

# Aortic Pseudoaneurysm After Transcatheter Aortic Valve Replacement

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## Abstract

Transcatheter aortic valve replacement has become a standard of care treatment for many patients with severe symptomatic aortic stenosis over the course of the past decade. While transcatheter aortic valve replacement has many advantages compared to surgical aortic valve repair, one disadvantage is the increased risk of vascular complications seen with transcatheter aortic valve replacement. In this case report, we present a rare post-transcatheter aortic valve replacement vascular complication of ascending aorta pseudoaneurysm formation.

**Keywords:** Angiography, pseudoaneurysm, TAVR, vascular

## Introduction

Aortic stenosis is the most common cardiac valvular disease in developed countries.<sup>1</sup> The 2 available treatment options for severe aortic stenosis are surgical aortic valve replacement (SAVR) and transcatheter aortic valve replacement (TAVR). The traditional SAVR procedure involves a sternotomy approach to replace the native valve. This was the standard treatment for severe aortic stenosis until the advent of TAVR. This less-invasive approach involves inserting a prosthetic valve through a vascular access site, most commonly the femoral artery, and guiding it to the location of the native valve. Balloon expandable prosthetic valves are guided by a balloon catheter to this location. Inflation of the balloon forces the stenotic native valve open and sets the prosthetic valve in place. Self-expanding prosthetic valves are inserted in a collapsed state. Once they are guided to the aortic valve, unsheathing the prosthetic valve allows it to assume its expanded state, forcing the stenotic native valve open.<sup>2</sup>

Implantation of a prosthetic aortic valve through this transcatheter approach was first described in 2002.<sup>3</sup> The procedure was initially approved for patients with high surgical risk based on demonstrated mortality benefits in those patients.<sup>4</sup> Over time, however, the body of evidence progressed to show that TAVR was associated with reduced mortality compared to SAVR across all surgical risks. This led to approval for a wider range of patients with severe aortic stenosis to receive TAVR.<sup>5,6</sup> Transcatheter aortic valve replacement volumes have increased in the last decade with volumes exceeding those of SAVR in 2019.<sup>7</sup> Transcatheter aortic valve replacement is now the standard recommended treatment

for severe symptomatic aortic stenosis, especially in the elderly population.

Certain complications are more and less common with TAVR compared to SAVR. TAVR has been shown to have a lower risk of stroke, major bleeding, acute kidney injury, and atrial fibrillation than SAVR. However, TAVR is associated with an increased risk of the need for permanent pacemaker implantation and vascular complications, both of which are also the most common types of complications seen with TAVR.<sup>6</sup>

Transcatheter aortic valve replacement-related vascular complications were relatively common in the first several years after its advent with 15.3% and 11.9% of the patients in the Placement of Aortic Transcatheter Aortic Valves (PARTNER) trial experiencing major and minor vascular complications, respectively.<sup>8</sup> The incidence of vascular complications has decreased over time with improved techniques and increased operator proficiency with the procedure. Vascular complications encompass a heterogeneous group of injuries ranging from relatively more common access site hematomas and pseudoaneurysms to relatively rare aortic dissections and ruptures.<sup>9</sup> In this case, we present an example of a rare TAVR-related vascular complication of ascending aortic pseudoaneurysm formation.

## Case Presentation

### Clinical Presentation

The patient was a 61-year-old female with a history of bicuspid aortic valve status post-femoral approach TAVR in February 2020 who presented in November 2021 with shortness of breath. Her other medical history included aneurysmal dilatation of the

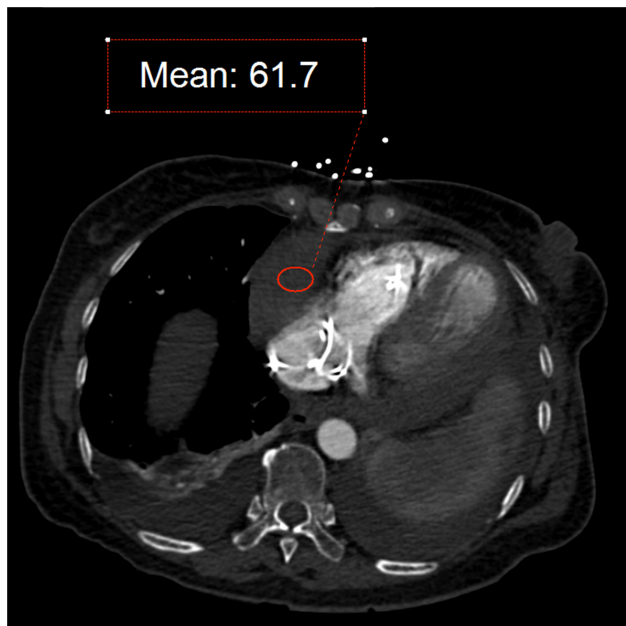
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**Figure 1.** Axial CT view at the level of the replaced aortic valve demonstrates high attenuation of pericardial fluid consistent with hemopericardium. CT, computed tomography.

ascending aorta, cervical cancer on chemotherapy, chemotherapy-induced pericarditis status post pericardial window, and sinus bradycardia status post pacemaker placement.

