Supplementary Tables. Short *VADEMECUM* (besides conventional intra and postoperative care) for post-cardiotomy extracorporeal life support implant, management, and weaning in adult patients

Table S1. Intraoperative implant, monitoring, and management

Indication		
	Failure to wean from CPB or cardio-circulatory compromise despite moderate/high dose of inotropes and vasoconstrictors as well as IABP for **LV or BiV failure**	Consider V-A ECLS support (preferable peripheral with distal perfusion – central if severe peripheral vascular disease or aortic prosthesis graft)
	Failure to wean from CPB or cardio-circulatory compromise despite moderate/high dose of inotropes and vasoconstrictors for **isolated RV failure**	Consider OxyRVAD (if ventilatory dysfunction coexists) or RVAD configuration (right atrium through femoral vein-pulmonary artery cannulation)
Monitoring		
	Blood lactate level	ECLS should be considered and applied prior to severe metabolic acidosis (lactate level <5-6 mmol/L)
	Venous cannula position (SVC) from the femoral vein in case of peripheral ECLS and adequate negative pressure (suction) at the ECLS pump	TEE or manual check
	Assessment of LV contractility, dilatation, signs of stasis (“smoke-like”), and extent of aortic valve opening, on full ECLS support	TEE -Consider immediate less-aggressive maneuvers, including IABP, or other direct or indirect LV venting modalities if no or very poor LV contraction, distension and signs of blood stasis as well as no aortic valve opening
	Check arterial pulsatility on full ECLS support	Consider IABP or other direct or indirect LV venting modalities with no or very low pulsatility
	Limb and cerebral perfusion monitoring	Front and bilateral limb perfusion monitoring with NIRS
Bleeding control		
	Full Protamine and no Heparin administration	
	Meticulous hemostasis and hemostatic glue around central cannulation sites	
	Sternal closure	Consider cannula externalization techniques to enhance sternal closure

CPB: cardio-pulmonary bypass; V-A: veno-arterial; LV: left ventricular; BiV: biventricular; RV: right ventricular; RVAD: right ventricular assists device; ECLS: extracorporeal life support; SVC: superior vena cava; IABP: intra-aortic balloon pump; TEE: transesophageal echocardiography; NIRS: near-infrared spectroscopy

Table S2. Postoperative implant, monitoring and management

Indication		
	LV or BiV (including cardiac arrest) failure despite moderate/high dose of inotropes and vasoconstrictors as well as IABP	Consider V-A ECLS support (preferable peripheral with distal perfusion – central if severe peripheral vascular disease or aortic prosthesis graft)
	Isolated LV failure despite moderate/high dose of inotropes and vasoconstrictors	Consider alternative to ECLS system (transaortic or transatrial devices)
	Isolated RV failure despite high dose of inotropes and vasoconstrictors	Consider OxyRVAD (is ventilatory dysfunction coexists) or RVAD configuration (right atrium through femoral vein-pulmonary artery cannulation) or RV-related support devices (trans-pulmonary)
		Consider percutaneous right atrium and pulmonary artery cannulation for minimally invasive RV support
Monitoring and Management		
	Continuous assessment of arterial pulsatility extent on full ECLS support	Consider conservative approach first if feasible and sustainable (lower ECLS flow, vasodilation, higher PEEP, slightly higher dose of inotropes)
	Continuous assessment of arterial pulsatility extent on full ECLS support despite less-aggressive actions (see above)	Consider IABP if not present or other direct or indirect LV venting modalities if no or very poor LV contraction, distension and signs of blood stasis
		Do not accept a pulsatile blood pressure (or protracted aortic valve closure) for more than 3-4 hours – LV unloading strategies to be implemented
	Chest X-ray	Daily or on-demand evaluation of lung stasis
	Anticoagulation and blood-element monitoring	No anticoagulation should be considered if postoperative bleeding (>50 cc/hour) is present, for at least 24-48 hours with ECLS flow >3 to 3.5 L/min.
		Platelet, free hemoglobin, d-dimer levels must be serially monitored
		Consider heparin-induced thrombocytopenia in the presence of excessive and refractory platelet consumption
	Blood lactate levels	Adjust ECLS flow according to blood level trends.
		Serial lactate level monitoring should be carried out to evaluate the efficacy of end-organ perfusion

