


# Use of an inverted On-X mitral valve in the aortic position in a resource limited setting

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## Abstract

Implanting an inverted aortic valve prosthesis in the mitral position has shown to be a viable solution for a small mitral annulus. We describe a case of implanting an inverted in the mitral prosthesis in the aortic position in a patient with an excessively large aortic annulus. A 46-year-old male with severe aortic insufficiency underwent aortic valve replacement during a surgical outreach program in Tegucigalpa, Honduras. Aortic valve annulus measured 30 mm on preoperative echocardiogram. An inverted On-X mechanical mitral heart valve with Conform-X sewing ring 25/33 mm was implanted with an excellent hemodynamic result and no paravalvular leak. To the best of our knowledge, this case demonstrates the first inverted mitral prosthesis implanted in the aortic valve position.

## KEYWORDS

valve repair/replacement, aortic valve, cardiac surgery

## 1 | INTRODUCTION

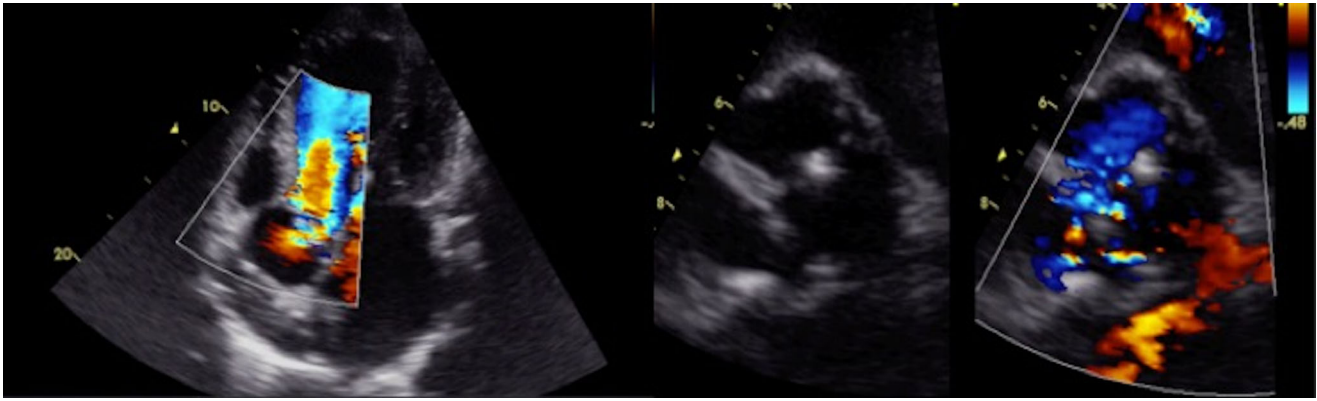
This report documents a case of implanting an inverted mitral prosthesis in the aortic position. In resource-limited settings, unexpected findings can force surgeons to make difficult decisions. In this case report, we describe the off-label use of an inverted mitral mechanical prosthesis in the aortic position. With this novel surgical technique, valve replacement surgeries can be more accessible, especially in resource-limited settings. This technique of using a mitral prosthesis in the aortic position has never been reported on in the scientific literature.

## 2 | CASE PRESENTATION

Informed consent was obtained by the patient. Consent from the institutional review board was waived, being a clinical case. A team from Duke University traveled to Tegucigalpa, Honduras, in July 2019 to perform valve replacements in patients who would otherwise not be offered surgery. This program was aimed at

ameliorating rheumatic heart disease and other acquired adult heart pathologies. The procedures were all conducted at Instituto Nacional Cardiopulmonar. CryoLife (Kennesaw, GA) donated On-X mechanical aortic and mitral valves to implant. Here, we present a case of a patient with an aortic annulus that was too large to allow the implantation of a traditional surgical aortic valve and required implantation of an inverted On-X mechanical mitral prosthesis.

