A Tale of Two Milestones — From Vineberg to Cribier: The Miracle of Technology

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ABSTRACT
The fields of interventional cardiology and cardiac surgery have witnessed remarkable technological achievements. We describe the case of a patient who underwent several such milestones over a period of nearly five decades. From a Vineberg operation in 1969, to coronary artery bypass graft surgery in 2000, and finally, transcatheter aortic valve replacement in 2013, her medical history illustrates the impact of such landmarks, at times when few other options existed.

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Over the last five decades, many physicians have contributed to remarkable cardiovascular surgical and interventional advancements, some of which are cemented in our memories. The achievements of Dr F. Mason Sones performing the first human invasive coronary angiography in 1958[1] and of Dr Rene Favaloro's first coronary artery bypass graft (CABG) surgery in 1967[2] are well known. Prior to either of these events, however, another pioneer, Dr Arthur Vineburg performed the first human internal mammary artery (IMA) implantation in April 1950[3] for the treatment of myocardial ischemia. These procedures revolutionized the management of coronary heart disease.

Fifty years later, in 2004, the field of valvular heart disease underwent a similar momentous advancement by Dr Alain Cribier when he performed the first human transcatheter aortic valve implantation (TAVR).[4] Ten years later, over 50,000 TAVRs have been performed worldwide, and the numbers are rapidly growing.[5]

In this case report, we describe a patient who has successfully undergone two such significant cardiovascular procedures 40 years apart, both performed at times in our medical history when few other options existed. Her story spans from one of the early cardiac surgical milestones to the most recent interventional one and is illustrative of the impact of such groundbreaking technological advances.

Figure 1. Right internal mammary artery graft anastomosed to the anterior wall of the left ventricle.

Figure 2. Left internal mammary artery graft anastomosed to the lateral wall of the left ventricle.

Editor's Note: Originally published by the *Journal of Invasive Cardiology* in 2014 and republished here in honor of Dr. Alain Cribier, this case by Kernis et al describes one of the thousands of transcatheter aortic valve replacement (TAVR) patients benefiting from Dr. Cribier, a pioneer of the TAVR procedure. Described by the president of the American College of Cardiology Dr. B. Hadley Wilson as a "true visionary", Alain Cribier, MD, passed away on February 16, 2024. As Dr. Wilson wrote of Dr. Cribier: "The field of cardiology is forever changed because of his vision, leadership and persistence."

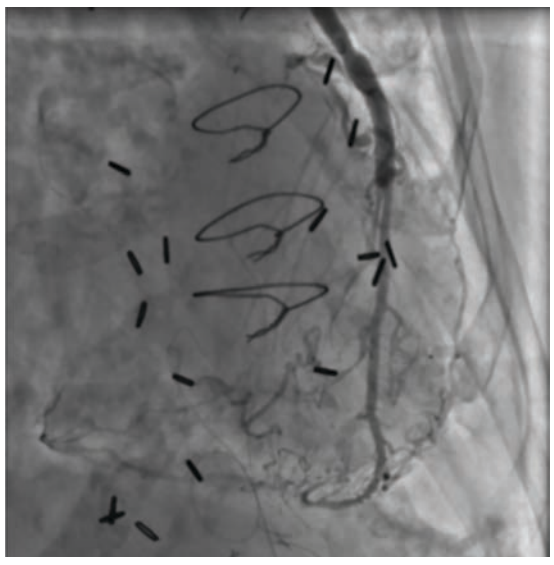

Figure 3. Saphenous vein graft anastomosed to the left anterior descending artery.

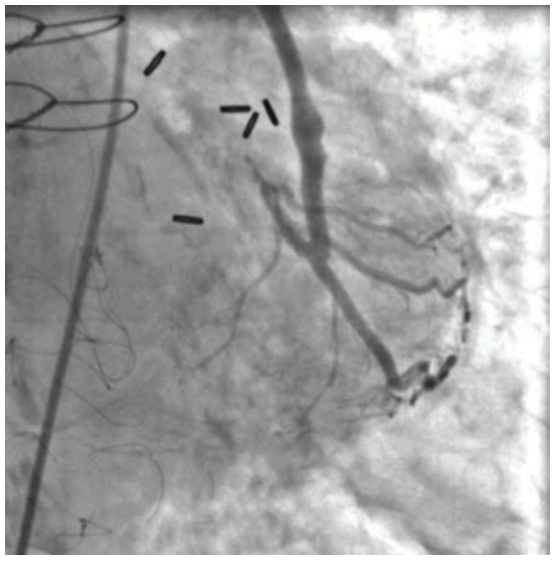

Figure 4. Saphenous vein graft anastomosed to the obtuse marginal artery.

