



Peer-Reviewed Case report

Reversible Mitral Regurgitation as a Complication of Impella® 5.0

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Abstract

The Impella® is a ventricular assist device used for temporary left ventricular support and has been approved for use since 2008. In this report we present a case of a patient who experienced mitral regurgitation as a complication shortly after placement of an Impella® as well as a brief literature review. To our knowledge this is the first such case demonstrating resolution of iatrogenic mitral regurgitation with removal of the device as opposed to permanent damage.

Keywords: Left ventricular assist device, Impella, Mitral Regurgitation

Introduction

The Impella® (Abiomed, Denver, MA) is a percutaneous left ventricular assist device used for temporary left ventricular support. First approved for use in 2009, the Impella® is now incorporated in five separate clinical practice guidelines as an option for management of heart failure, cardiogenic shock, and in cardiac transplant^{1,2,3,4,5}. A recently published, single center report revealed this technology as a viable option as a bridge to not only transplant but also durable mechanical support⁶. Reported complications resulting from the use of the Impella® devices (both 2.5 and 5.0) are hemolysis, pump failure, malposition, catheter kink, aortic dissection, aortic valve damage, mitral valve damage, groin hematoma, pseudoaneurysm, and acute limb ischemia. In this case, we report the first instance of acute mitral regurgitation due to entrapment of the drive line in the chordal apparatus which resolved with removal of the device.

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Case Report

The patient is a 71-year-old Caucasian male with coronary artery disease with four vessel coronary artery bypass, hypertension, hyperlipidemia, type 2 diabetes mellitus, morbid obesity with multiple prior admissions for decompensated systolic heart failure. The Patient initially presented to an outside hospital with multiple syncopal episodes. He was in atrial fibrillation, with diffuse ST elevation in the chest leads on the electrocardiogram. On coronary angiogram, there was a multivessel disease, with the only patent vessel being a diagonal branch. The estimated ejection fraction was 10-15%. Revascularization of the LIMA graft was attempted but unsuccessful. An intra-aortic balloon pump was placed at that time and the patient was then transferred to our institution for evaluation for left ventricular assist device placement.

Upon arrival, the patient was in cardiogenic shock with hypotension, acidosis and renal failure requiring high doses of vasopressor support. He was placed on venoarterial extracorporeal membranous oxygenation (VA ECMO) to facilitate recovery from end-organ damage and as a bridge to evaluation for left ventricular assist device. On hospital day five he was transitioned to a right subclavian Impella® 5.0 to facilitate ambulation and rehabilitation prior to definitive left ventricular assist device placement. Proper positioning of the device was difficult due to a small left ventricular cavity size. Concomitant transthoracic echocardiogram revealed low ejection fraction as already noted at the outside hospital as well as no evidence of valvular pathology; specifically, no mitral regurgitation (Figure 1).

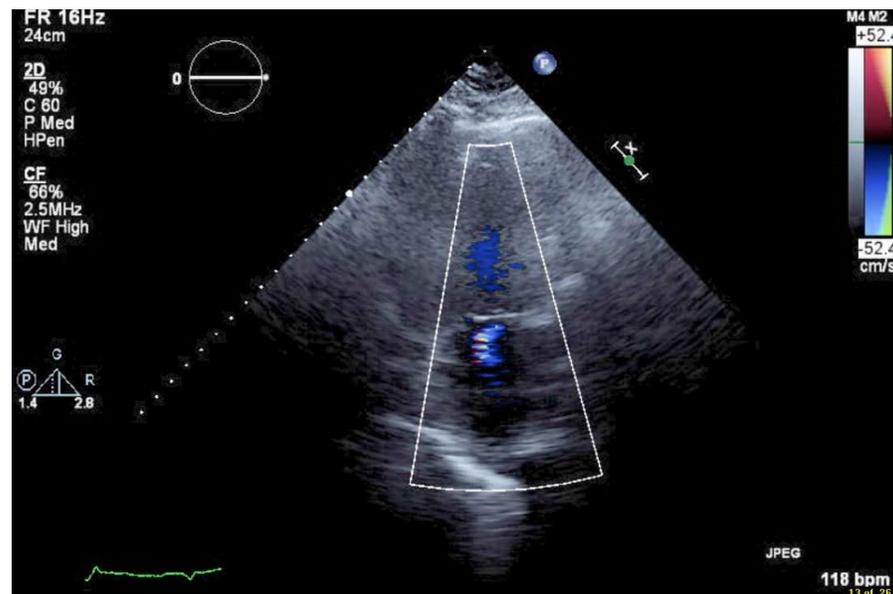


Figure 1. A transthoracic, two chamber echocardiographic view prior to any mechanical circulatory support showing trivial mitral regurgitation.

