I would ask for Impella, I trust it

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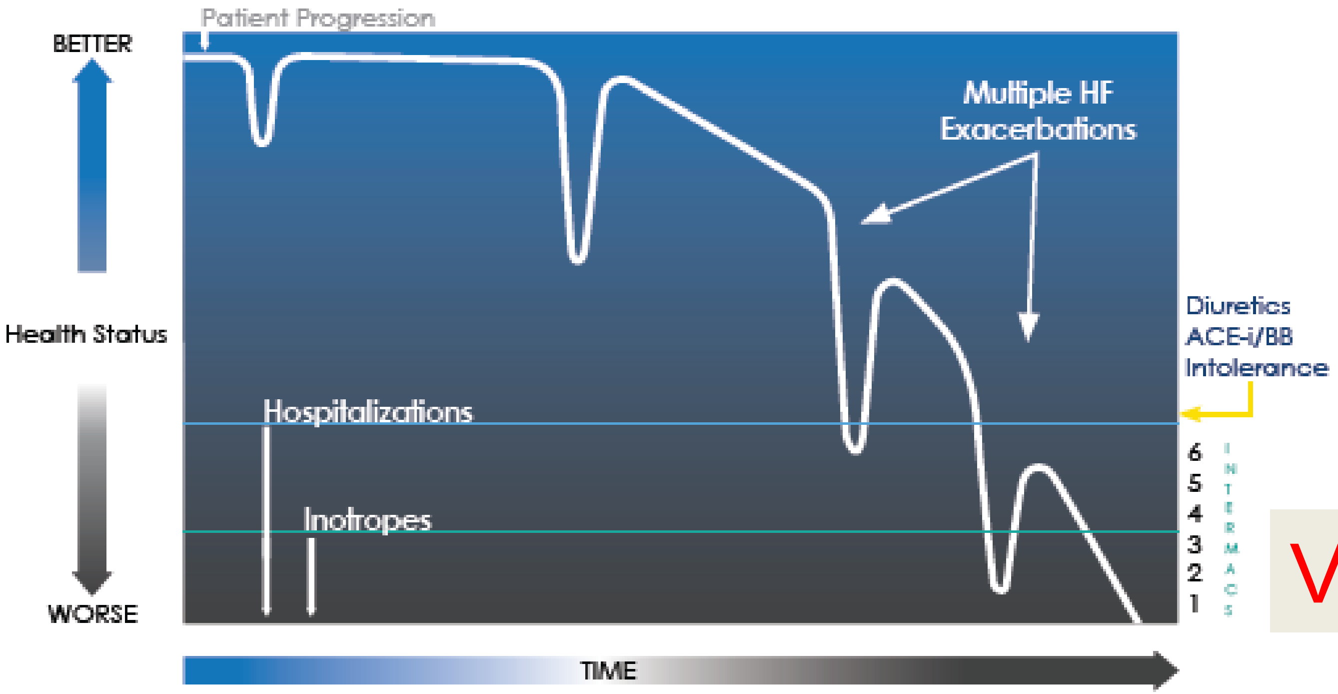
PROGRESSIVE NATURE OF HEART FAILURE



- Overall, 50% of heart failure patients do not survive beyond four years.[1]
- 40% of patients hospitalized with HF do not survive or are readmitted within one year.[1]

VAD program

[1] Dickstein K, et al. *Eur Heart J*. 2008;20:2388-2442.

Cardiogenic Shock: clinical definition

Unresponsive Hypotension
Prolonged MAP < 60 mmhg for > 30 min (or decrease in SBP more than 40 mmhg)
C I < 1,8 l/min/m2 or < 2,2 l/min/m2 with **inotropic support**

High filling pressures
CVP > 14 mmhg
Wedge pressure > 16 mmhg

Inadequate tissue perfusion
SVO2 < 55; Lactate continuously increase (or > 3)
Alteration in consciousness
Urine output < 30 cc/h

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WILEY

SCAI clinical expert consensus statement on the classification of cardiogenic shock

