**Table VIIIs – Case Reports**

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| **N°** | **AUTHOR** | **YEAR** | **JOURNAL**  | **COUNTRY**  | **CLINICAL CONDITION** | **INTERVENTION** | **CONCLUSION**  |
| **1**   | **Abu Saleh** [26] | 2015   | Texas Heart Institute Journal   | USA   |  Postcardiotomy Shock  |  Impella 5.0 + ECMO  | Impella device helps to directly unload the LV during VA ECMO support was successfully bridged to long-term support.   |
| **2**   | **Alam [27]** | 2019   | Journal of Cardiac Failure   | USA   |  CS post Left Ventricular Aneurysm  |  Impella 5.0  | Impella was used as a bridge to decision for 18 days in a patient with anterolateral/inferolateral LV aneurysm with severely reduced ejection fraction. The patient expired due to septic shock. Impella can be considered in LV aneurysm management.  |
| **3**   | **Al-Darzi** [28] | 2019   | Journal of Cardiac Failure   | USA   | Peripartum cardiomyopathy  |  Impella 5.0 post Impella 2.5  | Impella 5.0 was introduced as a bridge to recovery in woman during the third trimester of pregnacy after the failing of Impella 2.5.  Impella 5.0 is a feasible alternative to VA ECMO and provides a high level of hemodynamic support which could bridge to myocardial recovery in PPCMP patients suffering from cardiogenic shock.   |
| **4**   | **Alkhawam** [29] | 2019   | Heart & Lung   | USA   | RV failure post Impella 5.0  | Impella 5.0 and Impella RP  | This case report highlights the risk of acute RV failure following placement of an impella 5.0 and benefit of a percutaneous right ventricular assist device for RV failure. It is imperative to assess the right ventricular function before and immediately after initiation of left ventricular mechanical circulatory support.   |
| **5**   | **Arnautovic [30]** | 2019   | Case Reports in Cardiology   | USA   | CS in hypotiroidism  and ACS  | IABP + Impella 5.0  | Patient with hypothyroidism and ACS which subsequently lead to myxoedema coma  IABP escalated to Impella 5.0 was used in this rare condition.   |
| **6**   | **Beneduce [31]** | 2019   | European Heart Journal: Acute Cardiovascular Care   | Italy   | CS post AMI  | Impella 5.0  | For the first time is demonstrated the feasibility of Percutaneous Mitral Valve Repair with the new MitraClip XRT system in cardiogenic shock with concomitant Impella 5.0.   |
| **7**   | **Bhamidipati [32]** | 2016   | JACC: Cardiovascular Interventions   | USA   | CS post AMI in Kavasaki  | Impella 5.0  | Impella 5.0 was usefull to improve patient condition but during the extraction it was noted a fracture of the device  |
| **8**   | **Burns [33]** | 2015   | Innovations   | Canada   | Fulminant Viral Myocarditis  | Impella 5.0  | Impella 5.0 was used on a patient with fulminant viral myocarditis. It was safe and effective support and the patient was completely rehabilitated .  |
| **9**   | **Castillo-Sang [34]** | 2013   | Innovations   | USA   | CS post AMI  | Impella 5.0  | Even if the Impella 5.0 is approved for 6 hours of use in the treatment of cardiogenic shock, in this case the treatment it lasted for 35 days   |
| **10**   | **Cheung [35]** | 2019   | Heart Lung and Circulation    | Australia   | CS post AMI  | Impella 5.0  | This case highlighted the beneficial use of Impella in facilitating transition to definitive mechanical ventricular support when ongoing ECMO is problematic in a de-escalation strategy.   |
| **11**   | **Choi [36]** | 2011   | Innovations   | USA   | CS post AMI  | Impella 5.0  | The first case in which the Impella 5.0 device was placed directly into the ascending aorta via a small right anterior thoracotomy.  Advantages with a central insertion technique include that it provides the shortest fixation distance between the insertion site and the aortic valve.  |
| **12**   | **Dalal [37]** | 2019   | Case Reports in Cardiology   | USA   | AMI-CS  | Impella 5.0 + Impella RP  |  In this case the use of combined Impella RP and Impella 5.0 was effectively performed in a patient with persistent cardiogenic shock. He was discharged home from rehabilitation on hospital day 60 .  |
