Case Reports in Interventional Cardiology

Percutaneous Management of Aortic Root Rupture During Transcatheter Aortic Valve Replacement With Coil Embolization

Tarun Chakravarty, MD; Justin Cox, MD; Yigal Abramowitz, MD; David Lange, MD; Masaki Miyasaka, MD; Suhail Dohad, MD; Wen Cheng, MD; Raj R. Makkar, MD

Aortic root rupture is a rare, but potentially fatal, complication of transcatheter aortic valve replacement (TAVR).[1,2] Despite the advances in TAVR technology, aortic root rupture continues to be associated with high mortality because of the lack of effective treatment options for this complication. We describe 2 cases of aortic root rupture occurring during TAVR that were managed percutaneously with coil embolization of the periaortic space created by the root rupture.

Case 1

A 79-year-old patient underwent TAVR with a 29-mm Evolut R (Medtronic, Inc, Minneapolis, MN). Pre-TAVR computed tomography revealed annular perimeter 81.6 mm (mean diameter, 26.0 mm). Because of significant paravalvular aortic regurgitation (Figure 1A; Movie IA in the Data Supplement), post-dilation was performed with a 26 mm×4.5 cm True Balloon (Figure 1B; Movie IB in the Data Supplement). Immediately after post-dilation, a large pericardial effusion was noted (Figure 1C; Movie IC in the Data Supplement). Emergent pericardiocentesis was performed. Selective injection into the left coronary cusp with a 6F XB-LAD 3.5 guide catheter revealed the site of aortic root rupture in the left coronary sinus, with contrast extravasating into the pericardial space (Figure 1D and 1E; Movie ID and IE in the Data Supplement). A 0.035-inch straight Quick Cross Support Catheter (Spectranetics, Corp, Colorado Springs, CO) was advanced over a Balance wire into the periaortic space created by the root rupture, and two 3.5×10×8 mm MReye Embolization Coils (Cook Medical, Inc, Bloomington, IN) were placed outside the root rupture site (Figure 1F; Movie IF in the Data Supplement), with no residual pericardial effusion (Figure 1G; Movie IG in the Data Supplement). A computed tomogram performed 6 months after TAVR revealed the presence of coils outside the left coronary cusp (Figure 1H; Movie IH in the Data Supplement).

Case 2

A 74-year-old patient underwent TAVR with a 29-mm Sapien 3 (Edwards LifeSciences, Inc, Irvine, CA) valve. Pre-TAVR computed tomography revealed annular area 541.8 mm,[2] mean diameter 26.3 mm, and moderate-to-severe left ventricular outflow tract calcification (Figure 2A and 2B). Post-procedure, a large pericardial effusion was noted (Figure 2C; Movie IIA in the Data Supplement). Immediate pericardiocentesis was performed. Selective aortic root injection with a 6F AL1 catheter resulted in the identification of the site of the aortic root rupture (Figure 2D and 2E; Movie IIB and IIC in the Data Supplement). A 2.6F Lantern 115-cm Microcatheter (Penumbra, Inc, Alameda, CA) was advanced over a Balance wire into the periaortic space created by the root rupture (Figure 2F; Movie IID in the Data Supplement), and 4 Penumbra Coils (Penumbra, Inc) were deployed in succession (Figure 2G; Movie IIE in the Data Supplement), with successful occlusion of the aortic root rupture site (Figure 2G and 2H; Movie IIE and IIF in the Data Supplement.

Discussion

Treatment options for aortic root rupture during TAVR are limited, including conservative management, emergent pericardiocentesis, emergent surgical repair, or transcatheter valve-in-valve implantation to seal the site of rupture.[1,2] Coil embolization has been reported for other types of cardiac and aortic pseudoaneurysms.[3,4] The coiling technique, in the context of TAVR, has several considerations. Selective contrast injection into the sinuses is necessary to identify the site of bleed. In both cases, nonselective injection with a pigtail did not identify the site of rupture (Figures 1D and 2D). Dense packing at the site of rupture should be achieved with placement of multiple coils to isolate it from active circulation. We used coils, instead of plugs or occluder devices, because of the relatively easy delivery of coils through a microcatheter, which can even be delivered via a 6F diagnostic catheter. Because we adopted this technique, our usual approach for the management of new pericardial effusion post-TAVR is to initiate emergent supportive measures and attempt to identify the site of rupture with selective aortic root angiogram for percutaneous coiling. To the best of our knowledge, this is the first description of endovascular coil embolization of the

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periaortic space created by the root rupture for the treatment of this complication occurring during TAVR.