This document was endorsed by the American College of Cardiology (ACC), the American Heart Association (AHA), the Society of Critical Care Medicine (SCCM), and the Society of Thoracic Surgeons (STS) in April 2019

		Volume Status	
		Dry	Wet
Peripheral Perfusion	Warm	**Vasodilatory shock** (not CS) Increased cardiac index, low SVRI, low/ normal PCWP	**Mixed CS** Low cardiac index, low / normal SVRI, Elevated PCWP
	Cold	**Euvolemic CS** Low Cardiac index, high SVRI, low / normal PCWP	**Classic CS** Low cardiac index, High SVRI, Elevated PCWP

FIGURE 2 Different hemodynamic presentations of CS [Color figure can be viewed at wileyonlinelibrary.com]

Low caridac Output

Acidosis

Cardiac Arrest

TABLE 1 Descriptors of shock stages: physical exam, biochemical markers and hemodynamics

Stage	Description	Physical exam/bedside findings	Biochemical markers	Hemodynamics
A At risk	A patient who is not currently experiencing signs or symptoms of CS, but is at risk for its development. These patients may include those with large acute myocardial infarction or prior infarction acute and/or acute on chronic heart failure symptoms.	Normal JVP Lung sounds clear Warm and well perfused • Strong distal pulses • Normal mentation	Normal labs • Normal renal function • Normal lactic acid	Normotensive (SBP ≥ 100 or normal for pt.) If hemodynamics done • cardiac index ≥ 2.5 • CVP <10 • PA sat ≥65%
B Beginning CS	A patient who has clinical evidence of relative hypotension or tachycardia without hypoperfusion.	Elevated JVP Rales in lung fields Warm and well perfused • Strong distal pulses • Normal mentation	Normal lactate Minimal renal function impairment Elevated BNP	SBP <90 ***OR*** MAP <60 ***OR*** >30 mmHg drop from baseline Pulse ≥100 If hemodynamics done • cardiac index ≥ 2.2 • PA sat ≥65%
C Classic CS	A patient that manifests with hypoperfusion that requires intervention (inotrope, pressor or mechanical support, including ECMO) beyond volume resuscitation to restore perfusion. These patients typically present with relative hypotension.	***May Include Any of:*** Looks unwell Panicked Ashen, mottled, dusky Volume overload Extensive rales Killip class 3 or 4 BiPap or mechanical ventilation Cold, clammy Acute alteration in mental status Urine output <30 mL/h	***May Include Any of:*** Lactate ≥ 2 Creatinine doubling ***OR*** > 50% drop in GFR Increased LFTs Elevated BNP	***May Include Any of:*** SBP <90 ***OR*** MAP <60 ***OR*** >30 mmHg drop from baseline ***AND*** drugs/device used to maintain BP above these targets Hemodynamics • cardiac index < 2.2 • PCWP > 15 • RAP/PCWP ≥0.8 • PAPI <1.85 • cardiac power output ≤0.6
D Deteriorating/ doom	A patient that is similar to category C but are getting worse. They have failure to respond to initial interventions.	***Any of stage C***	***Any of Stage C AND:*** Deteriorating	***Any of Stage C AND:*** Requiring multiple pressors ***OR*** addition of mechanical circulatory support devices to maintain perfusion
E Extremis	A patient that is experiencing cardiac arrest with ongoing CPR and/or ECMO, being supported by multiple interventions.	Near Pulselessness Cardiac collapse Mechanical ventilation Defibrillator used	**"Trying to die"** CPR (A-modifier) pH ≤7.2 Lactate ≥ 5	No SBP without resuscitation PEA or refractory VT/VF Hypotension despite maximal support

