myocardial infarction, pulmonary embolism, AD, and pneumothorax, and these conditions can be fatal to both the mother and the fetus. In emergency situations, transthoracic echocardiography is preferred. However, CT Angiography (CTA) can obtain sufficient information and allow three-dimensional reconstruction of the aorta to help to determine surgical options. Current guidelines suggest that low-dose radiation during CTA is acceptable in the diagnosis of aortic diseases during pregnancy [4].

Prior to 28 weeks' gestation, the fetal survival rate is low [5]. Emergency surgery is a preferred option in the presence of AD, but the risk of postoperative fetal dysplasia during early pregnancy will be markedly increased, reducing the rate of fetal survival and normal growth.

Preoperatively, emergency multidisciplinary team was consulted, including Anesthesiology, Critical Care Medicine, Obstetrics, and Neonatology. Intraoperatively, CPB induced systemic inflammatory response [6] and was associated with maternal mortality of approximately 3% but a fetal mortality of 20% [7,8]. Hypothermia and rewarming can reduce uterine and placental blood flow, resulting in fetal bradycardia and fetal distress [7,9]. Blood flow to the uterus cannot regulate spontaneously and depends primarily on mean arterial pressure and vascular resistance. In addition, Hypothermic Circulatory Arrest (HCA) may lead to fetal brain atrophy and death [10,11]. However, HCA is still inevitable in type A AD involving the aortic arch.

In addition to surgery, medications will adversely affect surgical outcomes. Pregnant women should avoid the perioperative use of vasoconstrictors [12] because they will increase contraction to cause fetal hypoxia. Moreover, warfarin has clear potential for teratogenicity [13]. In this case, the aortic valve was preserved, thus avoiding the effects of warfarin. Furthermore, although the patient was treated with β–blockers and calcium channel blockers, fetal development was not affected. Generally, if the mother is treated with the above medications, the fetus should be monitored closely to avoid adverse outcomes.

Conclusion

Although AD during pregnancy is relatively rare, clinicians need a high clinical index of suspicion for pregnant women presenting with severe chest pain. For this disease, CTA should be performed, which is crucial for disease diagnosis and surgical options. In addition to multidisciplinary consultations involving emergency physicians, cardiovascular surgeons, anesthesiologists, intensivists, obstetricians, and neonatologists, rational and adequate treatment during and after surgery is essential for favorable outcomes.

Author contributors

Zhenqing Zhao was the main author, collected the data, wrote the initial manuscript.

Jianqiang Li and Peng Zhang reviewed the literature, and revised the manuscript.

Chaoliang Liu was the main surgeon and conducted the literature review, and reviewed and revised the manuscript.

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