Disclosures

Drs Chakravarty and Cox are proctor and consultant for Edwards LifeSciences. Dr Makkar is a proctor and consultant for Edwards LifeSciences and has received research grants from Edwards LifeSciences, Abbott, Inc, and Medtronic, Inc. The other authors report no conflicts.

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KEY WORDS: aortic rupture ■ aortic valve ■ pericardial effusion ■ rupture ■ transcatheter aortic valve replacement

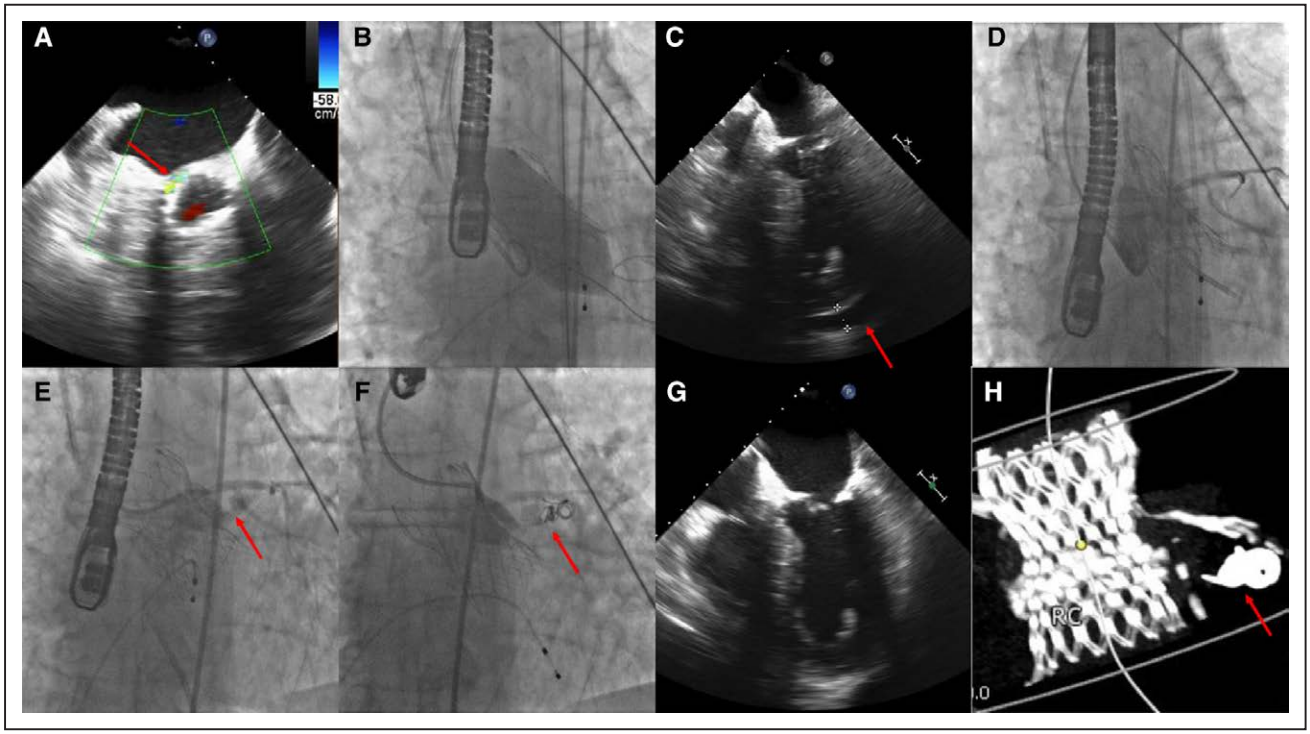

Figure 1. Coiling of the periaortic space created by the root rupture occurring during Evolut R valve implantation. **A**, Moderate paravalvular aortic regurgitation (arrow) after Evolut R valve implantation. **B**, Post-dilation performed with a 26 mm×4.5 cm Z Med II balloon. **C**, Cardiac tamponade immediately after post-dilation (arrow). **D**, Nonselective aortic root angiogram did not reveal the site of aortic root rupture. **E**, The site of aortic root rupture noted on selective angiogram of the left coronary cusp (arrow). **F**, Successful closure of the site of aortic root rupture with 2 MReye Embolization Coils (arrow). **G**, Final echocardiogram with no residual pericardial effusion. **H**, Coils outside the left coronary cusp noted on computed tomogram performed after transcatheter aortic valve replacement.