MCS

Acidosis

Conventional therapy

IABP Inotropes

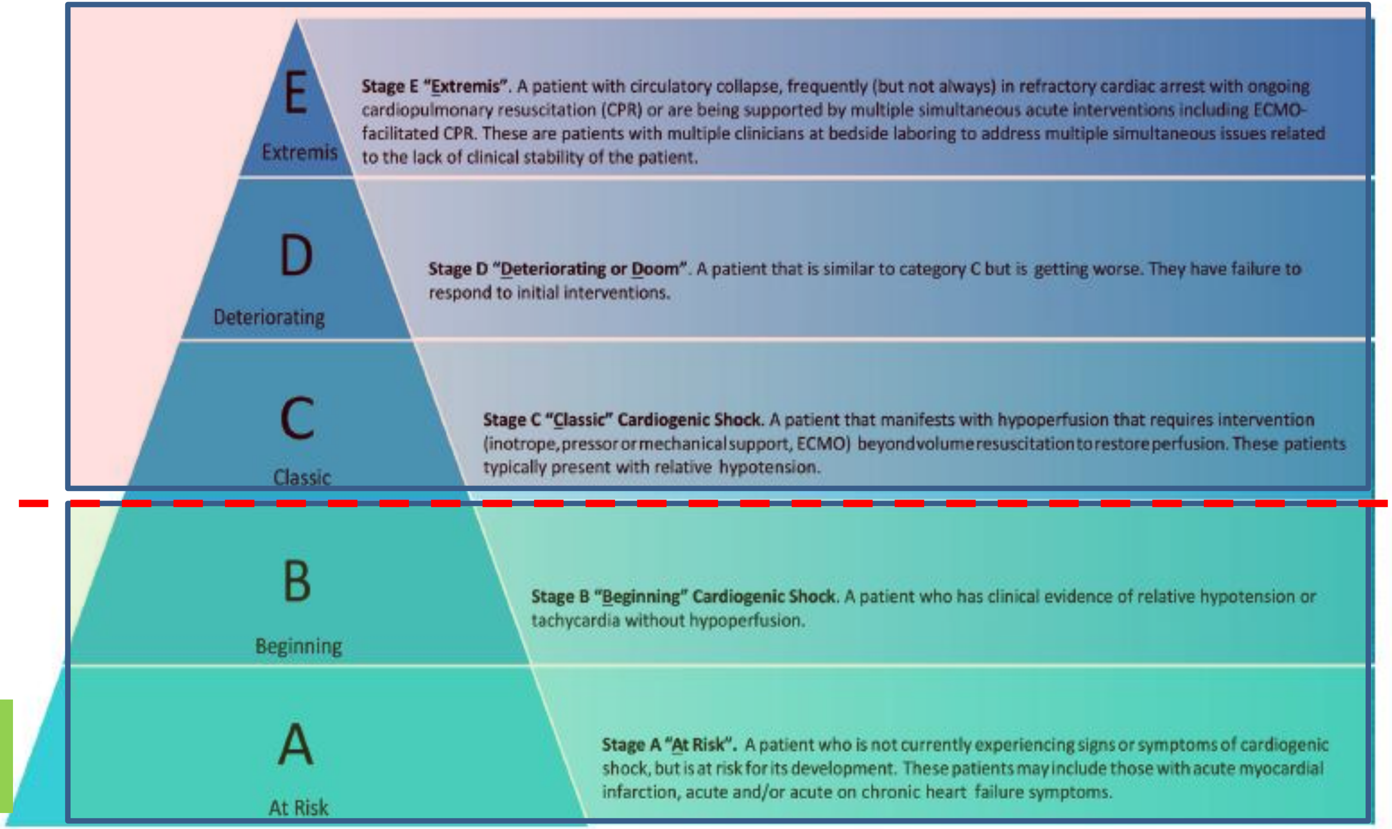


FIGURE 1 The pyramid of CS classification [Color figure can be viewed at wileyonlinelibrary.com]

AMI and Cardiogenic Shock

Early Assistence or Early Reperfusion?

