

## Case Reports

# Aortic Dissection and COVID-19 Pneumonia in a Pregnant Woman at 34 Weeks of Gestation

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## Abstract

Between 0.1% and 0.3% of all aortic dissections occur during pregnancy. Arterial hypertension, connective tissue disorders, and congenital cardiovascular anomalies—including bicuspid aortic valves—are well-known risk factors. The causality between pregnancy and aortic dissection is unclear, but there have been some observations that COVID-19 illness may increase the risk. This report describes a pregnant woman at 34 weeks of gestation who had a bicuspid aortic valve and experienced an acute aortic dissection while ill with COVID-19 pneumonia. Computed tomography confirmed a type A aortic dissection and bilateral patchy pulmonary opacities. Cesarean delivery was performed, followed by replacement of the aortic valve with a mechanical aortic prosthesis and reconstruction of the ascending aorta and hemiarch. The intraoperative course was uneventful, and the patient was successfully weaned from mechanical ventilation after 51 hours. COVID-19 during pregnancy seems to increase the risk for aortic dissection, although there is no evidence base for an association. Because guidelines for diagnosis and treatment in such complex cases are lacking, care from a multidisciplinary team is crucial for successful outcomes.

**Keywords:** Aortic dissection; COVID-19; interdisciplinary communication; pregnancy

## Introduction

Type A aortic dissection (TAAD) during pregnancy requires emergent surgery and is potentially lethal to the mother and fetus. The incidence of aortic dissection (AD) in the general population is 0.4 to 3.5 per 100,000 person-years, but the reported mortality is as high as 60%.<sup>1,2</sup> Only 0.0004% of pregnancies are affected by AD,<sup>3</sup> and only 0.1% to 0.3%<sup>3,4</sup> of all instances of AD occur during pregnancy. Reports conflict regarding a possible association between pregnancy and AD.<sup>1,5-7</sup> However, several conditions—including arterial hypertension, connective tissue disorders, and congenital cardiovascular anomalies including aortic hypoplasia, aortic coarctation, and bicuspid aortic valve (BAV)—are well-known risk factors for AD.<sup>4,8,9</sup> Furthermore, there are some observations that COVID-19 infection may contribute to vascular wall damage<sup>10</sup> and consequently increase the risk for AD. With the growing challenges in cardiac surgery during the ongoing COVID-19 global pandemic, it is important to improve understanding of cardiac pathophysiology in light of COVID-19 illness and to emphasize the importance of a multidisciplinary approach in caring for patients undergoing cardiac surgery. This report describes a pregnant woman at 34 weeks of gestation with a BAV and COVID-19 pneumonia who experienced a TAAD; successful outcomes for both the mother and child were achieved.

## Case Report

A 36-year-old woman (gravida 2, para 1) at 34 weeks of gestation presented to the emergency department with shortness of breath and sudden chest pain radiating to her back. She had been experiencing headaches and fatigue for 2 weeks, but her pregnancy had been uncomplicated thus far. A positive polymerase chain reaction test for SARS-CoV-2 confirmed infection. Because her symptoms were mild, she did not require hospitalization or supplemental oxygen. She was under the care of a cardiologist because of a BAV, but she did not have dilatation of the ascending aorta. She had no history of arterial hypertension, and there was no family history of connective tissue disorders.

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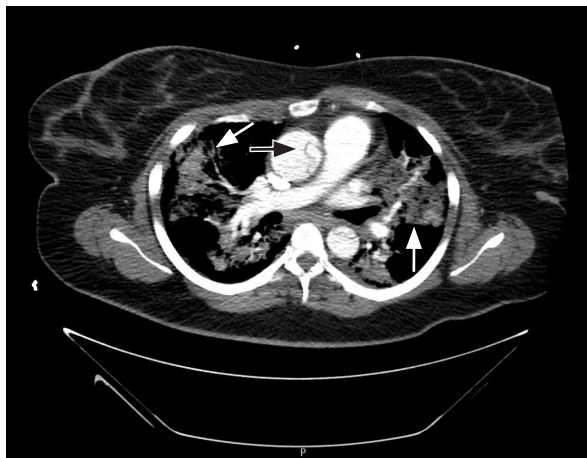
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Transthoracic echocardiography performed in the emergency department showed an intimal flap in the ascending aorta and severe aortic regurgitation. Transesophageal echocardiography (TEE) was attempted to confirm the diagnosis, but the patient was unable to tolerate the procedure, so computed tomography angiography (CTA) was performed. This showed a TAAD affecting the left subclavian artery; the visceral aortic branches were patent. Patchy, ground-glass opacities were observed in both lungs, revealing ongoing COVID-19 pneumonia (Fig. 1). The patient was conscious, hemodynamically stable, and had a stable respiratory status on supplemental oxygen via a simple face mask at a flow rate of 10 L/minute; there were no other remarkable symptoms.

The patient was transferred to University Hospital Centre Zagreb for cardiac surgery. She agreed to receive a mechanical aortic valve prosthesis if needed. A single dose of dexamethasone was administered to prevent fetal respiratory distress syndrome, and a nitroglycerin infusion was initiated to maintain the patient's systolic blood pressure under 120 mm Hg. The patient was transferred to the operating room where obstetricians, cardiac surgeons, cardiac and obstetric anesthesiologists, and a neonatology team were present.

