

Case Report

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Use of the Impella Left Ventricular Assist Device as a Bridge to Recovery in a Patient with Cardiogenic Shock Related to Takotsubo Cardiomyopathy

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Abstract

The Impella Recover LP 2.5® (Abiomed Inc, Danvers, Massachusetts, USA) is an effective and minimally invasive left ventricular assist device and a useful tool in the treatment of patients undergoing high risk percutaneous coronary interventions and critically ill patients with poor left ventricular function. We present the use of the revised Impella Recover LP 2.5® left ventricular assist device, in a patient with acute heart failure and cardiogenic shock secondary to severe Takotsubo cardiomyopathy. The revised Impella Recover LP 2.5® left ventricular assist device is able to provide cardiac output of up to 2.5 l/min. The patient was weaned off the Impella device in 48 hours and was discharged on day 6 of admission without sequelae.

Introduction

Takotsubo cardiomyopathy is a syndrome of reversible stress-induced cardiomyopathy associated with profound physical or emotional stress [1,2]. The clinical presentation of stress-induced cardiomyopathy includes heart failure, tachyarrhythmias, bradyarrhythmias, mitral regurgitation and cardiogenic shock. Patients in cardiogenic shock with poor left ventricular function remain at high risk for peri and post procedural morbidity and mortality. Intra-aortic balloon pump counter-pulsation is commonly used in these circumstances and has shown its efficacy to reduce intra-procedural major adverse cardiac and cerebral events [3,4]. However, IABP support is often unable to provide adequate circulatory support when complete hemodynamic collapse occurs [5,6]. Other more effective devices such as the tandem heart are more difficult to implant and have high complication rates. The Impella Recover LP 2.5® (Abiomed Inc, Danvers, Massachusetts, USA) is currently the smallest left ventricular assist device. It is minimally invasive, inserted percutaneously via a 13 French sheath. We report the successfully use of revised Impella Recover LP 2.5® device in a patient with acute severe heart failure following anaesthetic induction in a patients with acute cardiogenic shock with hemodynamic collapse.

Case Report

A previously fit and well 65 year old male manual worker was electively admitted for biopsy of a left posterior mandibular lesion. He received a general anaesthetic (Remifentanyl) infusion followed by Propofol and Atracurium induction. Immediately post induction he suffered a cardiac arrest. The patient required 3 cycles of Cardiopulmonary resuscitation for alternating pulseless ventricular tachycardia and pulseless electrical activity. He was successfully resuscitated. Post resuscitation Electrocardiogram showed brief left bundle branch block, however he developed florid pulmonary oedema and cardiogenic shock, requiring escalating inotropic (Noradrenaline, Enoximone and Metaraminol) and respiratory support. Initial bedside transthoracic echocardiogram showed a severely impaired and globally dilated left ventricle.

The patient was taken directly to the cardiac catheter lab to exclude a primary ischaemic cardiac event. In view of the significant hemodynamic compromise sustained, an Impella device was used to support cardiac output peri procedurally. The Impella was set at P8 (2.2 L/min) and a significant improvement in cardiac output was observed almost instantaneously (measured using FICK/thermodilution) from 2 L/min (pump off) to 3.3 L/min on pump activation.

Diagnostic coronary angiography was performed using standard Judkins catheters®. Coronary dominance was right sided. No obstructive coronary lesions were identified. Left ventriculogram using a pigtail catheter revealed impaired left ventricular function, with estimated ejection fraction of 20-25%. Severe apical hypokinesia and dilatation with hyperkinetic basal regions were observed as featured in Figure 1. The features were suggestive of transient apical ballooning syndrome presumably secondary to the severe anaphylactic reaction.

The Impella Recover LP 2.5® was secured in place after 13 French sheath removal. The patient was transferred to cardiac intensive care

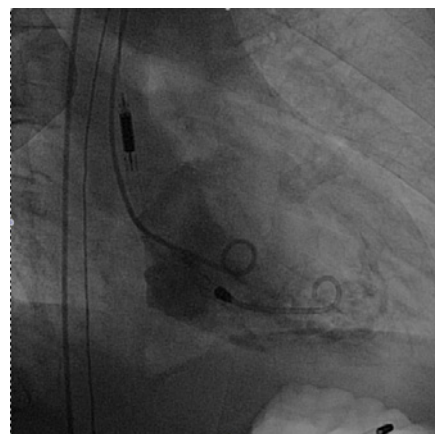


Figure 1: Global left ventricular dilatation with apical ballooning (Impella device in situ).