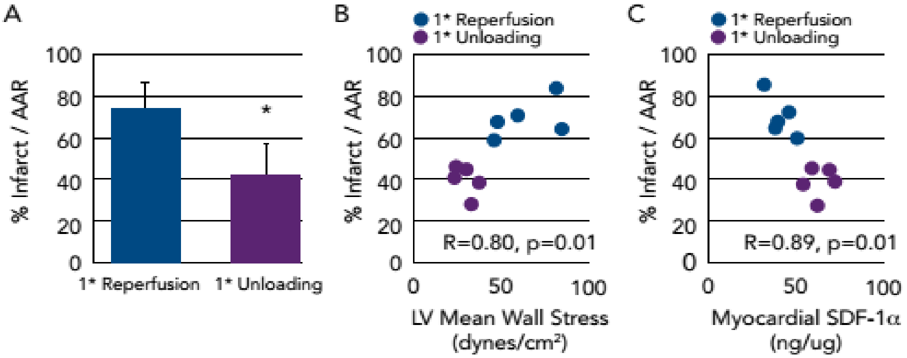
Primary Left Ventricular Unloading

JACC

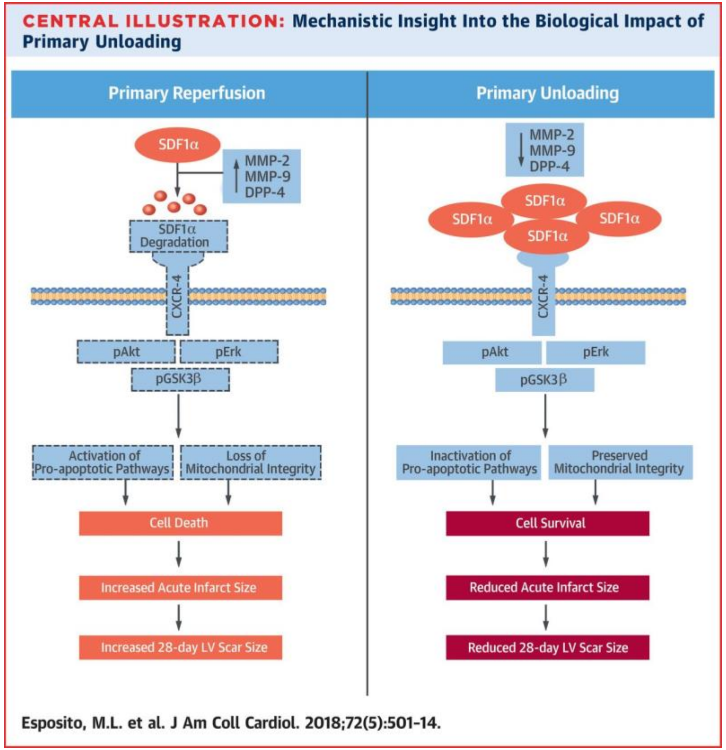
Left Ventricular Unloading Before Reperfusion Promotes Functional Recovery After Acute Myocardial Infarction

Michele L. Esposito, Yali Zhang, Xiaoying Qiao et al.

Figure 2: Effect of Mechanical Circulatory Support Before Reperfusion in Acute Myocardial Infarction



Source: Kapur et al, 2015.[9] AAR = assessment of the area at risk; LV = left ventricular; SDF-1 = stromal cell-derived factor 1



Unloading of the Left Ventricle

Immediate Mechanical Effects (minutes...)

Less myocardial oxygen demand

More myocardial Oxygen supply (subendocardial reperfusion)

Long-term Byochimical Effects (hours-days…)

Inactivation of pro-apoptotic pathways

Preserve mytocondrial integrity

Reduce AMI area and size

AMI and Cardiogenic Shock

Early Assistence or Early Reperfusion?

Early Assistance and Reperfusion!

