TAVR Complicated By Anomalous Coronary Arteries; Optimizing Procedural Strategies

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Background

Transcatheter aortic valve replacement (TAVR) is a well- established therapeutic option in patients with severe aortic stenosis (AS). Anomalous coronary artery anatomy is increasingly being recognized prior to intervention as routine 3-dimensional reconstructed computed tomographic imaging is used as part of pre-procedural planning (MDCT). Coronary artery obstruction during and after TAVR procedure can occur in 0.5-1.0% of individuals. One cause of obstruction can be compression of an anomalous coronary artery during deployment of the TAVR prosthesis. This report outlines critical features of four patients' anatomy and strategies used to optimize the procedural approach for each patient based on features related to the location and anatomic course of their anomalous arteries.

Discussion

In our case series, we discuss the pre-procedural preparations of two patients with an anomalous RCA's arising from the left sinus of Valsalva and two of the patients with anomalous and low-lying circumflex coronary arteries originating from the right sinus of Valsalva. The main purpose of the case series to understand the importance of imaging prior to performing the procedure. Whether the anomaly is benign or malignant, it is important to recognize these incidental findings in these intermediate to high cardiovascular surgery risk patients in order to reduce morbidity and mortality. In regards to low-lying coronary arteries, a standard precaution taken prior to the procedure is to determine the distance from the aortic annulus to overlying coronary arteries for safe deployment of a prosthetic valve in order to prevent obstruction of nearby coronary ostia. Our data suggests an additional consideration for patients with anomalous arteries in TAVR should proximity of the body of the artery to the annulus and stent. Although our study may have limitations due to small study population at a single facility, the case series presents types of unexpected coronary anomalies and subsequent associated risk of acute obstruction following TAVR deployment. Characterization of the coronary course may permit tailoring the procedure to the individual to avoid complications and instability. Our emphasis on computed tomography with coronary angiography to understand the anatomy, atherosclerotic disease, access site selection or even valve size determination provides information for procedural preparation and optimizing patient outcomes.

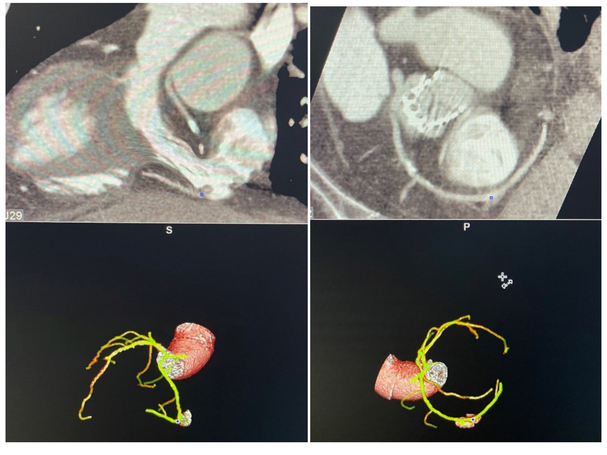


Fig. 2, lateral projection MDCT of anomalous RCA between ascending aorta and main pulmonary artery.
Fig. 3, oblique projection anomalous RCA with course between ascending aorta and main pulmonary artery demonstrating proximity to upper stent of TAVR prosthesis.

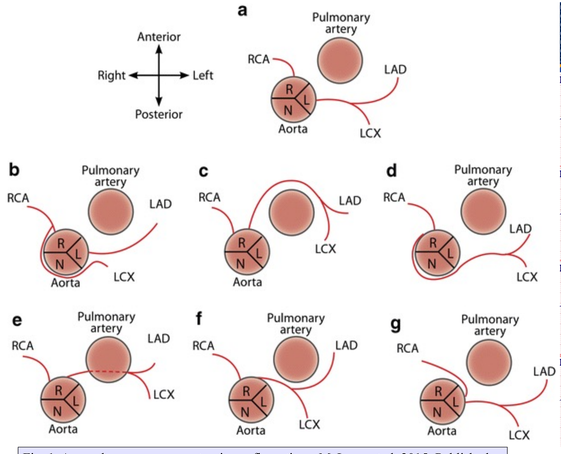


Fig. 1, Anomalous coronary anatomic configurations. McLarry et al. 2015. Published by SpringerLink Publishing. **a** Normal coronary artery origin and course. **b** Anomalous origin of the LCX from the RCA with a posterior (retroaortic) course; this is more commonly encountered than AAOCA of the LCX from the right sinus of Valsalva. **c** AAOCA of the LM with an anterior (prepulmonic) course. **d** AAOCA of the LM with a posterior (retroaortic) course. **e** AAOCA of the LM with a subpulmonic (intramyocardial) course. **f** AAOCA of the LM with an interarterial course. **g** AAOCA of the RCA with an interarterial course. *LCX* left circumflex coronary artery, *RCA* right coronary artery, *LAD* left anterior descending artery.

