The deltastream® system
Cardiosurgical therapy of post perfusion cardiac failure and cardiopulmonary failure
The advent of cardiopulmonary bypass with the heart-lung machine opened the door for heart surgery to create surgical treatment options for a broad variety of cardiovascular diseases. Especially in complex congenital heart disease and for many acquired cardiovascular diseases, heart surgery still remains the major pillar in advanced treatment strategies.

Upon the use of a heart-lung-machine about 3-5% of patients suffer from post perfusion cardiac failure associated with the sequela of cardiopulmonary bypass, e.g. ischemia, reperfusion damage or activation of the inflammatory cascade. The resultant myocardial pump failure frequently leads to pulmonary congestion necessitating intensified therapeutic efforts to potentially cure the patient.

Treatment with inotropic drugs and intra-aortic counterpulsation might be sufficient in the majority of cases with post perfusion myocardial failure. However, about 1% of patients require intensified treatment, e.g. with extracorporeal membrane oxygenation (ECMO) or extracorporeal circulatory life support (ECLS) as a bridge to recovery, to VAD or to transplantation. This creates life saving treatment options in a patient cohort with high mortality and has been proven for both adult and pediatric patients.

In all cardiogenic shock situations a rapid stabilization of the patient’s native circulation is indispensable to minimize mortality caused by malperfusion-related end organ failure. In such a situation cardiopulmonary assist with the help of ECMO/ECLS has been shown to be a promising and successful treatment option.

In patients suffering from massive acute pulmonary embolism with consecutive life-threatening circulatory failure the use of ECMO/ECLS enables stabilization of the patient’s circulation and guarantees sufficient gas exchange, thus improving outcome in these cases with otherwise fatal prognosis.

In patients with ventricular fibrillation, the use of therapeutic hypothermia offers a proven benefit in terms of an improved outcome. However, the majority of centers today use therapeutic hypothermia also for comatose survivors with other initial rhythms. Therapeutic hypothermia following ECPR is easy to apply by means of the heater/cooler unit, which is a component of the deltabreathe system and avoids severe side-effects or complications associated with mortality.

**Reasons for Cardiogenic Shock:**
- Acute myocardial Infarction (AMI)
- Infarction-related complications, e.g.
  - After papillary muscle rupture
  - Infarction-related ventricular septal defect
  - Rupture of the ventricular wall

**Extracorporeal Support Saves Lives**
Extracorporeal support was successfully employed by several experienced groups in cardiopulmonary resuscitation of patients with acute cardiogenic shock refractory to conventional therapy (see Figure 1). Perfusion technology can thus be used to salvage patients’ lives by means of extracorporeal cardiopulmonary reanimation (ECPR).

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BRIDGING STRATEGIES:
SAVING LIMITED RESOURCES

The use of ECLS protocols to support the circulation and provide extracorporeal gas exchange allows both perfusionist and cardiac surgeon to bridge the patient to surgical treatment, to recovery, to VAD or to transplantation. ECMO treatment, for instance, can be used in patients with pulmonary failure with end stage pulmonary disease as a bridge to transplant.[16,17]

In myocardial failure, ECLS can be used in a staged therapy concept as a bridge to bridge followed by the implant of an assist device (LVAD, RVAD or BiVAD) in case myocardial recovery is an option or organ transplantation is the final target.[18]

However, when used to support a patient in cardiogenic shock such a strategy is advantageous in preserving limited resources by avoiding LVAD implantation when a poor outcome is most likely.[19]

Naturally, ECLS therapy and the associated treatment options can also be used in acute post-transplant organ failure to allow time for decision making in such a complex situation.[20,21]

deltastream® INDICATIONS

When used by experienced perfusionists and in the hands of experienced cardiac surgeons the aforementioned treatment options offer a broad spectrum of indications for the deltastream® system:

- Post-perfusion cardiac failure[2,4,5]
- Post-perfusion cardiac failure in congenital heart disease[6,7]
- Cardiopulmonary resuscitation[8,9]
- Acute pulmonary embolism[11,12]
- Patient cooling after cardiac arrest[13,14]
- Cardiogenic shock[15,16,17]
- Bridging strategies[16,18,19]
- Post-transplant acute rejection[20,21]

ILCOR® RECOMMENDATIONS[15]

1. Unconscious adult patients with spontaneous circulation after out-of-hospital cardiac arrest should be cooled to 32-34° C for 12-24 h when the initial rhythm was VF

2. Such cooling may also be beneficial for other rhythms or in-hospital cardiac arrest

*International Liaison Committee On Resuscitation
deltastream®:
FOR ALL CARDIOPULMONARY PATIENTS

Since the advent of ECLS treatment in clinical practice during the 1970’s[22,23] these initially complex technologies underwent a successful evolution towards routine clinical use. Medos engineers succeeded in reducing the complexity of the ECLS equipment to a minimum with reliable, compact, safer and more user-friendly equipment. All of these requirements have to be met for current ECLS treatment in modern perfusion and cardiothoracic surgery.