| **13**   | **Davis [38]** | 2014   | ASAIO Journal   | USA   | AMI-CS  | IABP + Impella 5.0  | The increased blood sheer stress from micro axial design and high pump speed in the Impella 5.0 contributed to the development of early von Willebrand syndrome and excessive perioperative bleeding when bridged to a long term LVAD.   |
| **14**   | **Dominguez-Perez [39]** | 2014   | Critical Care and Shock   | Canada   | AMI-CS  | Impella 5.0  | This case higlighted impella 5.0 support in AMI-CS combined with the hypotermia protocol with a complete neurological recovery.  |
| **15**   | **Elmann [40]** | 2018   | European Heart Journal: Acute Cardiovascular Care    | USA   | AMI-CS  | Impella 5.0  | In patients with a malignant vascular disease direct aortic access may be used to Impella implant.   |
| **16**   | **Farris [41]** | 2018   | Critical Care Medicine   | USA   | AMI-CS  | Impella 5.0  | A therapeutic plasma exchange may be implemented before heparin re-exposure to avoid pump thrombosis and reduce postoperative hemorrhage in patients with heparin-induced thrombocytopenia who require VAD placement. Impella 5.0 was used as a bridge to a Heartmate II left ventricular assist device implantation.   |
| **17**   | **Gazdic [42]** | 2019   | European Heart Journal: Acute Cardiovascular Care   | Czech Republic   |   lymphocytic myocarditis and CS  | Impella 5.0 + ECMO  | After the use of  VA ECMO to resolve a right ventriculare failure, Impella 5.0 implantation was necessary to stabilize the patient.  |
| **18**   | **Hansen [43]** | 2014   | Critical Care Medicine   | Denmark   | lymphocytic myocarditis and CS  | Impella 5.0 + ECMO   | VA-ECMO was weaned with the use of only Impella 5.0 until the 17th day of use, whereupon Impella was phased out .   |
| **19**   | **Hollander [44]** | 2012   | Pediatr Transplantation   | USA   | dilated cardiomyopathy andCS   | Impella 5.0  | In a 10-year-old patient,  Impella 5.0 allowed the passage from ECMO to HeartMate II LVAD with success   |
| **20**   | **Hori [23]** | 2019   | Int Heart Journal   | Japan   | dilated cardiomyopathy andCS  | Impella 5.0  | The first case of a patient who was safely transported with Impella 5.0 over 450 km in Japan, underlining the hemodynamics  stabilization provided by Impella 5.0.  |
| **21**   | **Iskandir [45]** | 2019   | Journal of the American College of Cardiology   | USA   | Acute myiocarditis and CS  | Impella CP and then Impella 5.0 and Impella RP  | This case case of acute myocarditis highlights the importance of early recognition of need for mechanical circulatory support, right ventricular failure and the benefit of biventricular Impella support.  In particular, Impella CP was exchanged for a surgical Impella 5.0 and a percutaneous Impella RP.   |
| **22**   | **Jurcova [46]** | 2019   | European Journal of Heart Failure   | Czech Republic   | Fulminant lymphocytic myocarditis  | VA-ECMO + Impella 2.5 and then Impella 5.0  | This case illustrates that if acute viral infection is ruled out, immunosuppressive protocol can be successfully used in management of fulminant lymphocytic myocarditis together with temporary mechanical circulatory support consisting of VA-ECMO + Impella (first Impella 2.5 and then Impella 5.0)   |
| **23**   | **Jahanyar [47]** | 2019   | The Heart Surgery Forum   | USA   | AMI-CS  | Impella 5.0  | A case of an aortic root thrombus in the bridge from Impella 5.0 and Heartmate 3 - LVAD  |
| **24**   | **Johannesen [48]**   | 2019   | Journal of the American College of Cardiology   | USA   | Avanced heart failure due to aortic stenosis  | Impella 5.0  | The device Impella 5.0 was usefull  as a bridge to recovery in a patient with a calcific aortic stenosis who underwent a mechanical aortic valve replacement.    |
| **25**   | **Johnson [49]** | 2017   | The Journal of heart valve disease    | USA   | Avanced heart failure due to aortic stenosis  | Impella 5.0  | The device Impella 5.0 was usefull during a transcatheter aortic valve replacement    |
