

Surgical Management of a Type A Aortic Dissection in a Pregnant Patient

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Key Clinical Message: Despite emphasis for emergent surgical treatment of Stanford Type A aortic dissections, pregnant patients that are clinically stable may safely receive a staged approach instead, with delivery followed by delayed dissection repair.

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INTRODUCTION

Aortic dissection (AD) is a rare but life-threatening event in which a tear in the intima of the aorta allows circulating blood to enter between the layers of the vessel.¹ Stanford Type A AD's involve the aorta proximal to the origin of the left subclavian artery and classically present with pathognomonic 'tearing' chest pain, though some cases may present more insidiously.² These dissections are associated with a 1-2% increased mortality rate per hour, leaving fastidious diagnosis through either computed tomography angiography (CTA) or echocardiography a critical component to survival.^{1,3} Treatment consists of pain control, beta blockade for heart rate, blood pressure management, and typically emergent surgery.¹

While hypertension and connective tissue disorders are well-recognized risk factors for AD, other risk factors, such as pregnancy, may not be thoroughly understood. Nonetheless, child-bearing remains a critical consideration, as approximately 50% of the dissections seen in women under 40 years of age actually occur during pregnancy.^{1,4} Both diagnosis and management of AD vary in the pregnant population as well, with altered maternal physiology and concern for fetal well-being necessitating special consideration from clinicians. Although an abundance of literature exists pertaining to AD's in the non-pregnant population, data is inadequate regarding how this life-threatening condition should be clinically approached in pregnant patients. We sought to present a rare case of an AD in a third-trimester pregnant patient.

CASE DESCRIPTION

A 37-year-old G8P5 African American female at 31 weeks' gestation and with a past medical history significant for hypertension, gastric bypass surgery, gastro-esophageal reflux disease, and gestational diabetes mellitus presented emergently to an outside hospital with abdominal pain radiating to the neck with right arm numbness and weakness, as well as diarrhea, nausea, and emesis. Workup revealed an unremarkable electrocardiogram, normal troponins, and unremarkable chest x-ray. Hypotension 70/46 mmHg was noted, and the patient was admitted with a diagnosis of gastroenteritis with concern for sepsis. Two days later, in conjunction with persisting abdominal pain, the patient was found to have significantly lower blood pressures in the right upper extremity (65/48mmHg) compared to the left upper extremity (122/58mmHg). CT

Angiogram revealed a Stanford Type A AD involving the ascending aorta, aortic arch, descending thoracic aorta, and abdominal aorta with a dissection flap just below the origin of the superior mesenteric artery (**Figure 1 and 2**).

The patient was transferred to our institution where a multidisciplinary team of obstetricians, cardiac surgeons, and anesthesiologists decided to use a staged approach due to her clinical stability. The patient underwent an emergent cesarean section under general anesthesia. Concurrently, transesophageal echocardiography (TEE) was performed and showed preserved left ventricular systolic function (ejection fraction 60%), mild aortic regurgitation, and moderate mitral and tricuspid regurgitation. Importantly, the TEE indicated no pericardial effusion. The newborn was healthy and transferred to the NICU as a precaution. The patient was extubated and recovered from the cesarean delivery and 3 days later, the patient underwent a hemiarch replacement to repair the type A dissection. The patient was extubated the following day, soon weaned from vasoactive medications and had an uneventful recovery. She was discharged home on post-operation day 12. Written informed consent was obtained from the patient for their anonymized information to be published in this article.

DISCUSSION

Classically, AD's present with widened pulse pressure, unequal blood pressures in upper extremities, and pathognomonic 'tearing' chest pain radiating to the back.¹ However, recent literature has suggested these easily recognizable findings may not be as common, with one study finding only 50.6% of dissections to present with pain described as "tearing or ripping" and just 28.3% with radiating pain.⁵ Conversely, some cases present with vague symptoms, such as diarrhea and vomiting, which may easily be confounded with general malaises of pregnancy, as was the case with our patient initially.⁶ Individualizing risk factors in ambiguous settings such as these may make diagnoses more definitive. Our patient not only had chronic hypertension - a common risk factor for AD - but was also pregnant, which increased the likelihood of dissection from 1.24 per million in non-pregnant women to 14.5 per million in pregnant women due to the hyperdynamic state and hormonal effects on vasculature associated with pregnancy.^{4,7}

One of the challenges in diagnosing AD during pregnancy is imaging. While the gold standard for AD diagnosis has traditionally been CTA, both radiographs and CT scans are discouraged in pregnancy due to the potentially harmful effects of radiation to the fetus.⁸ In addition, contrast dyes utilized for angiography have been well-associated with nephropathy, potentially exacerbating the already-compromised state of the kidneys due to physiological changes of pregnancy.^{9,10} Although the dose of radiation delivered by CTA is below the limit for fetal harm, thus leaving the American College of Obstetrics and Gynecology in favor of utilizing CT imaging in pregnant patients that require imaging.¹¹ Other imaging alternatives, such as magnetic resonance imaging, can be utilized in pregnant patients with varying diagnostic accuracy and availability.⁸