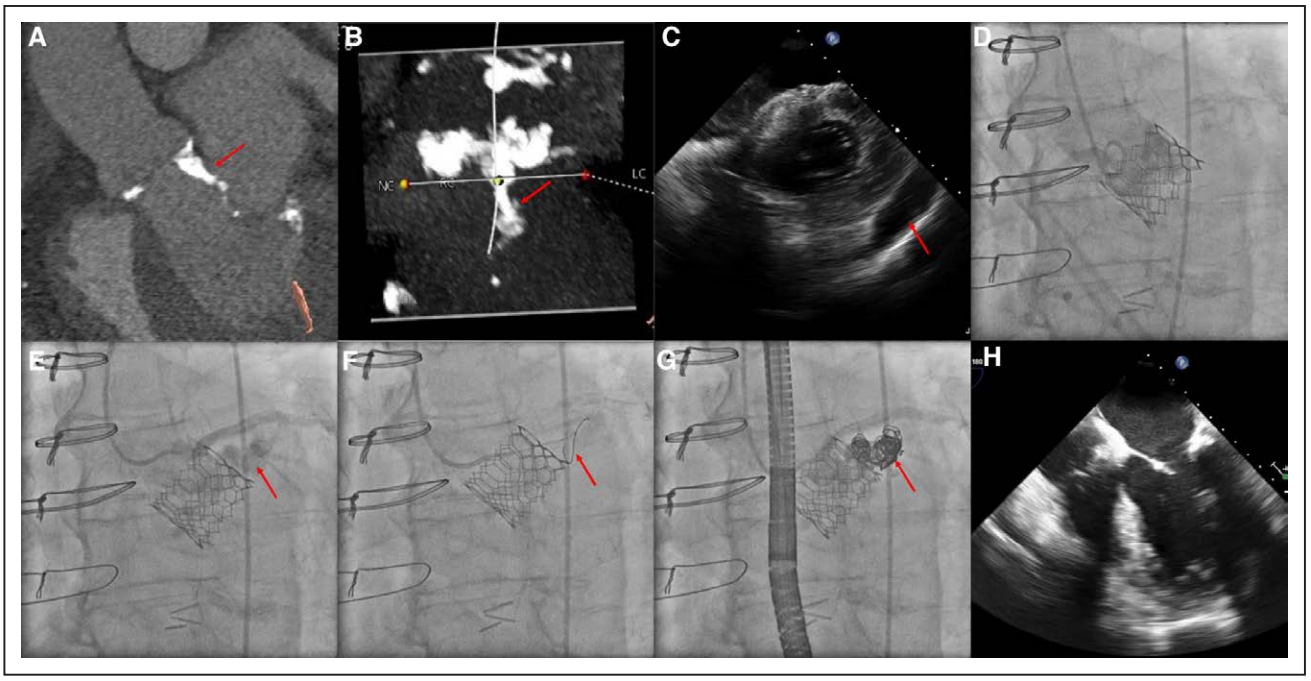

Figure 2. Coiling of the periaortic space created by the root rupture occurring after Sapien 3 valve implantation. **A** and **B**, Baseline computed tomogram revealing moderate-to-severe left ventricular outflow tract calcification (red arrow). **C**, Moderate-to-severe pericardial effusion (arrow) and cardiac tamponade after deployment of a Sapien 3 valve. **D**, Nonselective aortic root angiogram did not reveal the site of aortic root rupture. **E**, Selective injection into the coronary cusp with an AL1 catheter revealed the site of aortic root rupture (arrow). **F**, Balance wire advanced through AL1 diagnostic catheter into the periaortic space (arrow). **G**, Successful closure of the site of aortic root rupture with 4 Penumbra coils (arrow). **H**, Final echocardiogram with trivial pericardial effusion.

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