| **26**   | **Kumpati** [50] | 2012   | Innovations   | USA   | AMI-CS  | Impello 5.0  | This case reports the use an access for the Impella 5.0 via the external iliac via minimally invasive retroperitoneal access in a patient with severe ischemic cardiomyopathy.   |
| **27**   | **Ma [51]** | 2019   | Journal of American College of Cardiology   | USA   | Gient cell myocarditis   | Impella 5.0  | This case of an elderly male with giant cell myocarditis highlights the feasibility of immunopression and biventricular Impella  support as a bridge to recovery in a patient who was not a candidate for transplantation or durable mechanical circulatory support   |
| **28**   | **MacDonald [52]**   | 2015   | Canadian Journal of Cardiology   | Canada   | AMI-CS  | Impella 5.0  | Following Coronary Artery Bypass Grafting, a forty year old female continues in cardiogenic shock supported by intra-aortic balloon therapy and then on to further left ventricular support via Impella 5.0.  Following two weeks of intensive medical therapy; including LVAD repositioning, daily hemodialysis and consideration for transplantation, a difficult decision is made: the patient is removed from life support.   |
| **29**   | **Mahata [53]**   | 2016   | journal of American College of Cardiology   | USA   | AMI-CS  | Impella 5.0  | This case demonstrates the rare coexistence of LV thrombus and possible pus during temporary MCS. The optimal approach for bridging to permanent MCS device in these patients is unclear.    |
| **30**  | **Narain** [54] | 2012  | Case Reports in Critical Care  | USA  | Fulminant viral myocarditis  | Impella 5.0+ECMO  | This is the first case reported of the contemporary use of Impella and ECMO as a bridge to full recovery in an adult with myocarditis. It also presents a novel use of the Impella device in decompressing the left ventricle of an adult patient on ECMO.  |
| **31**   | **Nakamura** [55] | 2017   | Journal of Invasive Cardiology   | Japan   | Dilated cardiomyopathy and CS  | Impella 5.0  | Due to inadequate iliofemoral vasculature and desire for mobility, the axillary artery was considered to be the most appropriate access approach for temporary mechanical circulatory support. The procedure was well tolerated and the patient was supported for 17 days, at which time the device was safely removed in a fully percutaneous manner at the time of permanent left ventricular assist device placement.   |
| **32**   | **Nakamura[56]**  | 2019   | Journal of Artifcial Organs   | Japan   | AMI-CS  | Impella 5.0  | A 70-year-old patient with refractory heart failure of ischemic etiology complicated with combined valvular disorders was initially treated treated with Impella 5.0 as a bridge to LVAD. The autors emphasize the importance of early ventricular unloading that may facilitate myocardial recovery.   |
| **33**   | **Nakao [57]** | 2019   | Circulation Journal   | Japan   | Dilated cardiomyopathy and CS   | Impella 5.0  | This is the first case of hemolysis caused by swinging motion of the Impella device (it was located 35mm from the aortic valve, within the manufacturer recommendations, but the Impella device was striking the left ventricular septal wall)   |
| **34**  | **Oetken**  [58] | 2019  | Critical Care Medicine  | USA  | Peripartum Cardiomyopathy  | Impella 5.0  | This case demonstratrates that a high purge pressure and low flow rate state may be successfully resolved with a tPA purge solution with minimal adverse effect.   |
| **35**   | **Ogawa [59]** | 2019   | Internal medicine   | Japan   | Fulminant viral myocarditis with CS  | Impella 5.0  | The article reports the clinical potential of Impella 5.0 support in the treatment of recurrent fulminant myocarditis with profound cardiogenic shock. Given its effect of cardiac protection with sufficient systemic perfusion,  Impella 5.0 should be considered the first-line therapy for the treatment of this critical disorder.   |
