Transcatheter aortic valve replacement (TAVR) has emerged as a proven therapy for treatment of severe, symptomatic aortic stenosis (AS) in patients at extreme risk for conventional aortic valve replacement (AVR) [1]. In addition, for patients with inadequate femoral access and concomitant cardiopulmonary pathologies, alternative access approaches and their utility in hybrid procedures, such as TAVR with concomitant percutaneous coronary intervention, have been increasingly reported [2]. TAVR has been adopted safely through the transaortic (TAo) approach in patients with prohibitive transfemoral or transapical access [3]. To our knowledge, no one has reported the utility of the TAo approach for single-stage hybrid endovascular procedures. We report the first hybrid treatment combining TAVR + thoracic aortic endovascular repair (TEVAR) for critical AS and descending thoracic aortic aneurysm (DTA) in a patient at extreme risk.

An 88-year-old woman in New York Heart Association class IV heart failure with an ongoing history of severe AS (aortic valve area, 0.5 cm²) presented to our clinic. The patient was extremely frail with a history of subclavian artery stenosis, atrial fibrillation, hypertension, pulmonary hypertension, hyperlipidemia, moderate mitral regurgitation, chronic obstructive pulmonary disease (COPD), renal insufficiency, diabetes mellitus (type II), transient ischemic attack, osteoarthritis, and a gait abnormality with multiple prior surgical interventions to hip, knee, and spine creating significant rehabilitation challenges. She was believed to be at extreme risk for conventional AVR (predicted risk of mortality STS score, 13.5%) and was subsequently evaluated for TAVR. Abdominal aortography was performed and revealed severe angulation of the midabdominal aorta and extreme tortuosity of the iliacs, with severe calcification in the iliofemoral vasculature. A computed tomographic (CT) angiogram with 3D M2S (M2S, West Lebanon, NH) reconstruction confirmed an extremely tortuous aorta and DTA measuring 6.0 × 5.2 cm. Peripheral vascular disease prohibited retrograde access for transfemoral TAVR + TEVAR. After careful evaluation, the decision was made to perform a combined TAVR + TEVAR. Direct TAo access through mini-sternotomy was planned for retrograde placement of an Edwards Sapien Transcatheter Heart Valve (THV; Edwards Lifesciences, Irvine, CA) for TAVR and antegrade placement of two GoreTAG stent grafts (WL Gore, Flagstaff, AZ) in DTA for TEVAR.

The combined procedure was performed in the hybrid operating room suite. TAo access was gained through partial mini-sternotomy via a J incision. Two concentric purse string sutures were placed along the distal ascending aorta. Systemic heparin was given and the aorta was punctured with a needle. Under fluoroscopic guidance, a wire was advanced into the aortic root. Following serial dilatation, a presized 24-French Edwards Retrolift 3 (RF3) introducer sheath was advanced into the ascending aorta (Fig 1). After crossing the valve, a 22-mm-diameter Tyshak balloon (B. Braun Interventional Systems Product, Bethlehem, PA) was advanced through the RF3 sheath for balloon aortic valvuloplasty using rapid ventricular pacing. At the same time, a 26-mm Sapien THV was crimped onto the RF3 Delivery System on the back table. After balloon aortic valvuloplasty, the valve was then advanced through the RF3 sheath on the delivery system and successfully deployed under direct fluoroscopy.

Concomitant TEVAR was then performed. After removing the delivery system, the RF3 introducer sheath was gently pulled back and redirected 180° toward the proximal arch. The combined procedure was performed using a hybrid system with a single-stage TAo approach for single-stage hybrid endovascular repair.
descending aortic arch. A stiff wire was placed over a multipurpose access catheter into the DTA. Diagnostic angiography was performed to optimize the proximal and distal landing zones in relation to the DTA. In an antegrade fashion, two GoreTAG (37 mm × 15 cm proximal, 40 mm × 20 cm distal) stent grafts were introduced through the RF3 sheath and deployed with 5 cm of intergraft overlap (Fig 2). Completion angiography confirmed well-placed Sapien THV and GoreTAG endoprostheses. Finally, the Edwards RF3 sheath was removed and the TAo access site was closed in standard fashion. Postoperative recovery was uneventful with no evidence of infection or neurologic deficit. She was discharged on postoperative day 8. In clinic at 14 months follow-up, echocardiogram and CT scan demonstrated normal LV and aortic valve function (ejection fraction 60%; peak/mean gradients 12/6 mm Hg) with no increase in aortic insufficiency. Both the Sapien THV and GoreTAG stent grafts remained well-positioned with no evidence of stent migration or endoleak. There have been no reoperations or hospitalizations.
Comment

