**The Development of Mechanical Circulatory Devices**

**in MacKay Memorial Hospital**

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| **2024**馬偕紀念醫院國際論壇**:** 機械式循環輔助系統 |
| 馬偕紀念醫院心臟血管中心主辦**/**臺灣介入性心臟血管醫學會協辦 |
| **Hosted by Cardiovascular Center of MacKay Memorial Hospital, Taipei** |
| **Co-organized by Taiwan Society of Cardiovascular Intervention**  |
| **Date: 17th March 2024** |
| **Venue: 4thConference Hall (4F), TamsuiMacKay Memorial Hospital**  **(No.45, MinshengRd., Tamsui Dist., New Taipei City)**馬偕樓第四講堂 |

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| **時間** | **主題** | **講師簡歷** |
| **09:10-09:30** | **The Development of Mechanical Circulatory Devices in MacKay Memorial Hospital** | **Dr. Wei Ren Lan (藍偉仁醫師 ) Staff Specialist, Department of Cardiovascular Medicine , MacKay Memorial Hospital**  |
| **09:30-9:55** | **Is Intra-aortic Balloon Pump Enough in Clinical Scenarios** | **Dr. Shu Hao Wu (吳書豪醫師) Staff Specialist, Department of Cardiovascular Medicine , MacKay Memorial Hospital**  |
| **09:55-10:30** | **Double Lumen Cannula Application in VV-ECMO** | **Prof. William Alex JakobleffDirector of the Montefiore Institue of Minimally Invasive Surgery; USA** |
| **10:30-11:05** | **Past, Present, Future of ECPR in Japan** | **Prof. Toru HifumiChief of Staff at St. Luke’s International Hospital, Japan** |
| **11:25-12:00** | **Integrating Impella into Clinical Practice** | **Dr James Xu Director of Training and Education at the Department of Cardiology, Liverpool Hospital, Sydney** |
| **12:00-12:40** | **All You Need to Know About Mechanical Circulatory Support: iVAC 2L & LAVA-ECMO** | **Dr Jung Cheng Hsu (許榮城主任)Director of Cardiology, Far Eastern Memorial Hospital, Taipei** |

**The Development of Mechanical Circulatory Devices in MacKay Memorial Hospital**

***Speaker***: Dr. Wei Ren Lan (藍偉仁 醫師)
Staff Specialist, Department of Cardiovascular Medicine, MacKay Memorial Hospital

***Moderator:*** Dr. Cheng Ting Tsai (蔡政廷 主任)
Director, Department of Cardiovascular Medicine, MacKay Memorial Hospital

***Time:*** 09:10 am -09:30 am

***Abstract:***

The idea of mechanical circulatory support (MCS) has existed for more than 200 years. The development of MCS devices provide reliable circulatory support, temporarily supporting a patient’s circulation either until recovery, transplantation or as a means to permanently replace a failed heart.

The methods for providing MCS have varied greatly. The two commonly used MCS for hemodynamic support in my hospital before the year 2012 are intra-aortic balloon pump (IABP) and extracorporeal membrane oxygenation (ECMO).

With limited hemodynamics support from IABP, temporary extracorporeal assist devices, such as ECMO are frequently used for patients in cardiogenic shock, particularly in our hospitals that do not routinely insert implantable VADs or perform cardiac transplantation. Serial innovations and advances in technology have led to easier percutaneous application of a miniaturized V-A bypass system that can simply initiated by an interventional Cardiologist. Percutaneous cardiopulmonary support system (PCPS) has gained its popularity in our hospital since 2012, mainly due to its rapid priming and rapid insertion in emergency situations. However, both ECMO and PCPS do not unload left ventricle. The Impella device, a catheter-based miniaturized ventricular assist device (VAD), provide immediate and sustained unloading of the left ventricle, while increasing overall systemic cardiac output.

