Transapical Retrieval of a Ruptured and Immobilized TAVR Balloon

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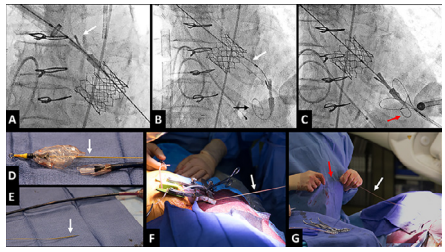

Distal segment/*inner tubing* (white arrow). Stiff (black arrow) and soft (red arrow) wires.

Central Message

The distal segment of the TAVR delivery system was immobilized and disconnected but was held by the *inner tubing*. The stiff wire was exchanged for a softer wire via *inner tubing* and snared transapically.

A 92-year-old female with symptomatic severe aortic stenosis and a Society of Thoracic Surgeons (STS) mortality score of 21% underwent direct aortic transcatheter aortic valve replacement (TAVR) because she had a high-grade stenosis of the mid-abdominal aorta and bilateral stenotic subclavian/carotid arteries. Her past surgical history included coronary bypass surgery for right coronary artery, extra-anatomic aortocarotid, and right subclavian bifurcating hemashield conduit graft surgery.

A right second intercostal surgical incision was made and an 18 Fr. introducer sheath was placed at an adequate height in the ascending aorta. The Certitude delivery system[1] with a 26-mm Sapien S3 transcatheter heart valve (Edwards Lifesciences, Irvine, CA) was advanced to the level of aortic annulus (Fig. 1A) over an extra-small Safari wire (Boston Scientific, Marlborough, MA). The valve was successfully deployed in a standard fashion at nominal pressure of 5 atm (rated burst pressure – 7 atm) with 23 mL inflation volume. Immediately after deployment, blood was noted in the indeflator (Fig. 2A, white arrow) suggesting rupture of the Certitude balloon. While attempting to pull the delivery system, the proximal segment of the delivery sheath got detached from distal fragment (Figs. 1B and 2C, white arrows; Supplementary Video 1), the distal fragment of the balloon along with the conical-shaped radiopaque (RO) shoulder got stuck at the tip of the introducer sheath (Fig. 1D, black arrow). The proximal segment was removed and the *inner tubing* of the delivery system that held the distal shoulder was identified over the Safari wire (Fig. 2B–D). Despite upsizing the introducer sheath to a 26 Fr. DrySeal sheath (Gore Medical, Newark, DE) over the *inner tubing*, the distal segment could not be retrieved.

A decision was made to retrieve the delivery system transapically. The patient was placed on cardiopulmonary bypass (arterial cannula in ascending aorta through the right second intercostal space immediately above the TAVR access and venous cannula through right femoral vein) and a direct needle access of left ventricular (LV) apex was performed. A purse string suture was placed at the LV apex and an 8 Fr. sheath was introduced. The direct aortic introducer sheath was removed and the aortic purse string suture was secured. The Safari wire was exchanged for a regular 0.035″ J-wire (Cordis Corporation, Miami Lakes, FL) through the exteriorized *inner tubing* of the delivery system (Fig. 1E and F). Then an 18–30 En Snare (Merit Medical, UT) was used to snare the J-wire from the apex (Fig. 1G–I). The J-wire along with the distal segment of the delivery system was successfully retrieved transapically.

Patient recovered well post procedure. She was transferred to rehabilitation center 4 days post procedure. She remained well and asymptomatic at a month follow-up. No significant aortic valve gradient or regurgitation was noted on echocardiography at 1 month.

Balloon rupture of transcatheter heart valve is rare but a serious complication during TAVR. Entrapment of the conical-shaped distal RO shoulder and detachment of the *inner tubing* of the Edwards Certitude delivery system can occur but can be retrieved transapically. Although the exact mechanism by which the detachment occurred is unclear, the likely location of detachment is at the site of attachment of inner tubing to the delivery handle (Fig. 2F). In our case, transapical access for retrieval added additional procedural time and additional access. The distal segment may have been retrievable with a