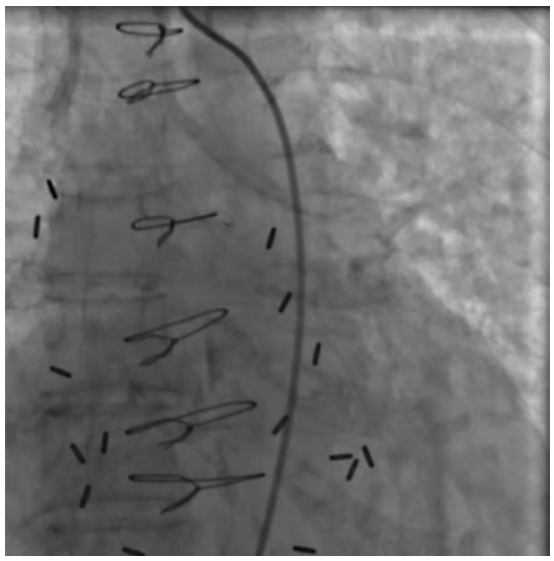

Figure 5. Right internal mammary artery graft anastomosed to the anterior wall of the left ventricle from cardiac catheterization in 2010.

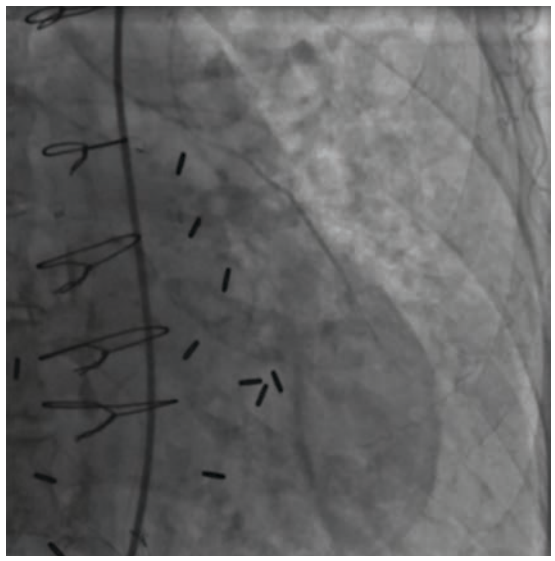

Figure 6. Left internal mammary artery graft anastomosed to the lateral wall of the left ventricle from cardiac catheterlzation in 2010.

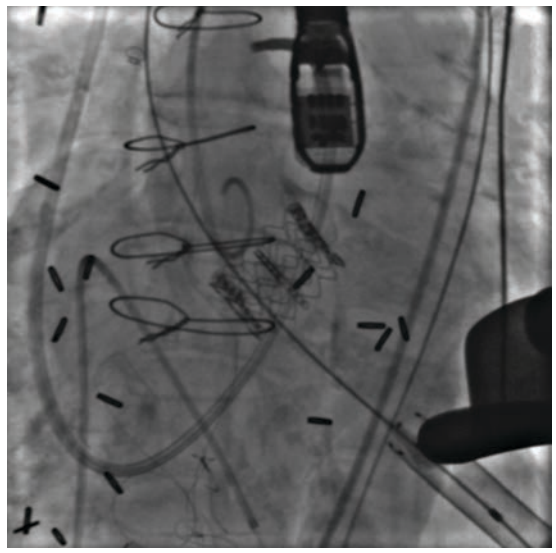

Figure 7. Edwards Sapien transcatheter heart valve.

Case Report

An 88-year-old Caucasian female was referred for evaluation of severe aortic stenosis (AS). Her symptoms included dyspnea with any physical activity (New York Heart Association class IV) and progressively worsening fatigue. Echocardiography revealed an aortic valve area of 0.3 cm^2, a mean aortic valve gradient of 53 mmHg by continuity equation, and a left ventricular ejection fraction of 25%.

Her past medical history was significant for hypertension, hyperlipidemia, coronary artery disease (CAD), prior myocardial infarction (MI), ischemic cardiomyopathy, multiple prior cardiac surgeries, and prior left carotid endarterectomy. In 1969, via a sternotomy, the patient underwent a Vineberg procedure for chronic stable angina. Her right internal mammary artery (RIMA) was sutured into the anterior wall of the left ventricular (LV) myocardium and the left internal mammary artery (LIMA) was sewn into the lateral LV wall.