Shortly after Impella® placement, the patient experienced a pulseless electrical activity cardiac arrest and underwent emergent cannulation with VA ECMO. A



transesophageal echocardiogram was performed which demonstrated the Impella® tangled in the mitral apparatus causing restriction of mitral valve leaflet motion as well as severe mitral regurgitation (Figures 2 and 3, Video 1: <https://vimeo.com/208673728> and 2: <https://vimeo.com/208673681>).

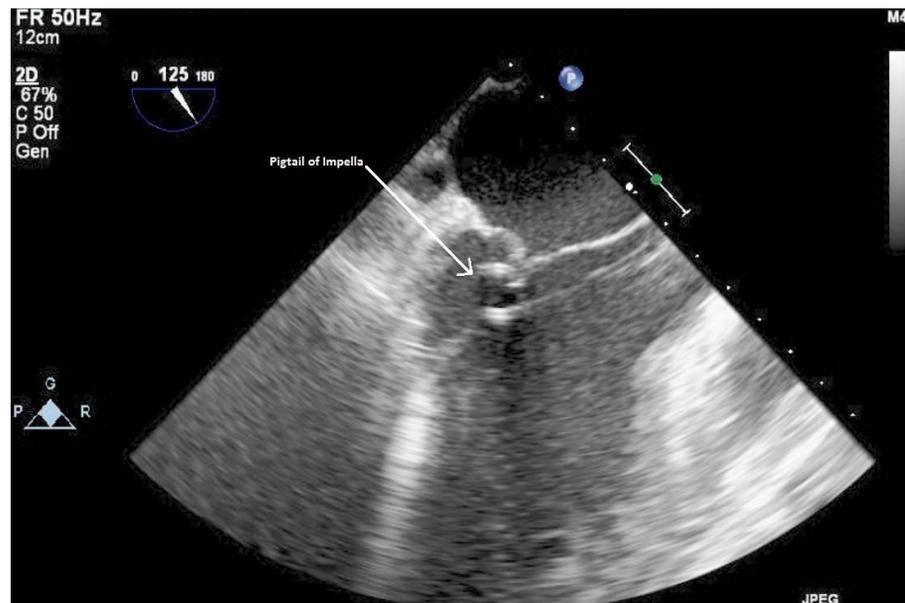


Figure 2. A trans-esophageal, mid-esophageal, 3-chamber view depicting the pigtail of the Impella® entangled in the mitral subvalvular apparatus.

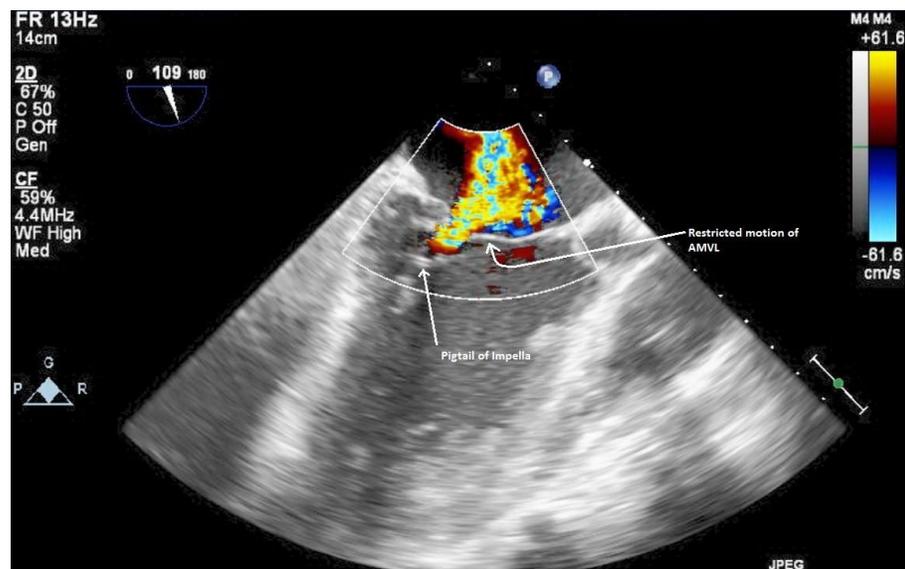


Figure 3. A color Doppler of a trans-esophageal, mid-esophageal, 3-chamber view depicting severe mitral regurgitation with associated pigtail of the Impella® entangled in mitral subvalvular apparatus resulting in restricted closure of anterior mitral valve leaflet



The most likely reason for this to have occurred is that the device was either inserted or migrated deep in to the left ventricular cavity resulting the entrapment of the pigtail catheter of the Impella in mitral valvular apparatus. Attempts at repositioning the device into the left ventricle apex were unsuccessful. The device continued to have malfunction alarms and was ultimately removed with resolution of mitral regurgitation (Figure 4, Video 3: <https://vimeo.com/208673780> and 4: <https://vimeo.com/208673969>).