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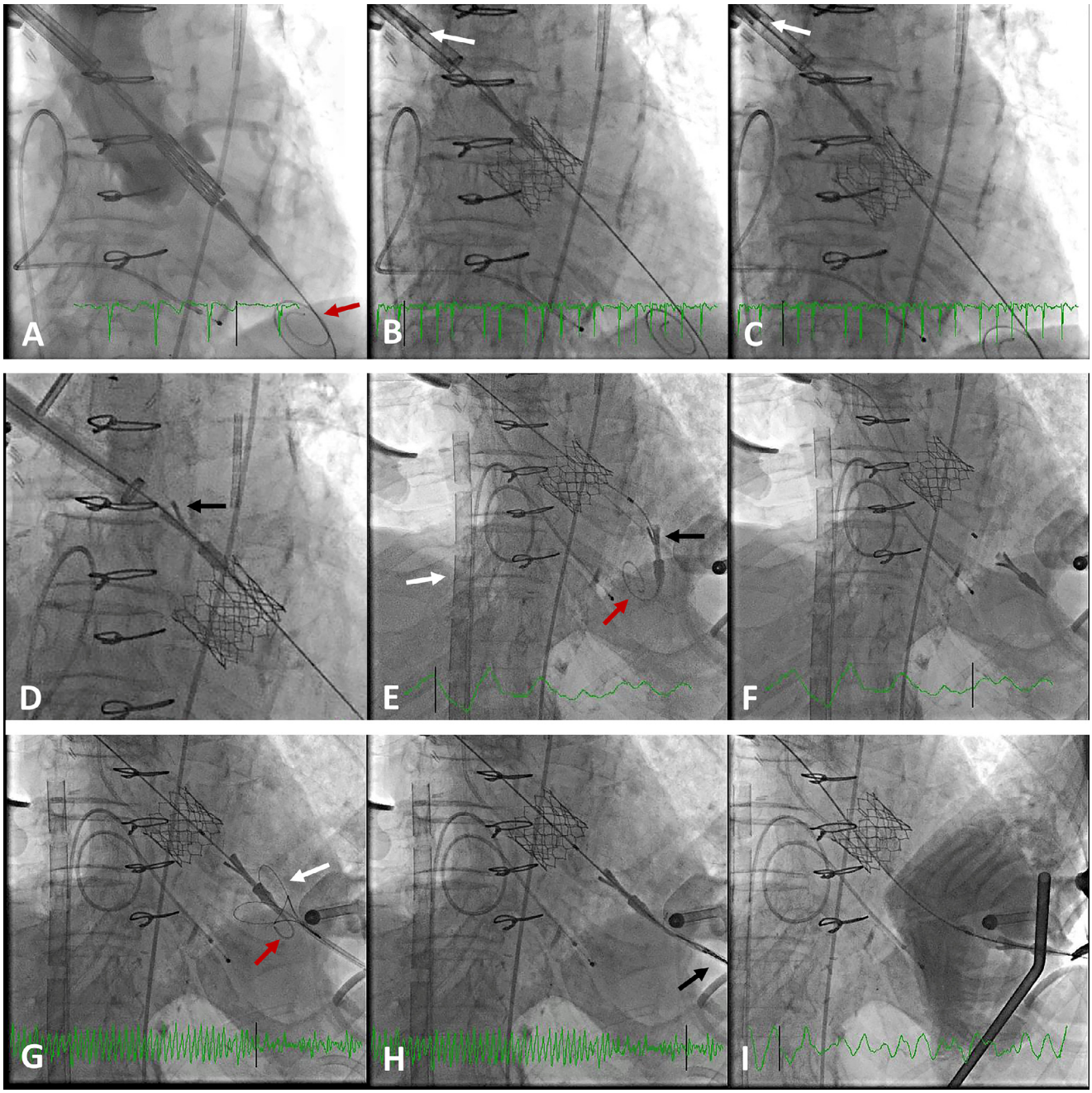

Figure 1. (A) An 18 Fr. introducer sheath is noted placed via direct aortic access. The Edwards Certitude 26-mm Sapien S3 delivery system is seen over the Safari wire (red arrow) with the valve at the level of aortic annulus. (B and C) After successful deployment of the valve, on pulling the delivery system the proximal RO shoulder (white arrows) is seen detaching from the distal segment. (D) The conical-shaped distal RO shoulder is seen trapped at the distal end of the introducer sheath (black arrow). (E) Patient was placed on cardiopulmonary bypass with the venous cannula (white arrow) in the right atrium. The introducer sheath was taken out and the aortic purse string suture was secured. The Safari wire (red arrow) is seen being pulled out leaving the distal segment of the delivery system in the left ventricle (LV). (F) The distal segment is seen attached to the *inner tubing* which is secured externally. (G) A regular 0.035″ J-wire is seen advanced through the *inner tubing* into the LV. An 8 Fr. sheath is placed into the LV apically and an 18–30 En Snare is being used to snare the J-wire. (H and I) Subsequently, the J-wire and distal segment of the delivery system are being retrieved apically.

large Amplatz Goose Neck Snare (Medtronic, Minneapolis, MN) via the direct aorta route itself, thus, avoiding transapical access. Additionally, although we elected to place the patient on cardiopulmonary bypass, the procedure could have been performed without cardiopulmonary bypass. Prompt recognition of the inner tubing of the delivery system allowed for exchange of the Safari wire for a more softer wire which was successfully snared through the transapical route. Thus,