		If blood level trends do not improve despite high ECLS flow (check LV unloading), consider bowel ischemia and apply appropriate diagnostic assessment (CT)
	Cardiac enzyme levels	Cardiac injury extent must be closely monitored and follow cardiac recovery or persistent/new injury
	Liver function	Liver function must be closely monitor, particularly in the presence of RV failure to assess the trends of support efficacy
	Renal function	Diuresis and creatinine levels should be monitored and used to timely establish external replacement (CRRT) in case of acute dysfunction
	Fluid balance	Excessive fluid overload should be removed as soon as the hemodynamic condition and ECLS performance allow, also with CRRT in case of limited spontaneous or stimulated renal response
	Adequate negative pressure (suction) at the ECLS pump and flow must be monitored	Consider additional cannula (SVC or contra-latera femoral vein) in case of high negative pressure on venous cannula (also after position check or repositioning) and adequate filling
	Serial TEE assessment of LV contractility, dilatation, signs of stasis (“smoke-like”), extent of aortic valve opening as well as left cardiac chambers on full ECLS support	Consider IABP or other direct or indirect LV venting modalities if no or very poor LV contraction, distension and signs of blood stasis
		Consider frequent TEE monitoring in the presence of mechanical valve prosthesis
	Limb and cerebral perfusion monitoring	Front and bilateral limb perfusion monitoring with NIRS
		Serial and close monitoring of cannulated limb perfusion adequacy
		Consider distal angiography or surgical revision of the cannulated limb in case of ischemia if distal perfusion is already in place
		Consider cannulation of the contra-lateral limb (with distal perfusion) or axillary artery or ascending aorta cannulation if ischemia occurs at the cannulate limb (with distal perfusion)
	Right and left arm oximetry	Assessment of potential differential oxygenation (“Harlequin syndrome”)
		Consider Hybrid ECLS configuration (outflow cannula in SVC) in case of high differential oxygenation or upper torque desaturation

	CT	Consider brain CT in case of clinical (pupil asymmetry or no light reaction, seizures) for neurologic complication suspicion
	EEG	Consider EEG in case of clinical (pupil asymmetry or no light reaction, seizures) for neurologic complication suspicion
	Brain-related blood markers	Assessment of S-100 or enolase might be considered to monitor brain integrity
	Duration and weaning	Weaning trials should start as signs of cardiac recovery is observed
		Weaning should be gradual with at least 24 hours of observation
		Weaning should be achieved in 5-7 days, if not, consider escalation of support or treatment if suitable candidate
		Prolonged ECLS support should be expected in patients with myocarditis-like status

CPB: cardio-pulmonary bypass; V-A: veno-arterial; LV: left ventricular; BiV: biventricular; RV: right ventricular; RVAD: right ventricular assist device; ECLS: extracorporeal life support; SVC: superior vena cava; PEEP: positive end-expiratory pressure; IABP; intra-aortic balloon pump; TEE: transesophageal echocardiography; CT: computed tomography; CRRT: continuous renal replacement therapy; NIRS: near infra-red spectroscopy; EEG: electro-encephalography

Table S3. Weaning or transition from extracorporeal life support in the presence of left/biventricular or isolated right ventricular failure.