With multiple treatment modalities available, the challenge for the practicing interventional cardiologist is to understand which MCS offers the best use in each clinical scenario and to understand how patient characteristics impact this choice. We hope, with newer innovations, such devastating complications like strokes, arterio-venous (AV) malformations with gastrointestinal bleeding, right heart failure, and device-related infection will be taken care of. The goal of this forum is to define a practical approach for the interventional cardiologist regarding when to use MCS, how to select MCS device type, and practical points to consider when utilizing MCS devices

**Is Intra-aortic Balloon Pump Enough in Clinical Scenarios**

***Speaker***: Dr. Shu Hao Wu (吳書豪 醫師)
Staff Specialist, Department of Cardiovascular Medicine , MacKay Memorial Hospital

***Moderator:*** Dr. Jui Peng Tsai (蔡瑞鵬 主任)
Director of Cardiovascular Center, MacKay Memorial Hospital

***Time:*** 09:30 am -09:55 am

***Abstract:***

In the realm of cardiovascular interventions, Intra-Aortic Balloon Pumping (IABP) continues to hold a pivotal position, offering a lifeline to patients in critical cardiac conditions. This talk aims to explore the contemporary evidence and evolving clinical role of IABP in the management of various cardiac pathologies.

Recent studies underscore the efficacy of IABP in optimizing hemodynamics and enhancing coronary perfusion, particularly in scenarios like acute myocardial infarction, cardiogenic shock, and refractory angina. Furthermore, advancements in device technology have bolstered its safety profile and usability, making it a preferred choice in high-risk percutaneous coronary interventions and as a bridge to advanced cardiac support systems.

Moreover, ongoing research endeavors are shedding light on the nuanced applications of IABP, including its role in improving outcomes in patients undergoing complex coronary interventions and its potential synergy with emerging therapies like extracorporeal membrane oxygenation (ECMO) and ventricular assist devices (VADs).

As we navigate the dynamic landscape of cardiovascular care, it is imperative for clinicians to recognize the enduring relevance of IABP and its evolving clinical role. By integrating the latest evidence and harnessing the capabilities of modern IABP technology, healthcare providers can optimize patient outcomes and usher in a new era of cardiac care.

**Double Lumen Cannula Application in VV-ECMO**

***Speaker***: Prof. William Alex Jakobleff
Director of the Montefiore Institue of Minimally Invasive Surgery; USA

***Moderator***: Dr. Chen Yen Chien (簡禎彥 主任 )
Director, Department of Cardiovascular Surgeon, MacKay Memorial Hospital

***Time***: 09:55 am -10:30 am

***Abstract:***

To choose appropriate cannula to meet physiologic needs of patients is important.

A recent bicaval dual-lumen cannula is designed to allow for easy and safe cannulation, precise positioning and monitoring, and appropriate physiologic support for patients with acute respiratory failure. A single-site, dual-lumen venovenous extracorporeal membrane oxygenation (VV-ECMO) facilitates mobilization, reduces recirculation, and mitigates insertion and infectious risks of an additional access site.

This dual-lumen cannula provides visible radiopaque markers for accurate placement with ease, crescent-shaped lumen for optimized pressure flow performance and efficient distant between drainage and infusion for reduced recirculation.

Here I share my tips of using this dual lumen cannula percutaneously in VV-ECMO from perspectives of Montefiore health system.

**Past, Present, Future of ECPR in Japan**

***Speaker:*** Prof. Toru Hifumi
Chief of Staff at St. Luke’s International Hospital, Japan

***Moderator:*** Dr. Chun Ming Shih (施俊明 院長)
Superintendent, Taipei Medical University Hospital

***Time:*** 10:30 am -11:05 am

***Abstract:***

Extracorporeal cardiopulmonary resuscitation (ECPR) followed by targeted temperature management has been demonstrated to significantly improve the outcomes of out‐of‐hospital cardiac arrest (OHCA) in adult patients. Although recent narrative and systematic reviews on extracorporeal life support in the emergency department are available in the literature, they are focused on the efficacy of ECPR, and no comprehensively summarized review on ECPR for OHCA in adult patients is available. In this review, we aimed to clarify the prevalence, pathophysiology, predictors, management, and details of the complications of ECPR for OHCA, all of which have not been reviewed in previous literature, with the aim of facilitating understanding among acute care physicians. The leading countries in the field of ECPR are those in East Asia followed by those in Europe and the United States. ECPR may reduce the risks of reperfusion injury and deterioration to secondary brain injury. Unlike conventional cardiopulmonary resuscitation, however, no clear prognostic markers have been identified for ECPR for OHCA. Bleeding was identified as the most common complication of ECPR in patients with OHCA. Future studies should combine ECPR with intra‐aortic balloon pump, extracorporeal membrane oxygenation flow, target blood pressure, and seizure management in ECPR.