Surgical planning for AD in pregnant patients is challenging, necessitating effective communication between the patient, anesthesiologists, obstetricians, and cardiac surgeons. Factors that impact clinical decision making include the onset and presentation of AD symptoms, hemodynamic stability, and fetal viability.¹² Additionally, surgical repair is generally poorly tolerated with fetal loss upwards of 30% due to a complex response to stress and cardiopulmonary bypass.¹³ Although there are no official guidelines regarding the management of AD in pregnancy, some have proposed tailoring treatment based on gestational age.⁴ Additional literature has developed this strategy further by suggesting emergent cesarean section with sternotomy standby followed by surgical repair of the aorta within a few days.¹⁴ In our patient's case, the clinical team decided to have the patient undergo cesarean section first, in case of any hemodynamic instability that may have developed during the procedure.

We present a case of successful surgical treatment of an AD in a pregnant patient after an initial delay in diagnosis treated with a staged approach of delivery followed by delayed dissection repair. AD's represent a potentially catastrophic complication of pregnancy. Although AD's are thought to have the hallmark easily identifiable tearing chest pain, atypical presentations may delay accurate diagnosis and clinical manage-

ment. Increased clinical suspicion for AD is warranted in patients with corresponding risk factors, especially pregnancy. Treatment aims to mitigate the risk of both fetal and maternal demise, and typically includes emergent cesarean section and AD defect repair, though consensus regarding the timing of repair is currently lacking. While AD in the general population is well studied, future studies should aim to better describe how AD may present during pregnancy and how management differs in the gravid patient from that of non-pregnant patients.

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The Authors declare that there is no conflict of interest.

REFERENCES

1. Levy D, Goyal A, Grigorova Y, Farci F, Le JK. Aortic Dissection. In: StatPearls. *StatPearls Publishing* ; 2022. Accessed March 15, 2023. <http://www.ncbi.nlm.nih.gov/books/NBK441963/>
2. Baimatova I, Singh H, Khanafer A. Debakey Vs Stanford: Are they the same? *Heart Lung Circ* . 2016;25(8):e102. doi:10.1016/j.hlc.2015.12.044
3. Harris KM, Nienaber CA, Peterson MD, et al. Early Mortality in Type A Acute Aortic Dissection: Insights From the International Registry of Acute Aortic Dissection. *JAMA Cardiol* . 2022;7(10):1009. doi:10.1001/jamacardio.2022.2718
4. Zeebregts CJ, Schepens MA, Hameeteman TM, Morshuis WJ, de la Rivière AB. Acute Aortic Dissection Complicating Pregnancy. *Ann Thorac Surg* . 1997;64(5):1345-1348. doi:10.1016/S0003-4975(97)00916-8
5. Hagan PG, Nienaber CA, Isselbacher EM, et al. The International Registry of Acute Aortic Dissection (IRAD): New Insights Into an Old Disease. *JAMA* . 2000;283(7):897. doi:10.1001/jama.283.7.897
6. Wu J, Xie E, Qiu J, et al. Subacute/chronic type A aortic dissection: a retrospective cohort study. *Eur J Cardiothorac Surg* . Published online July 16, 2019:ezz209. doi:10.1093/ejcts/ezz209
7. Kinney-Ham L, Nguyen HB, Steele R, Walters E. Acute Aortic Dissection in Third Trimester Pregnancy without Risk Factors. *West J Emerg Med* . 2011;12(4):571-574. doi:10.5811/westjem.2011.5.2257
8. Yoon I, Slesinger TL. Radiation Exposure In Pregnancy. In: StatPearls. *StatPearls Publishing* ; 2022. Accessed March 15, 2023. <http://www.ncbi.nlm.nih.gov/books/NBK551690/>
9. Hussein W, Lafayette RA. Renal function in normal and disordered pregnancy. *Curr Opin Nephrol Hypertens* . 2014;23(1):46-53. doi:10.1097/01.mnh.0000436545.94132.52
10. Modi K, Padala SA, Gupta M. Contrast-Induced Nephropathy. In: StatPearls. *StatPearls Publishing* ; 2022. Accessed March 15, 2023. <http://www.ncbi.nlm.nih.gov/books/NBK448066/>
11. Committee Opinion No. 656 Summary: Guidelines for Diagnostic Imaging During Pregnancy and Lactation. *Obstet Gynecol* . 2016;127(2):418. doi:10.1097/AOG.0000000000001309
12. Patel PV, Alter R, Frenn R, Waters TP. Aortic Dissection in a Pregnant Patient without Other Risk Factors. *Case Rep Obstet Gynecol* . 2019;2019:1-3. doi:10.1155/2019/1583509
13. Kostadinovska B, Nikolic A, Slaveski D, Milojevic M. Acute aortic dissection in a patient with Marfan syndrome during advanced pregnancy. *J Card Surg* . 2020;35(2):499-502. doi:10.1111/jocs.14408
14. Song S, Lu L, Li L, Peng H, Wu X. Antepartum acute Stanford type A aortic dissection: a case report and literature review. *J Cardiothorac Surg* . 2022;17(1):73. doi:10.1186/s13019-022-01817-7