In January 2000, the patient underwent cardiac catheterization for progressively worsening exertional chest discomfort and dyspnea. Cardiac catheterization revealed triple-vessel disease with chronic occlusions of her ostial left anterior descending (LAD) artery, distal left circumflex (LCX) artery, and proximal right coronary artery (RCA). Both RIMA and LIMA grafts were patent. The RIMA had normal flow to the anterior LV wall, with vessel arborization and collateralization of the distal LAD and right posterior descending artery (PDA) as well as retrograde filling to the mid LAD (Figure 1). The LIMA was patent to the lateral LV wall with a similar appearing myocardial vascular network with direct collateral filling of the obtuse marginal (OM) and right posterolateral artery (PL) with retrograde flow to the distal left circumflex (Figure 2). On account of symptoms felt to be due to myocardial ischemia, she underwent redo sternotomy and CABG surgery, with reversed saphenous vein Y-grafting to a bifurcating obtuse marginal artery and a reversed saphenous vein graft (SVG) to the LAD. Approximately 1.5 hours after surgery, persistent and worsening hypotension prompted her cardiac surgeons to emergently perform redo sternotomy, during which she underwent repositioning of her SVG to the OM to remove a kink in her graft

In an ironic twist of fate, she required surgical coronary revascularization in 1969 when interventional options were unavailable, and four decades later, she needed a transcatheter valve replacement when conventional surgical operations were not an option for her.

Ten years later, she was diagnosed with asymptomatic severe aortic stenosis. Over the next few years, she developed severely disabling class IV symptoms, but she continued to live independently. Her Society of Thoracic Surgery (STS) score was 16.2 and she was deemed to be of prohibitive cardiac surgical risk. The patient was then referred for evaluation for possible TAVR.

She subsequently underwent further testing, including computed tomography (CTA) of her aortic root and bilateral iliofemoral arteries (aortic valve annulus, 369 mm^2; 69 mm perimeter; 20.6 mm diameter; bilateral common iliac arteries with 5 mm mean luminal diameters), three-dimensional transesophageal echocardiography, and cardiac catheterization. Invasive coronary angiography revealed unchanged chronically occluded LAD, LCX, and RCA, and patent SVGs to the distal LAD and OM (Figures 3 and 4). Notably, the RIMA and LIMA grafts were somewhat atretic, but patent and with normal antegrade flow to the anterior and lateral LV myocardium, respectively (Figures 5 and 6), despite competitive filling from patent SVGs.

Following all testing, valve conference case review, multidisciplinary team discussions, and patient and family counseling and consent, successful and uncomplicated TAVR was performed via transapical access under general anesthesia with fluoroscopic and transesophageal imaging. Right heart catheterization, temporary RV apical pacing wire placement, and aortography were accomplished uneventfully. Thoracotomy, LV apical exposure, and ventriculotomy with Ascendra sheath placement were performed without difficulty. Balloon aortic valvuloplasty (20 mm x 3 cm Sapien balloon; Edwards Lifesciences) was undertaken with rapid pacing of 160 bpm without significant hemodynamic compromise or worsening aortic insufficiency. A 23 mm Sapien THV valve was then positioned and deployed uneventfully with rapid pacing at 180 bpm (Figure 7). The patient required no escalation in vasopressors or inotropes following device implantation and transesophageal echocardiography confirmed ideal placement with trivial paravalvular aortic insufficiency, a residual mean aortic valve gradient of 6 mmHg, normal coronary flow, and no aortic injury.

The patient was discharged home on postprocedure day 3 and she remains without any cardiovascular symptoms over 30 days later.

The patient was able to undergo innovative procedures that dramatically improved her morbidity and mortality. From Vineberg to Cribier, hers is a tale of two milestones.

Discussion

This case report is unique in that it describes a patient who underwent a successful Vineberg operation, redo CABG surgery with emergent re-exploration, and a transapical TAVR procedure over a 43-year span. Dr Topoz et al reported the case of a similar patient who underwent the Vineberg operation (also in 1969) and redo CABG in 1990.[6] Both patients were found to have patent IMA grafts decades later following their initial surgery, which illustrates the remarkable durability of IMA grafts and the Vineberg operation.

In addition to her early cardiac surgical success, our patient also underwent one of the most recent interventional landmarks. In an ironic twist of fate, she required surgical coronary revascularization in 1969 when interventional options were unavailable, and four decades later, she needed a transcatheter valve replacement when conventional surgical operations were not an option for her. On both occasions, she was able to undergo innovative procedures that dramatically improved her morbidity and mortality. From Vineberg to Cribier, hers is a tale of two milestones.

Conclusion

This case report illustrates the remarkable benefits that 1 patient received over a 40-year span from milestone achievements in cardiac surgery and interventional cardiology. ■

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