### Technique

The interdisciplinary team decided to perform an emergent cesarean delivery (CD), followed by induction of general anesthesia and cardiac surgery. Following delivery of the breech fetus (Fig. 2), the male infant was assessed by the neonatology team; he was born cyanotic and generally hypotonic, without spontaneous respiration efforts. After 5 minutes of resuscitation, he started breathing normally. His Apgar scores were 2, 6, and 8 at 1, 5, and 10 minutes, respectively.



**Fig. 1** Aortic computed tomography angiography shows an intimal flap in the ascending aorta; patchy opacities are visible in both lungs.

### Abbreviations and Acronyms

AD	aortic dissection
BAV	bicuspid aortic valve
CD	cesarean delivery
CTA	computed tomography angiography
GA	gestational age
MRA	magnetic resonance angiography
TAAD	type A aortic dissection
TEE	transesophageal echocardiography



**Fig. 2** Three-dimensional computed tomography reconstruction of the aorta shows the fetus in a breech position.

An abdominal drain was placed to monitor bleeding during cardiopulmonary bypass, and the abdomen was closed. After cannulation of the right femoral artery and the right atrium, cardiopulmonary bypass was established. The target systemic temperature was 19 °C when circulatory arrest without cerebral perfusion was initiated. A tear of the intimal layer of the aortic wall was observed distal to the sinotubular junction, above the right commissure. Replacement of the aortic valve was performed using a 25-mm mechanical aortic prosthesis (On-X; CryoLife, Inc), and resection and reconstruction of the ascending aorta and hemiarch were performed using a 38-mm Intergard woven prosthesis (Getinge AB). The duration of circulatory arrest was 23 minutes. Intraoperative TEE revealed normal function of the mechanical aortic valve and preserved function of both ventricles. Despite an uneventful intraoperative course, the patient was maintained on mechanical ventilation because of persistent hypoxia requiring higher fractions of inspired oxygen ( $\leq 70\%$ ) and positive end-expiratory pressure ( $\leq 10$  mm Hg); she was weaned from mechanical ventilation after 51 hours. The patient was discharged on postoperative day 23, and the infant was discharged on day of life 22.

## Discussion

The increased activity of the renin-angiotensin-aldosterone pathway, increased blood volume and cardiac output,<sup>11</sup> and hormonal changes leading to alterations in vascular wall architecture<sup>12</sup> may explain the increased risk for AD during pregnancy and shortly after delivery.<sup>13</sup> An additional risk factor for AD in the patient described in this report is her BAV, which is found in up to 15% of all individuals with AD.<sup>14</sup> Some clinicians recommend that first-degree relatives of individuals with a BAV and related aortic complications should be informed and screened for this condition using echocardiography.<sup>14</sup>

This report describes the rare combination of AD in pregnancy and COVID-19 pneumonia, ultimately with successful outcomes. Some authors of case reports describe relatively young individuals with arterial dissection and COVID-19 illness without any contributing medical history. Tabaghi and Akbarzadeh<sup>15</sup> observed AD in a previously healthy 47-year-old woman with respiratory insufficiency caused by COVID-19 pneumonia. This patient developed acute TAAD on the eighth day of admission and died.<sup>15</sup> Interesting instances of bilateral carotid artery dissection in a 58-year-old man<sup>16</sup> and bilateral vertebral artery dissection in 39-year-old woman,<sup>17</sup> both with COVID-19, have also been published.

It is not known whether there is causality between COVID-19 and arterial dissection, or whether the association is just a coincidence, but the intriguing temporal sequence in reported patients,<sup>15-18</sup> including the one described in this report, suggests COVID-19 illness as a possible trigger for arterial dissection or AD. Vascular damage from viral infection may be caused by a direct interaction of SARS-CoV-2 and the endothelial receptor for angiotensin-converting enzyme 2, leading to endothelial activation and cytokine storm, with consequential tissue damage and weakening of the vessel wall.<sup>10,19</sup>

Because of the small number of ADs occurring during pregnancy, there are no guidelines for diagnostic tools or surgical treatment that are stratified by gestational age (GA). According to guidelines from the European Society of Cardiology on the diagnosis and treatment of aortic diseases, TEE, CTA, and magnetic resonance angiography (MRA) are considered equivalent methods for confirming or excluding AD, but CTA and MRA provide a superior assessment of the extent of the AD and the involvement of the major aortic branches, and they allow better surgical planning.<sup>20</sup> An adverse effect of CTA is ionizing radiation, and the gadolinium contrast used for MRA is associated with many pathologic neonatal conditions<sup>21</sup>; also, MRA takes longer than CTA. The patient in this report could not tolerate TEE; therefore, CTA was performed to confirm the diagnosis and perform precise surgical planning.

Zeebregts et al<sup>22</sup> recommend aortic repair without CD before 28 weeks of gestation; after 32 weeks of gestation, emergency CD before cardiac surgery is necessary. If the GA is between 28 and 32 weeks, the risks for mother and fetus should be considered by a multidisciplinary team before making a decision.<sup>22</sup> It seems that the recommendation to perform CD before aortic repair when the GA is past 32 weeks is common practice and yields mostly successful results.<sup>23-26</sup>

This report describes an interesting combination of conditions that may have increased the risk for AD in a young woman. Besides the well-known risk factor of BAV, there are indications that pregnancy and COVID-19 may have also increased the risk for AD. Because of the lack of guidelines for diagnosis and treatment of this rare condition, the contributions of a multidisciplinary team are crucial for a successful outcome. Causality between AD, pregnancy, and COVID-19 illness is unclear; further research is mandatory to elucidate the relationship.

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