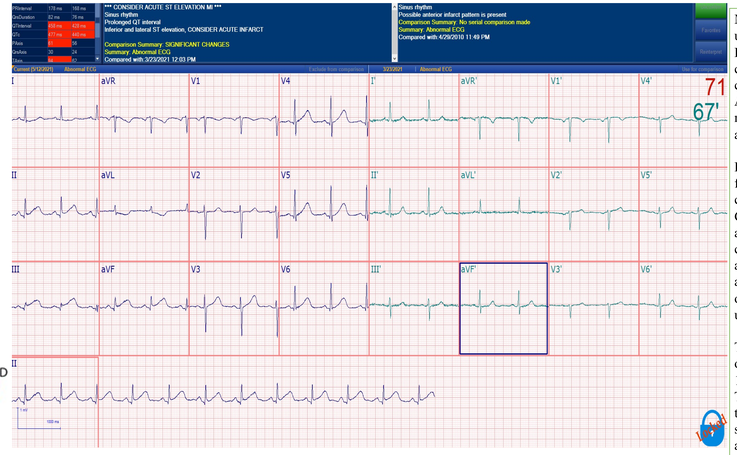


Fig. 4, EKG show new ST elevation in leads II, III and aVF after TAVR deployment (type G anatomic variant with anomalous RCA coursing between PA and ascending aorta).

Conclusions

In this report of four clinical cases, we demonstrate customized approaches taken to successfully perform transcatheter aortic valve replacement (TAVR) in high-risk and severely symptomatic patients identified to have anomalous coronary anatomy. We specifically demonstrate that selective TAVR / SAVR and CABG / PCI as needed and performed concurrently is a feasible option with a tailored strategy providing an optimal approach in these challenging patients. Careful preoperative planning may reduce invasiveness and improve procedural outcomes. Patients with anomalous arteries which cross or course adjacent to the aortic annulus may benefit prophylactic stent placement prior to TAVR and be at higher risk for needing surgical revascularization.

References

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Case Reports

METHODS - This report outline the preoperative features and clinical course of four patients who underwent intervention for severe symptomatic aortic stenosis at our institution over a two year period. Four patients had preoperative evaluation in the high-risk valve clinic including high-resolution computerized tomography, transthoracic echocardiography, transesophageal echocardiography, cardiac catheterization, functional testing and evaluation by one cardiologist and two cardiothoracic surgeons. Anatomic anomalies were further defined by aortography at the time of the intervention. Attempts were made to delineate important coronary anomalies prior to determining the procedural strategy employed and patient stratified according to the structural heart valve committee prior to intervention.

RESULTS - The patients suffered from 2 primary disparate anatomic anomalies (Types G and B - see figure 1). Two patients with an anomalous RCA's arising from the left sinus of Valsalva with a course cephalad to and remote from the aortic annulus and had uncomplicated initial TAVR deployment (Type G). One patient experienced global ST changes following deployment and post-procedure coronary angiography demonstrated no fixed luminal defect. However, persistent chest pain and inferior ST changes necessitated repeat cardiac CTA. Imaging (see figure 3) showed the RCA was noted to lie adjacent to the upper stent of the valve in a malignant course between the aorta and main pulmonary artery and it was impossible to confirm perfect patency due to artifact (see figure 1). Due to evidence of ongoing ischemia she underwent prompt CABG with a reversed saphenous vein graft to RCA and ultimately did well.

Two patients had anomalous and low-lying circumflex coronary arteries originating from the right sinus of Valsalva (Type B). One of these patients had prophylactic placement of an intracoronary stent (2.25 x 12 Xience) in the anomalous artery and wire adjacent to the aortic annulus. Following deployment of the TAVR prosthesis (Edwards 23mm S3) she experienced acute coronary insufficiency. She was successfully treated by expansion of the stent with return of circumflex artery perfusion and hemodynamic stabilization. The second patient had an ectatic ascending aorta associated with a bicuspid aortic valve and elected to have a surgical aortic valve replacement (SAVR) with ascending aorta repair. The anomalous artery was identified but not revascularized.

All patients experienced a prompt recovery and discharge home without further complications.

Fig. 5, RCA arising from normal right sinus of Valvalva with anomalous obtuse marginal branch on coronary heart angiogram.
Fig. 6, posterior view of aortic root showing normal RCA and anomalous circumflex arteries traveling along the aortic annulus with ectatic ascending aorta in patient with bicuspid aortic stenosis.