The deltastream® system serves as a complete system for all patients requiring cardiopulmonary support.

YOUR ADVANTAGES DURING PATIENT TREATMENT

The Medos deltastream® system is optimized for cardiosurgical therapy and offers a unique combination of safety, mobility and ease of use.

The deltastream® system consists of the MDC console user interface, the completely new and unique DP3 rotational pump, the quiet and powerful heater/cooler, and finally the unifying deltastream® Trolley.

In consequence the complete deltastream® system offers optimized, flexible and individually adjustable treatment strategies for your patients of all ages: from neonates to adults.

AT A GLANCE:
- Optimized and individualized applicability
- Mobility and flexibility during use
- Maximum safety and gentle treatment for the patient
- Universal use for patients of all ages: from neonates to adults
- Cooling and warming according to treatment requirements
SIMPLE, EFFECTIVE AND SAFE: THE deltastream® SYSTEM

**deltastream® MDC CONSOLE**

- Preload control prevents suction of the inflow cannula
- Increased flexibility due to modular positioning
- Precise and sensitive flow and pressure control enabling treatment of neonates and adults with only one pump size
- Trend display of all operating parameters
- Zero-flow mode allows immediate discontinuation of any blood flow by RPM reduction, preventing unwanted backflow
- Unique and variable power supply concept
- Mobility due to battery operation (hot swappable) and detachable touch-screen

Further safety features are the flow sensor with integrated bubble detector, four individually applicable pressure sensors and a level sensor for use in an open ECC system. All these features qualify the deltastream® system as a versatile and safe choice for modern perfusion.

**deltastream® HC**

- Efficient cooling and warming with one device
- Safe and precise temperature control
- Dense and robust design
- Simple and intuitive handling
- Quiet and powerful operation

**deltastream® DP3 PUMP**

- High hydraulic performance results from optimized flow conduction in unique rotational pump device
- Pulsatile flow optional
- Flow range from 0 to 8 l/min
- Long run times due to high-tech ceramic bearing and magnet coupling
- Approved for medium-term use of up to 7 days
- Minimal priming volume (16 ml)
- Minimized tubing length due to flexible positioning

**deltastream® TROLLEY**

- Flexible trolley combines all components
- Maximized mobility with ergonomic and safe design
- Space-saving and compact design ideal for use in crowded areas

MADE IN GERMANY
The deltastream® technology is different from the usual technology in two distinct points: the compact design of the deltastream® pump offers an extremely flexible positioning of the pump system in addition to comprehensive control and sensor options of the system offering a high degree of safety and simple handling.

The extremely flexible positioning of the deltastream® pump and all of its components offers a minimized length of the tubing thereby reducing priming volume and foreign surface contact. However, highly simplified and minimized systems require special control and safety features: preload control prevents suction of the infl ow cannula. The zero-fl ow mode allows an immediate discontinuation of the blood flow of its components offers a minimized length of the tubing thereby reducing priming volume and foreign surface contact. However, highly simplified and minimized systems require special control and safety features: preload control prevents suction of the infl ow cannula. The zero-fl ow mode allows an immediate discontinuation of the blood flow.

Further safety features are a flow sensor with integrated bubble sensor, four independent pressure sensors and a level sensor for use with open ECC systems. These features allow the deltastream® system to comply flexibly with all of the requirements of perfusionists and cardiac surgeons in daily clinical practice.

To summarize, the deltastream® system fulfi lls all user requirements thus making ECLS therapy a more versatile and reliable tool for perfusionists and cardiac surgeons in the treatment of their critically ill patients.

CONTROL & SAFETY FEATURES:

- Preload control
- Zero-fl ow mode
- Flow & bubble sensor
- Level sensor
- 4 pressure sensors

REFERENCES


On request we would be happy to send you the complete Compendium of Evidence containing the most relevant publications. Please send an e-mail to info@medos-ag.com.