| **36**   | **Osswald [60]**   | 2019   | Journal of Thoracic Disease   | USA   | AMI-CS  | Impella 5.0  | The report suggests that in cases where weaning patients from durable LVAD systems is conceivable, the Impella pump provides a least invasive option to facilitate the gradual transition from full mechanical circulatory support to independent circulation.    |
| **37**   | **Pariyadath [61]**  | 2014   | American Journal of Respiratory and Critical Care Medicine   | USA   | Thyrotoxicosis-induced CS  | IABP + Impella 5.0  | Targeted therapies hyrotoxicosis-Induced Cardiogenic Shock are lacking, nowadays is mostly supportive care. In this case, the use of both an IABP and a temporary Impella LVAD allowed for reversal of the shock syndrome and complete clinical recovery.   |
| **38**   | **Patel [62]** | 2012   | Anesthesia and analgesia   | USA   | Gian cell myiocarditis with CS  | IABP+Impella 5.0  | Transesophageal echocardiography is an excellent adjunct when used with fluoroscopy to verify appropriate Impella  device placement. More reports describing the echocardiographic findings associated with the Impella device are needed.   |
| **39**   | **Peltan [63]** | 2014   | Perfusion   | France   | Post-infarction surgery CS  | Impella 5.0  | The authors describe a new use for the Impella 5.0, as a right ventricular assist device after the surgical treatment of a posterior post-infarction cventricular septal defect.   |
| **40**   | **Poorna [64]** | 2018   | European Journal of Heart Failure    | USA   | Inflammatory dilated cardiomyopathy   | Impella 5.0  | The article presents tha case of a patient with inflammatory dilated cardiomyopathy who changed different mechanical support devices, from IABP to Impella CP to Impella 5.0. His recovery reiterated that timely use of appropriate mechanical support device, guideline directed medical therapy, and CRT can help recover cardiac function in situations where there is a reversible cause of cardiogenic shock.   |
| 41   | **Rajagopalan [65]** | 2014   | Journal of Invasive Cardiology   | India   | AMI-CS  | Impella 5.0  | The Impella 5.0 device can provide hemodynamic support in the setting of low cardiac output. The upper extremity access has the advantage of longer-term support, which may be needed if ventricular recovery is delayed or if several days are required to optimize patients for subsequent surgery.   |
| **42**  | **Ruhparwar [66]** | 2019  | Journal of Cardiac Surgery  | Germany  | 1)Dilated Cardiomyopathy  2) AMI-CS  | Impella 5+ VA-ECMO  | This study describes the management of 2 patients with CS trated with a new ECPELLA, Impella 5.0 (in axillary artery) and ProtekDuo cannula (in jugular vein) as a bridge to LVAD. This ECPELLA 2.0 is also groin-free and the patient starts full mobilization as early as they weaned from the respirator.    |
| **43**   | **Samuels [67]** | 2016   | Innovations: Technology and Techniques in Cardiothoracic and Vascular Surgery    | USA   | AMI-CS  | Impella 5.0+VV-ECMO  | This study describes the configuration and advantages of combined  VA ECMO with the Impella  5.0 in the management of postcardiotomy biventricular failure ad a bridge for further mechanical support or heart transplantation.  |
| **44**   | **Sayed [68]** | 2017   | Journal of cardiothoracic surgery   | USA   | AMI-CS  | VA-ECMO + Impella 5.0  | The combined use of VP ECMO and Impella 5.0 is effective in the management of postcardiotomy biventricular failure as a bridge for further mechanical support or heart transplantation.   |
| **45**   | **Shah [69]** | 2015   | Texas Heart Institute Journal   | USA   | AMI-CS  | Impella 5.0  | The patient’s vascular anatomy and prior surgery precluded conventional percutaneous implantation of an Impella 5.0 ventricular support  device. The authors delivered the Impella device through the patient’s vasoconstricted axillary artery. The success of this approach suggests that combining the expertise of cardiologists and cardiovascular surgeons can improve the outcomes of patients with complex anatomic issues.    |