From V-A ECLS	
	Stable hemodynamic conditions for at least 24 hours
	Mean arterial pressure >60 mmHg in the absence or low vasopressors/inotropes
	Low arterial lactates (<2 mmol/L)
	PaO_2/FiO_2 >100 mmHg with ECLS FiO_2 <21% and FiO_2 40% at mechanical ventilator
	Aortic-flow velocity time integration (VTI) >10-12 cm at ECLS flow of 1-1.5 L/min
	Left ventricular ejection fraction >20-25%
	Doppler lateral mitral annulus peak systolic velocity ≥6 cm/sec
	LV and RV adequate contractile response to volume challenge
	Venous and arterial patency and lack of thrombi should be checked at after decannulation
	Use of other temporary assist device, like trans-aortic suction device, may be used to enhance ECLS weaning
	Transition to VAD if hemodynamic stabilization achieved, with expected high mortality, however, in the presence of liver dysfunction, inflammatory status, and obesity
From OxyRVAD ECLS (isolated RV support)	
	No sweep gas for at least 2 hours to the oxygenator and maintained acceptable systemic arterial O2 saturation (>90%) with normal respiratory parameters
	Stable hemodynamics with low doses of inotropes for at least 24 hours
	Weaning trial should parallel prophylactic inotropic infusion (Levosimendan)
	No signs of liver (transaminase increase) or renal (oliguria, anuria) stasis or evidence of steady and/or marked decrease
	TAPSE >10 mm with ECLS flow at 1-1.5 L/min
	Off-pump Long-axis/short-axis ratio <0.55
	Lack of thrombi at the pulmonary artery level should be checked at after decannulation

V-A: veno-arterial; ECLS: extracorporeal life support; RV: right ventricle; TAPSE: tricuspid annular plane systolic excursion; LVAD: left ventricular assists device; OxyRVAD: right ventricular assist device with oxygenator

Table S4. Type of hybrid ECLS configurations (according to ELSO nomenclature) (Broman LM, Taccone FS, Lorusso R et al. Crit Care 2019;23:36)

Type of configuration	**Cannula/catheter/device position**
Isolated ECLS – peripheral	
V_f-A_fV_j	Femoral vein – femoral artery/jugular vein
V_fV_j-A_f	Femoral vein/jugular vein – femoral artery
V_f-AsV_j	Femoral vein – subclavian artery/jugular vein
V_fV_j-As	Femoral vein/jugular vein – femoral artery
V_fV_p-A_f	Femoral vein/pulmonary artery – femoral artery
(dl)V_a-A_fV_p	Double-lumen right atrium – femoral artery/pulmonary artery
V_fV_p-As	Femoral vein/pulmonary artery (single-lumen) – femoral artery
V_f-As/V_p	Femoral vein– femoral artery/pulmonary artery (single-lumen)
(dl)Va-AsV_p	Double-lumen right atrium – femoral artery/pulmonary artery
(dl)V_aV_p-A_f	Double-lumen right atrium/pulmonary artery – femoral artery
(dl)V_aV_p-A_s	Double-lumen right atrium/pulmonary artery – subclavian artery
(dl)$\underline{V_{svc}V_{ivc}}$-$A_fV_a$	Double-lumen superior/inferior vena cava – femoral artery/right atrium
(dl)$\underline{V_{svc}V_{ivc}V_a}$-$A_f$	Double-lumen superior/inferior vena cava/right atrium – femoral artery
Isolated ECLS - central	
V_a-A_aV_j	Right atrium-ascending aorta/jugular vein
(dl)V_p-A_a	Double-lumen pulmonary artery – aorta
(dl)V_a-A_a	Double-lumen right atrium – aorta
V_aV_j-A_a	Right atrium/right jugular vein – aorta
V_aV_f-A_a	Right atrium/femoral vein – aorta
ECLS [conventional one drainage and one perfusion cannulas or hybrid (see above)] + combined catheters/devices	
Venting catheter in LV	LV apex – transaortic catheter – transmitral catheter
Venting catheter in LA	Trans-septal – superior right pulmonary vein
Venting device in PA	Transpulmonary catheter
IABP	Transfemoral
Impella	Transfemoral – transaortic – trans-subclavian suction device
TandemHeart	Transfemoral vein
PulseCath	Transaortic suction device

The "-" stands for the oxygenator position between drainage and perfusion
LV: left ventricle; LA: left atrium; PA: pulmonary artery