As the role of TAVR in the treatment of severe-critical AS patients with significant co-morbidities grows, alternative access approaches in patients with inadequate femoral access are being performed with increasing frequency. Alternative access includes transapical, direct aortic (TAo), and subclavian/carotid artery approaches, each with its own advantages and disadvantages. In this patient, iliofemoral access was not possible. Because of the need for concomitant TAVR and TEVAR, both transapical and TAo approaches were considered. Our group decided that TAo offered the ideal benefit of performing TAVR first to optimize hemodynamics, before placement of TEVAR. The disadvantage of the transapical approach was that it would require the GoreTAG endoprosthesis to either cross a severely stenotic aortic valve, creating a risk for hemodynamic instability, or the freshly deployed Sapien prosthesis with the attendant risk for valve damage. In addition, because of the patient’s history of COPD, we believed that a left thoracotomy would be poorly tolerated from a pulmonary standpoint.

A specific introducer sheath for TAo access is being designed; however, this was not available at the time of operation. The only commercially available TAVR platform was the Edwards transfemoral RF3 system. To optimize our procedure via the TAo approach, the RF3 sheath was cut short and adjusted to the ideal length required for device delivery. Given the large diameter of the 24-French Edwards RF3 sheath, ante-grade TEVAR and deployment of the two GoreTAG stent grafts was possible without exchanging for a new introducer sheath. Radiopaque markers were no longer present because the distal tip of the sheath was removed after cutting the sheath. Therefore, for ease of visualization, the outside of the RF3 sheath was measured and marked at 1-cm increments. Owing to the lack of ascending aortic working space (in order to allow room for the balloon expansion), only 2 cm of the sheath was placed within the ascending aorta. At our institution, this approach using a presized and premarked RF3 sheath has been highly successful for alternative access TAVR.

The feasibility of this procedure in an 88-year-old patient with severe comorbid disease attests to the utility of the TAo approach for hybrid endovascular operations. However, success requires a comprehensive heart team in the setting of a hybrid operating room suite with sophisticated imaging.

References


Intimal Intussusception in Aortic Dissection and Coexisting Coronary Artery Disease

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Intimal tear is rarely circumferential in aortic dissection. In such an instance, intimal intussusception may occur. This exposes the patient to the additional risk of severe aortic regurgitation, blockage of the left main coronary artery ostium, or both in proximal intimal intussusception in ascending aortic dissection. Here we present a 61-year-old patient with ascending aortic dissection, aortic regurgitation caused by an intussuscepted proximal intimal flap, and coexisting coronary artery disease. The presenting symptoms and electrocardiographic findings simulated an acute coronary syndrome. Among other diagnostic measures, only transesophageal echocardiography clearly defined the pathologic condition. The patient underwent a successful aortic root replacement and coronary artery bypass grafting.

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Proximal intimal intussusception in the context of ascending aortic dissection is rare [1]; yet, it may cause severe aortic regurgitation by disturbing the coaptation of the aortic leaflets [2, 3], impairment of coronary blood flow by left main coronary artery occlusion [3, 4], or both. These occurrences may further complicate the diagnostic and operative management of aortic dissection. We present a patient who had ascending aortic dissection, coronary artery disease, and aortic regurgitation caused by intussuscepted intimal flap.

A 61-year-old heavy smoker with no history of hypertension was admitted to our emergency room. Before admission, he had lost consciousness for half an hour after experiencing

Video 1 can be viewed in the online version of this article [http://dx.doi.org/10.1016/j.athoracsur.2013.05.110] on http://www.annalsthoracicsurgery.org.