| **46**   | **Spillmann**  [70] | 2019   | BMC Cardiovascular Disorders    | Germany   | Chronic Inflammatory Cardiomyopathy  | Impella 5.0  | Prolonged unloading with an Impella device offers a circulatory support with additional disease modifying effects important for bridge-to-recovery in patients with inflammatory cardiomyopathy.   |
| **47**   | **Thomas [71]** | 2013   | Journal of Cardiac Surgery   | USA   | CS after aortic valve replacement  | Impella 5.0  | The authors present a case highlighting use of the Impella 5.0 for postcardiotomy cardiogenic shock after coronary artery bypass and bioprosthetic aortic valve replacement. Support was maintained for 7 days before being successfully weaned with myocardial recovery and no damage to the bioprosthetic aortic valve (this is the first published report of successful use of an Impella 5.0)   |
| **48**   | **Vaishnav [72]** | 2019   | Journal of Cardiac Failure   | USA   | CS in LVAD patient  | Impella 5.0 + impella RP  | The authors report an LVAD patient who presented with cardiogenic shock and successfully bridged to heart transplantation with biventricular Impella support.   |
| **49**  | **Varian [73]** | 2019   | ESC Heart failure   | USA   | Sarcoidosis with CS  | Impella 5.0 + Impella RP  | The authors report a patient with biventricular failure secondary to rapidly progressive cardiac sarcoidosis refractory to medical management who was bridged to heart transplant with Impella 5.0 and Impella RP—temporary left and right ventricular assist devices, respectively. This is the first successful bridge to transplantation using these devices in biventricular heart failure and cardiogenic shock.   |
| 50  | **White [74]** | 2019   | ASAIO Journal   | USA   | CS post transposition of the great artery surgery   | Impella 5.0  | The article describes the use of the Impella 5.0 as a bridge to HeartMate 3 implantation in a highly sensitized patient with severe pulmonary hypertension following the Mustard procedure for transposition of the great arteries.   |
| 51   | **Yamamoto [75]** | 2019   | European Heart Journal    | USA   | Fulminant myocarditis with CS  | Impella 5.0  | Mitral chordal rupture by Impella is a relatively rare complication. However, vulnerability of the mitral valve leaflet and chordae due to inflammation could be a potential risk for Impella related chordal rupture. Author's experience suggests the need for closer monitoring of Impella, especially in patients with fulminant myocarditis.   |
| 52   | **Yoshida [76]** | 2018   | Circulation Journal   | Japan   | Dilated cardiomyopathy  | Impella 5.0  | The Impella 5.0 was inserted for refractory cardiogenic shock in a 50-year-old man with acute deterioration of end-stage dilated cardiomyopathy, because the Impella 2.5 or intra-aortic balloon pumping could not provide sufficient circulatory support (first case in japan). Three days of circulatory  support with the Impella 5.0 enabled stabilization of hemodynamic status and recovery of end-organ function,and facilitated durable LVAD implantation without right heart failure.   |

*Legend:*

CS (cardiogenic shock), AMI-CS (acute myocardial infarction-related cardiogenic shock), LV (left ventricle), ECMO (extracorporeal membrane oxygenation), VA ECMO (Venoarterial extracorporeal membrane oxygenation), VV ECMO (veno- venous extra corporeal membrane oxygenation) VP ECMO (veno- pulmonary extra corporeal membrane oxygenation),  PPCMP (Pregnant patient with peripartum cardiomyopathy), CI (cardiac index), RV (right ventricle), PMVR (percutaneous mitral valve repair), LVAD (left ventricular assist device), RVAD (right ventricular assist device), LT CF-LVAD (long term continuous flow left ventricular assist device), ST CF-LVAD (short term continuous flow left ventricular assist device), HIT (heparin-induced thrombocytopenia), AVWS (early von Willebrand syndrome), MCS (mechanical circulatory support).