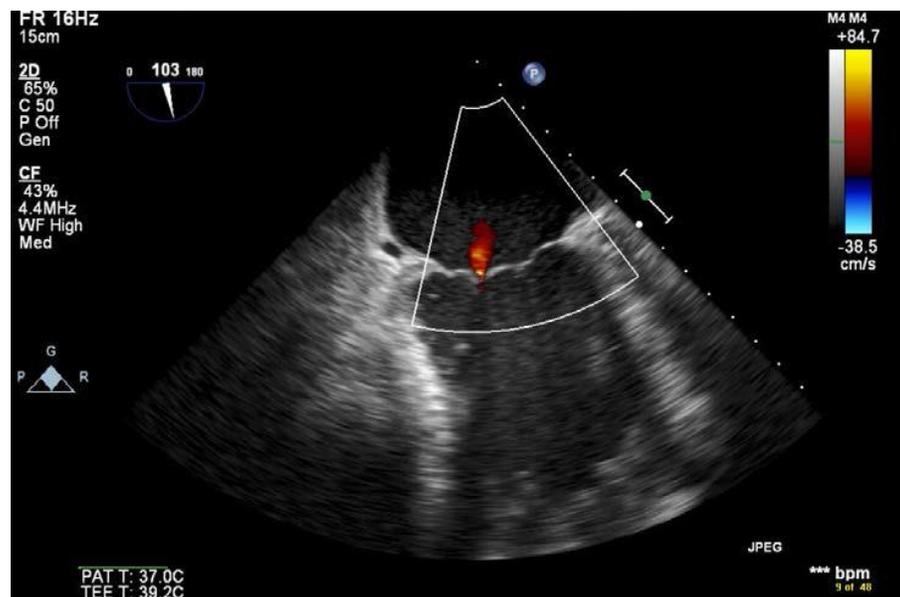


Figure 4. A color Doppler of a trans-esophageal, mid-esophageal, 2-chamber (commissural) view depicting resolution of severe mitral regurgitation after withdrawal of the Impella[®] device with subsequent adequate apposition of mitral valve leaflets.

The patient was continued on ECMO support until hospital day 19 when he underwent LVAD placement and was ultimately discharged about 40 days later. Unfortunately, he was readmitted 17 days later for acute on chronic systolic heart failure which was further complicated by a stroke and he passed away shortly after the decision was made to withdraw care.

Discussion

The Impella[®] 5.0 is a feasible alternative to more invasive extracorporeal assist devices (ECMO). The device can be placed by arterial cut-down in either the femoral or axillary artery, although the latter is preferred to allow mobility during device support. In addition to ambulatory potential associated with Impella[®] 5.0 support, certain patient populations may benefit more so than ECMO due to the physiologic benefit of reducing myocardial oxygen consumption. This is due to the Impella[®] Support resulting in a leftward shift of the pressure-volume Loop ultimately leading to a marked reduction in pressure-volume area as



well as marked decrease in left ventricular end diastolic pressure and thus resulting in decreased myocardial oxygen consumption. These properties may be of particular interest for patients with cardiogenic shock, who would benefit from this aspect of Impella® technology more so than ECMO support. To date, there is only one prospective study evaluating the Impella® 5.0, which ultimately led to its approval. This study, along with a larger (albeit retrospective) analysis similarly demonstrated that when compared to ECMO there is similar success in terms of weaning, successful bridging to destination support, and overall survival. Interestingly, the RECOVER I study experienced a relatively low rate of adverse events: the only safety end points were death and stroke, of which there were one of each, and one patient of the sixteen in the study experienced hemolysis although the investigators did not establish relatedness to the use of the device. A newer prospective study enrolling 40 patients had zero strokes or major bleeding events but reported a significant rate of acute renal dysfunction (33%), bleeding requiring transfusion (28%), and device malfunction (70%)³. Due to the relatively recent incorporation of percutaneous left ventricular assist devices in the management of heart failure and cardiogenic shock, the body of literature related to their use is still growing. There are individual case reports for complications with use of the Impella® relating to the mitral apparatus and have consisted of both mitral regurgitation and mitral stenosis^{7,8,9}. To our knowledge this is a first published case of reversal of mitral regurgitation with withdrawal of the device. One observation we have made is that the complications in the aforementioned case reports as well as our experience, involved the use of an Impella® LP 5.0, which is possibly a consequence of the device's larger size compared to that of the Impella® 2.5.

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