**Integrating impella into clinical practice**

***Speaker:*** Dr James Xu
Director of Training and Education at the Department of Cardiology, Liverpool Hospital, Sydney

***Moderator:*** Dr Tien Ping Tsao (曹殿萍主任)

Director of Division of Cardiology, Heart Center, Cheng Hsin General Hospital, Taipei

***Time:*** 11:25 am -12:00 noon

***Abstract:***

The integration of the Impella device into the clinical practice of both interventional cardiology and cardiac surgery for high-risk percutaneous coronary interventions (PCIs) and the management of cardiogenic shock is a testament to its pivotal role in modern cardiac care. This device, renowned for its capacity to provide direct left ventricular unloading and support, represents a significant advancement over traditional mechanical circulatory support (MCS) systems in treating critically ill cardiac patients. This abstract compares the Impella with other MCS devices from the combined perspectives of an interventional cardiologist and a cardiac surgeon, focusing on its application in high-risk PCI and cardiogenic shock.

Impella's unique ability to offer up to 4.3 or 6.0 L/min of blood flow directly unloads the heart and sustains systemic circulation, making it an invaluable tool in the management of patients undergoing high-risk PCI or suffering from cardiogenic shock. This contrasts with the intra-aortic balloon pump (IABP), which indirectly supports cardiac function through diastolic augmentation, and extracorporeal membrane oxygenation (ECMO), which provides comprehensive cardiopulmonary support but at the cost of higher invasiveness and associated complications.

For both interventional cardiologists and cardiac surgeons, the choice of Impella over other MCS devices hinges on its minimally invasive nature, rapid deployability, and unique hemodynamic benefits. These features allow for more nuanced management of complex cardiac conditions, facilitating improved outcomes through enhanced myocardial perfusion and reduced cardiac workload.

However, the decision to utilize Impella must be carefully weighed against the clinical scenario, patient-specific factors, and the relative risks and benefits of alternative MCS options. The collaborative approach between interventional cardiologists and cardiac surgeons is crucial in optimizing patient selection and procedural strategies, ensuring that the integration of Impella into clinical practice enhances patient care and outcomes in the context of high-risk PCI and cardiogenic shock. This multidisciplinary perspective highlights the importance of technological advancements in MCS and their transformative impact on the treatment of severe cardiac conditions.

**All You Need to Know About Mechanical Circulatory Support: iVAC 2L & LAVA-ECMO**

***Speaker:*** Dr Jung Cheng Hsu (許榮城 主任)
Director of Cardiology, Far Eastern Memorial Hospital, Taipei

***Moderator:*** Dr. Kuang Te Wang (王光德 院長)

Superintendent, Taitung MacKay Memorial Hospital

***Time:*** 12:00 noon -12:40 pm

***Abstract:***

iVAC2L is a pulsatile left ventricular assist device that can provide hemodynamic support. It is designed to be used in patients with impaired left ventricular function who undergo high-risk percutaneous coronary intervention (PCI). iVAC2L can help to maintain stable blood pressure, reduce myocardial oxygen consumption, and improve coronary and end-organ perfusion during high-risk PCI and early stage of cardiogenic shock.

It can also help to prevent or manage complications such as cardiogenic shock, acute decompensated heart failure, or arrhythmias.

High risk PCI may benefit from prophylactic or rescue use of mechanical circulatory support devices such as iVAC2L. However, the use of these devices also carries some potential risks, such as vascular complications, bleeding, infection, or device malfunction. Therefore, the decision to use iVAC2L or other devices should be based on careful assessment of the patient’s condition, the complexity of the PCI procedure, and the availability and expertise of the operator.

LAVA ECMO is a novel technique that uses a single or two cannula to provide biventricular support for patients with cardiogenic shock or severe aortic regurgitation. It stands for left atrial venoarterial extracorporeal membrane oxygenation. It involves inserting a fenestrated cannula into the left atrium through a transseptal puncture and connecting it to a VA-ECMO circuit. This way, blood is drained from both the left and right atria and returned to the arterial system, bypassing the failing ventricles. LAVA ECMO can improve hemodynamics, reduce left ventricular distension, and prevent pulmonary edema. It can also be used as a bridge to recovery, durable left ventricular assist device, or cardiac transplantation.

LAVA ECMO is a complex and invasive procedure that requires expertise in transseptal puncture and echocardiography. It also carries some potential risks, such as vascular complications, bleeding, infection, or device malfunction. Therefore, it should be reserved for carefully selected patients in experienced centers.