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unit. Whilst in cardiac intensive care unit the Impella was maintained at P7 (2 L/minute). This maintained the patient's cardiac output at 4.4 L/min, cardiac index at 2.2 L/min/m², on quadruple strength Noradrenaline and Enoximone. He required no renal support. Electrocardiogram returned to baseline with no Left bundle branch block. Peak creatinine kinase post resuscitation was 585 U/L and 12 hour Troponin T was 0.05 micrograms/L. Other blood work was unremarkable.

Within 24 hours of Impella implantation the patient was off all respiratory and inotropic support, remaining haemodynamically stable, no longer in pulmonary oedema and maintaining good urine output. There was no evidence of hypoxic brain injury.

Echocardiography 24 hours after the initial event shows return to near normal left ventricular function and dimensions with mild residual apical ballooning and hypokinesia only. The patient was transferred to coronary care and over the following 48 hours was weaned off the Impella device®, which was removed 72 hours after implantation without complication. The patient was discharged on day 6 of admission without sequelae. On outpatient review 2 weeks post discharge he has returned to full health.

Discussion

Apical ballooning syndrome, also known as Takotsubo cardiomyopathy is thought to be a stress-induced cardiomyopathy. A study by Nascimento et al. [7] reported a male incidence of 37%. It is usually self-limiting disorder and treatment is supportive but patients can present as cardiogenic shock in 13 to 18 percent of cases with rapid haemodynamic collapse and has been associated with an in-hospital mortality rates ranged from 0 to 8 percent [8,9]. In our patient the Impella was used as part of an emergency strategy in a patient who suffered significant haemodynamic compromise without adequate response to extensive inotropic treatment. In our assessment it would have been unlikely that Intra-aortic balloon pump counterpulsation in this patient would have provided the level of support needed to overcome the hemodynamic compromise. In our patient the Impella offered significant haemodynamic support and was able to provide flow from the LV across the aortic valve at up to 2.5 l/min even with severe left ventricular dysfunction and haemodynamic collapse. Takotsubo cardiomyopathy is characterized by an acute onset of reversible left ventricular apical ballooning (during systole) typically affecting the distal half/two thirds of left ventricular walls. Occasionally left ventricular outflow tract obstruction is seen secondary to left ventricular basal hyperkinesis, this was not a feature in this case [10-12]. Its presentation mimics that of an acute ischaemic event typically in post-menopausal females, although as seen in our case, there is no or minimal increase of cardiac enzymes [10,11]. Similar reports of transient apical ballooning syndrome post anesthesia induction have been published [13,14] and is thought to be related to exaggerated sympathetic activation and catecholamine release during induction of anesthesia. In this case the Impella left ventricular assistance appears helped left ventricular recovery within 24 hours of implantation while left ventricular function usually takes 7-10 days before it returns to normal [15].

Impella device has been successfully used in the settings of cardiogenic shock associated with acute myocardial infarction and High risk percutaneous coronary interventions [16-18], as a bridge to heart transplant [19], facilitated pos-operaative recovery following

coronary artery by pass surgery [20], fulminant acute myocarditis [21] and balloon aortic valvuloplasty in a high-risk patient [22].

Although at somewhat higher risk of vascular complications and limb ischemia than an intra-aortic balloon pump due to the need for a 13-French sheath, the Impella Recover LP 2.5® is unlikely to cause these complications as commonly as other left ventricular assist or circulatory bypass devices requiring much larger sheaths (>20 French). Another left ventricular assist device, the Tandem Heart (Cardiac Assist, Inc.; Pittsburgh, PA, USA) does not only require large bore sheaths with an associated higher complication rate, but also requires more complex manoeuvres such as a trans-septal puncture at implantation, a technique unfamiliar to most coronary interventional cardiologists.

Impella Recover LP® is a safe and effective left ventricular assist device in high-risk percutaneous coronary interventions, reducing the rates of peri-procedural major adverse cardiac and cerebral events. Reduction in myocardial workload, increase of coronary end organ perfusion, adequate haemodynamic support unloads the ventricle reducing inotropic requirements and reduces the risk of haemodynamic deterioration during high risk percutaneous coronary interventions and left ventricular supportive therapy.

Angiographic assessment of the femoral and iliac artery is vital to ensure suitability of vascular access and pre-closure with arterial closure devices such as the Perclose™ (Abbott Vascular Devices, CA, USA). This is likely to reduce the risk of vascular and ischemic complications. The Impella can be easily removed immediately post procedure but can stay in situ for up to 7 days.

Conclusion

We report the use of Impella Recover LP® left ventricular assist device in Takotsubo cardiomyopathy with severe haemodynamic sequelae following anesthetic induction. The Impella Recover LP 2.5® is an effective and minimally invasive left ventricular assist device in the treatment of patients with hemodynamic collapse.

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