On the evaluation of her shortness of breath, she was found to have small pericardial effusion and large left pleural effusion on echo. A computed tomography (CT) chest was ordered for further evaluation.

#### Imaging Findings

Computed tomography chest without contrast showed a hyperdense pericardial effusion concerning hemopericardium (Figure 1). Concern was raised over the location of the recently placed pacemaker leads as a possible source of hemopericardium from perforation. A computed tomography angiography (CTA) of the chest was obtained.

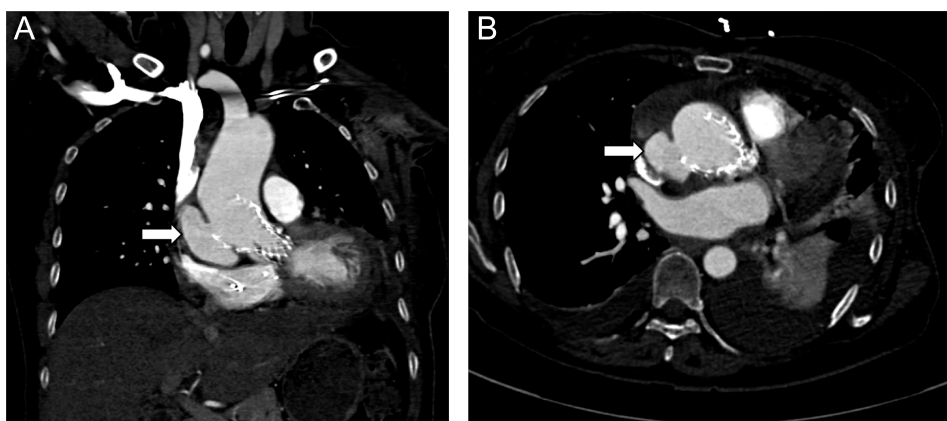
The CTA of the chest showed a large pseudoaneurysm in the ascending aorta just distal to the replaced aortic valve. The pseudoaneurysm is seen extending superiorly and communicating with the pericardium resulting in the hemopericardium noted. True aneurysmal dilatation of the ascending aorta was noted again as well, stable in size from prior imaging (Figures 2 and 3). The pacemaker leads were in an appropriate position without evidence of perforation.

#### Outcome

The patient underwent aortic graft replacement with a 28-mm Dacron graft, concurrent aortic valve replacement, aortic root replacement, evacuation of pericardial hematoma, and coronary artery bypass graft. She recovered without complication and was discharged home.



**Figure 3.** The three-dimensional reconstruction image highlights the pseudoaneurysm (arrow) located at the posterior aspect of the ascending aorta.



**Figure 2.** Coronal (A) and axial (B) CTA images show a pseudoaneurysm (arrow) located at the right posterior aspect just above the replaced aortic valve. True aneurysmal dilatation of the aorta, unrelated to and preceding the TAVR procedure, is seen as well. CTA, computed tomography angiography.

## Discussion

Transcatheter aortic valve replacement shows a higher rate of vascular complications compared to SAVR.<sup>6</sup> However, this encompasses a heterogeneous group of injuries occurring anywhere from the artery of access to the aortic annulus itself and ranging in acuity from immediate intraoperative or postoperative presentation to incidental findings on later follow-up.

Our case presents an injury to the ascending aorta that was detected more than a year after the TAVR procedure. Few case reports of injury to the ascending aorta have been described in the literature. In each case, the injury resulted in a pseudoaneurysm that was found on follow-up imaging outside of the acute postoperative period. Schamroth et al suggested an injury mechanism involving a tear in the aorta that occurred at the time of the TAVR procedure that slowly developed into a pseudoaneurysm, which is likely given the delayed or incidental finding of the injury.

Different approaches to the treatment of the pseudoaneurysm were utilized. In our case, given the hemopericardium at the time of finding, open repair of the pseudoaneurysm was performed with the concurrent evacuation of the hemopericardium. Other cases in the literature employed a watchful waiting approach until spontaneous thrombosis of the pseudoaneurysm occurred or performed percutaneous exclusion with a vascular plug.<sup>10,11</sup>

While only a few cases of ascending aorta injury were reported in the literature, many more instances of aortic annular injury were found with a reported incidence of up to 1.0%. The risk of annular rupture is higher with moderate or severe left ventricular outflow tract calcification, using balloon-expandable TAVR devices rather than self-expanding TAVR devices, and oversizing of the device.

Though no studies have been done on the relationship between these factors and ascending aortic injuries, it is plausible that calcification of the ascending aorta may cause similarly decreased pliability that increases the risk of injury. Similarly, balloon-expandable devices and oversizing of the device can be hypothesized to increase the risk of ascending aortic injury via similar mechanisms involved in their demonstrated increase of annular injury risk. The presence of bicuspid valve and annular asymmetry are risk factors for annular injury, but we suspect these do not play a significant role in ascending aortic injury following TAVR as presented in our case.<sup>12</sup>

**Informed Consent:** Written informed consent was obtained from the patient who participated in this study.

**Peer-review:** Externally peer-reviewed.

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