A 46-year-old male patient presented in February 2018 with worsening dyspnea on exertion and lower extremity edema. He was admitted to the hospital and diagnosed with congestive heart failure. Transthoracic echocardiogram demonstrated a dilated left ventricle (end-diastolic dimension 11.1 cm and end-systolic dimension 9.7 cm), ejection fraction of 40%, severe aortic insufficiency (Figure 1), severe mitral regurgitation, aortic annular diameter of 30 mm, and an aortic root measuring 4.7 cm. Medical history was significant for atrial fibrillation treated with rivaroxaban (Xarelto), transient ischemic attack, and tobacco use (25 pack-year history). The patient also had a family history of heart disease. After the initial presentation, he was placed on optimal medical therapy in preparation for surgery, which

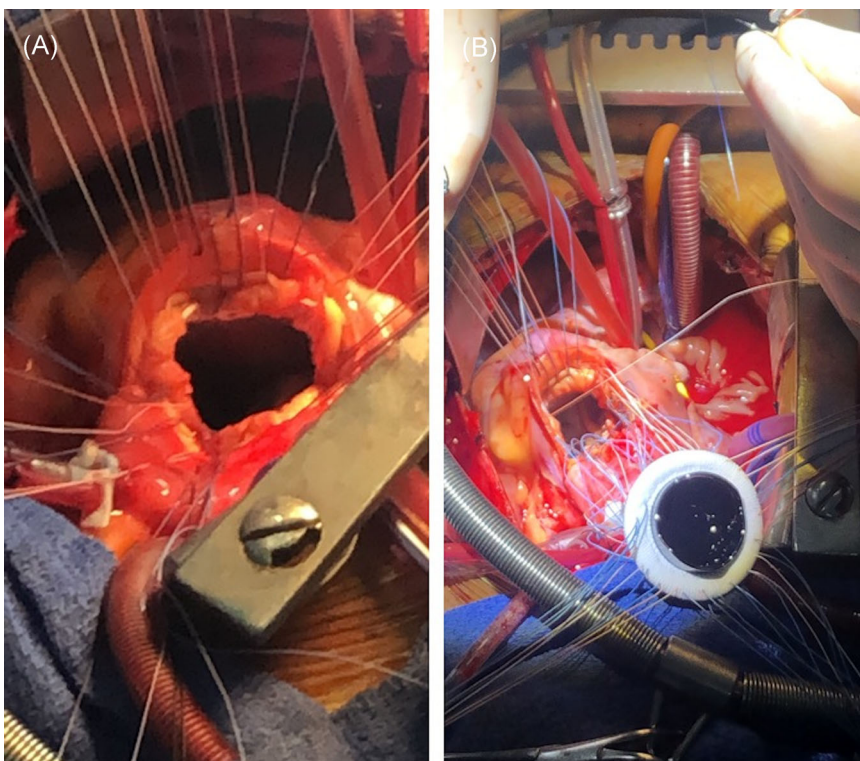


**FIGURE 1** Preoperative transthoracic echocardiography with color Doppler showing extensive aortic insufficiency in both a longitudinal and transverse view

included bisoprolol, furosemide, enalapril, spironolactone, and warfarin. This subsequently improved his EF to 50% to 60%.

Guidelines recommend replacing the aortic root at a diameter greater than 4.5 cm in the setting of patients undergoing aortic valve replacement (AVR).<sup>1</sup> Ideally, our patient would be treated with an aortic root replacement; however, this was a medical mission with limited resources, and we did not have the necessary valve conduit to perform a root replacement. Dacron tube grafts were not available to create a valve conduit. The patient was taken to the operating room for AVR, mitral valve repair, and left atrial appendage (LAA) oversewing. The mitral valve was repaired with a downsizing 30 mm Simulus ring (Medtronic, Minneapolis, MN), and the LAA was