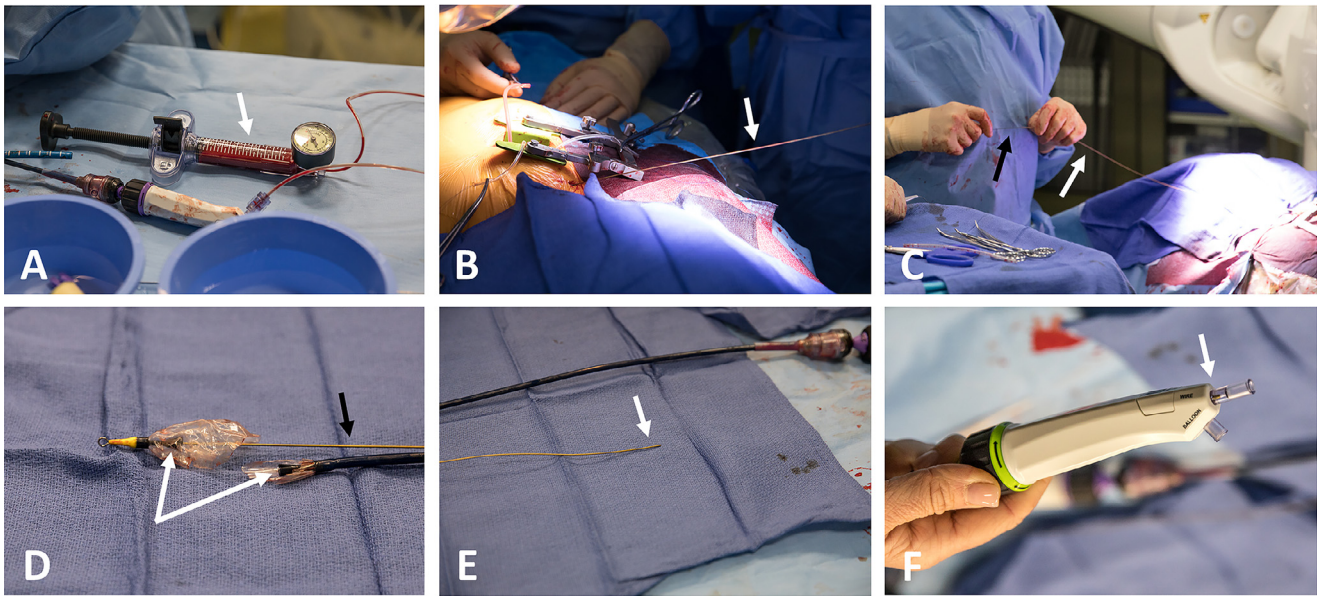

Figure 2. The Certitude delivery system has the distal balloon end where the Sapien S3 valve is premounted on the balloon between 2 RO shoulders. Distally handle has a flex wheel, 2 ports (balloon inflation port, guidewire lumen port), the inner tubing is attached to the distal RO shoulder distally and guidewire lumen of the handle distally.[1] (A) Blood is seen in the indeflator suggesting rupture of the balloon. (B) The detached *inner tubing* (white arrow) of the Certitude delivery system is externalized through the right second intercostal space and aorta is secured with purse string suture. (C) The operator is seen manipulating the 0.035″ J-wire (black arrow) through the *inner tubing* (white arrow) allowing the second operator to snare the J-wire transapically. (D) The balloon is seen torn horizontally. The *inner tubing* (black arrow) is attached to the distal segment which has the larger part of the torn balloon. The 2 conical-shaped RO shoulders (white arrows) are seen on both proximal and distal segments. (E) The externalized distal end of *inner tubing* (white arrow) was used to exchange wires. The outer part of the delivery system is seen in the background. (F) The handle of delivery system is shown with the arrow indicating the most suspected detachment site of the *inner tubing*.

understanding the TAVR delivery systems is extremely important to salvage serious complications.

Acknowledgment

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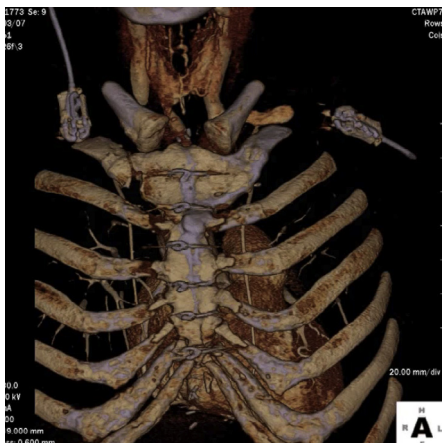
SUPPLEMENTARY MATERIAL

The following is the supplementary data to this article:



Video 1. Preprocedural CT imaging shows calcified aortic arch, calcified stenotic innominate, and left subclavian arteries. The aortocarotid and right subclavian bifurcating graft is seen. A 26-mm Sapien S3 Certitude delivery system is seen introduced through the 18 Fr. sheath via direct aortic access. After the successful valve deployment, while attempting to pull the delivery system, the proximal segment is seen detaching from the distal segment. Subsequently, attempts at retrieval of the distal segment by upsizing introducer sheath to 26 Fr. DrySeal sheath are seen, however. The distal conical-shaped RO shoulder is seen getting trapped at the distal end of the introducer sheath. Then cardiopulmonary bypass cannulae are noted. The Safari wire was exchanged for a J-wire through the inner tubing of the delivery system. Apical access was obtained and an 8 Fr. sheath was introduced. Then an En Snare was used to snare the J-wire and the distal segment of the delivery system transapically.

REFERENCE

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