Novel use of a transapical endovascular suction device for mitral valve endocarditis in a high-risk surgical patient with successful cerebral protection

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Title:

Novel use of a transapical endovascular suction device for mitral valve endocarditis in a high-risk surgical patient with successful cerebral protection

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Central picture legend: Echo-guided transapical suction aspiration of a mitral valve vegetation.

Central Message: Novel use of transapical suction aspiration with generous cerebral protection
strategy for mitigation of embolic events in endocarditis.

Meeting: This was presented as an e-poster at the 2022 Mitral Conclave in Boston, MA—May
13-14, 2022.

Perspective statement: Early surgical treatment of valvular endocarditis has demonstrated
benefits. Some patients, however, remain extremely high risk for surgery. While right-sided
endocarditis has used more minimally invasive technologies, there is limited experience with
these techniques in left-sided endocarditis. Here we present the 2nd ever case report of
transapical aspiration of a mitral valve infectious vegetation.

Word Count: 737
Glossary of Abbreviations:

ICU - Intensive Care Unit
ECMO - Extracorporeal Membrane Oxygenation

Case Report:

Patient Presentation:

A 79-year-old male presented with a deep sternal wound infection 3 weeks following emergent repair of a ventricular perforation sustained during arrhythmia ablation. This was aggressively treated with sternal debridement and negative pressure wound therapy in preparation for plastic surgery reconstruction. Clinically, the patient progressed but began experiencing crescendo TIAs. Echocardiography revealed a new mobile density at the base of the anterior mitral leaflet (figure 1) as well as new small infarcts on imaging. As a singular case report without any identifying information, per institution no IRB approval or patient request is required.

Traditional cardiac surgery was considered high-risk because of: 1) severe left ventricular dysfunction; 2) moderate aortic and mitral valve disease (video 1a-1b); 3) a densely adherent and inflamed operating field; and 4) the need for a timely plastic surgical wound closure.

We candidly offered both standard of care mitral valve surgery and off-label AngioVac (Angiodynamics, Latham, NY) use to remove the vegetation. The patient elected to proceed with off-label treatment.
Procedure (video 2):

This complex operation merged cardiac surgery, interventional cardiology, advanced echocardiography, and perfusion disciplines. The left ventricular apex was exposed through a small left 5th interspace incision and secured with concentric pledged polypropylene purse-string sutures. Simultaneously, the right common femoral artery and vein along with the right radial artery were percutaneously accessed and the patient was heparinized to an ACT of 250.

The Sentinel cerebral protection system (Boston Scientific, Marlborough, MA)—a 2 stage embolic protection device—was inserted via the right radial artery and deployed into the innominate and left common carotid artery. An 8F occluding balloon was inserted via the right femoral artery and advanced to the ostium of the left subclavian artery to complete the cerebral protection strategy. This completed the positioning of our cerebral protection strategy (video 3).

The left ventricular apex was accessed at a location where echocardiographic orthogonal planes predicted smooth passage of an Amplatz wire into the ascending aorta while avoiding the mobile vegetation and subvalvular mitral apparatus (video 4). A 26F sheath was placed through the ventricular apex and positioned at the vegetation. A 16F venous return sheath was placed into the right femoral vein and the AngioVac circuit was completed (figure 2) and deaired.

The AngioVac cannula was inserted through the transapical sheath and positioned close to the vegetation. The left subclavian balloon was inflated. The AngioVac was activated and navigated with echo and fluoroscopy using multiple passes (video 5) until adequate removal of the vegetation was confirmed (video 6). Heparin was reversed and all sheaths and catheters were
removed. The left ventricular apex purse strings were tied and the thoracotomy was closed in a standard fashion. The patient was transported the ICU. Post-procedural echocardiogram revealed 1-2+ MR.

Hospital Course:
Post-operatively the patient did well and experienced no further neurologic sequelae. The patient’s sternal wound was subsequently closed by plastic surgery and the patient was discharged to a rehabilitation facility with a 6-week course of cefazolin. He returned to home one month later.

The patient was serially followed by internal medicine and cardiology. Progressive echocardiograms revealed increasing MR to 3-4+ MR. The patient refused additional interventions for his MR.

Approximately 4 months later the patient presented to emergency room with symptoms of heart failure and expired in the emergency room shortly thereafter of unknown cause. His last echocardiogram was performed approximately 2 weeks prior to expiration and again revealed 3-4+ MR.

Discussion:
This case represents the second report\(^1\) of transapical suction aspiration of the mitral valve with the AngioVac device. The first case was performed by attaching the AngioVac circuit onto an ECMO circuit\(^1\), whereas this case was without ECMO support.
This patient was clearly indicated for surgery via the 2016 consensus guidelines due to worsening endocarditis with embolization. However, the patient elected for only less invasive options than traditional open-heart surgery given his high-risk profile. With our institution’s experience with the AngioVac system as well as the aforementioned case report, we found it prudent to offer this treatment as an experimental option to the patient, with full disclosure of its novel and off label use.

The key to performing this safely was the generous cerebral protection strategy. While the AngioVac system uses negative pressure to minimize any embolization risk, by protecting the innominate artery and left common carotid artery with the Sentinel device and the left subclavian artery with balloon occlusion we were able to prevent any cerebral embolic phenomenon. The patient subsequently experienced no subsequent TIAs. Examination of the sentinel device revealed no appreciable solid material.

This lesion was accessible due to the ventricular-facing aspect. For atrial-facing vegetations or aortic-facing aortic valve vegetations this approach is less appealing. To date we have performed an off label aortic valve aspiration for a mixed ventricular/aortic facing vegetation with mixed results. This demonstrates the importance of ascertaining which direction the vegetation is facing to appropriately frame an approach for a given vegetation.

Finally, it is noted that this technique is not the standard of care for normal endocarditis. Care should be taken to adhere to the consensus guidelines whenever possible. For patients for whom
the operate risks are exceedingly high, AngioVac remains an off-label and yet to be fully explored option. This paper demonstrates the technical feasibility of mitral valve AngioVac via a transapical approach for embolic event risk reduction as part of a multi-disciplinary heart team approach and patient/goal-directed care.

References:
Figure Legends:

Figure 1. Echocardiographic demonstration of the mitral valve vegetation.
Figure 2. Diagram of the vascular access sites.

Video Legends:

Video 1a-b. Echocardiogram showing mitral valve disease with mitral annular calcification.
Video 2. Complete case video.
Video 3. Final positioning of the cerebral protection strategy.
Video 4. Loading the transapical AngioVac system.
Video 5. Active suction aspiration of the vegetation.
Video 6. Completion echocardiogram.