oversewn with a running 4-0 polypropylene suture. The aortic valve cusps were excised, and the annulus was found to be larger than a 31 mm sizer (the largest aortic valve sizer); therefore, a standard aortic prosthesis was too small to be implanted. An On-X Mitral Conform-X 25/33 mm valve was inverted and implanted with supra-annular pledgeted mattress stitches (Figure 2). Cardiac bypass and aortic cross-clamp time were 183 and 122 minutes, respectively. The patient had an uneventful postoperative course and was anticoagulated with coumadin, then discharged home. Pathology showed myxomatous degeneration of the aortic valve with dystrophic calcification. The patient has been seen in postoperative clinic at a 90 day follow up and symptoms can be described as New York Heart



**FIGURE 2** Intraoperative picture of the On-X Mitral 25/33 mm Conform-X valve implantation without (A) and with the prosthesis in view (B)

Association functional classification 1, on warfarin therapy with a goal international normalized ratio (INR) of 2 to 3. This is in line with the recommendation by the American College of Chest Physicians for mechanical aortic valves.<sup>2</sup>

### 3 | DISCUSSION

In Honduras, there is an overwhelming need for cardiac surgery, the disease burden far outpaces the funding for health care. There is only one hospital that performs cardiac surgery in the country which leads to a wait list of hundreds of people needing valve replacement. Even if the patient is able to find medical care, surgical costs often exceed the annual income of the average citizen several times over. Honduras has a population of approximately 9.5 million inhabitants and during the last several decades, negative events have tormented the health care system. Contributing factors include the collapse of the government-owned health centers, a national financial crisis, and governmental corruption. Unfortunately, these events have greatly hindered national improvement in health care. According to the Ministry of Health of Honduras, 72% of the population receives health care provided by government-owned institutions (public hospitals and the Honduran Institute of Social Service), 10% receive health care from private institutions, and 18% do not receive any type of health care.<sup>3</sup>

In an effort to address this gap in care, our group initiated an effort led by the Duke Heart Center to travel to Honduras to establish a sustainable cardiac surgery program. One of the limitations our group encountered was the need to bring various valve sizes to fit the annulus of each patient. While the surgical team can get a preliminary size estimate using echocardiography, valve sizers are used intraoperatively to confirm the size of the prosthesis that will be implanted based on true anatomical annular diameter. In a setting with limited resources, a perfect fit valve may not be achievable. It raises the issue of how to creatively, yet safely, use the available valves to fit the surgical needs. The On-X Mitral Conform-X valve is a mechanical mitral prosthesis that fits annulus diameters measuring 25 to 33 mm. It is constructed with a 25-mm mitral prosthesis with a conformable sewing cuff that will fit an annulus as small as 25 mm or as large as 33 mm. The stitches are placed in the sewing cuff further out on the perimeter of the cuff to accommodate a larger annulus.

The On-X mechanical valve is the only Food and Drug Administration approved mechanical valve that can maintain an INR of 1.5 to 2.0 after 3 months of standard therapy.<sup>4</sup> This lower INR goal of 1.5 to 2.0 led to a 60% reduction in bleeding events with no increase in thromboembolism compared to an INR of 2.0 to 3.0. This lower INR goal for the On-X valve makes it an ideal prosthesis in the aortic position for patients in developing countries that may have difficulty managing their anticoagulation and accessing medical care.

There has been a success in using inverted aortic valves in the mitral position. A review of 31 patients that had a small mitral annulus (<25 mm diameter) showed that the St. Jude Regent aortic valves are a reasonable option in a setting where the mitral annulus is smaller than the normal range of mitral valve options.<sup>5</sup> To the authors' knowledge, using a mitral prosthesis in the aortic annulus has never been described.

### 4 | CONCLUSION

The use of an inverted mechanical mitral valve can be a viable option in a markedly enlarged aortic annulus. Postoperative hemodynamic parameters confirm that this is a suitable solution that meets valve replacement standards. This finding is of great importance especially in resource-limited settings where valve size options are often limited.

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#### SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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