Currently available percutaneous MCS

	iVAC 2L®	TandemHeart™	Impella®5.0	Impella® 2.5	Impella® CP	ECLS (multiple systems)
Catheter size (F)	11 (expandable)	–	9	9	9	
Cannula size (F)	17	21 venous 12–19 arterial	21	12		17–21 venous 16–19 arterial
Flow (L/min)	Max 2.8	Max. 4.0	Max. 5.0	Max. 2.5	3.7–4.0	Max. 7.0
Pump speed (rpm)	Pulsatile, 40 mL/ beat	Max. 7500	Max. 33 000	Max. 51 000	Max. 51 000	Max. 5000
Insertion/placement	Percutaneous (femoral artery)	Percutaneous (femoral artery + vein for left atrium)	Peripheral surgical (femoral artery)	Percutaneous (femoral artery)	Percutaneous (femoral artery)	Percutaneous (femoral artery + vein)
LV unloading	+	++	++	+	+	–
Anticoagulation	+	+	+	+	+	+
Recommended duration of use	–21 days	–14 days	10 days	10 days	10 days	–7 days
CE-certification	+	+	+	+	+	+
FDA	–	+	+	+	+	+
Relative costs	++	+++++	++++	+++	++++	+(+)

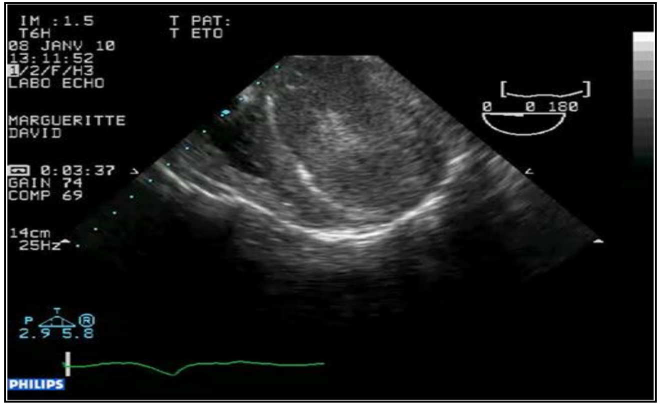
Reproduced from Ref. [57] with permission

Impella®
World's Smallest Heart Pump

HCS-AV00557rC

	VA ECMO	Impella
Advantages	Low cost Biventricular support Oxigenator Feasible implantation on CPR No Cath Lab	Less invasive LV unloading Subendocardial reperfusion Small catethers Easy to implant
Disadvantages	LV overload Subendocardial malperfusion Risk of Bleeding Limb perfusion Cardiac surgeon?	Harlequin syndrome Limb malperfusion Partial support ? Hemolysis Cath Lab High costs

Rationale for UNLOAD the LV on VA ECMO

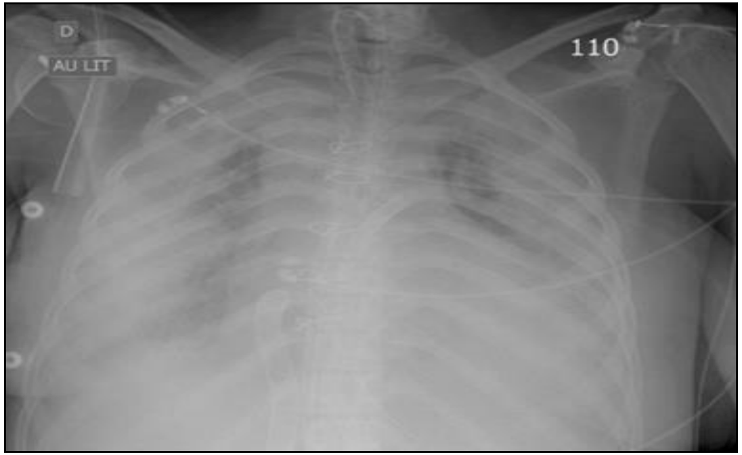


LV overload

Pulmonary edema

Harlequin syndrome

MOF



2015 SCAI/ACC/HFSA/STS Clinical Expert Consensus Statement on the Use of Percutaneous Mechanical Circulatory Support Devices in Cardiovascular Care (Endorsed by the American Heart Association, the Cardiological Society of India, and Sociedad Latino Americana de Cardiologia Intervencion; Affirmation of Value by the Canadian Association of Interventional Cardiology—Association Canadienne de Cardiologie d'intervention)*

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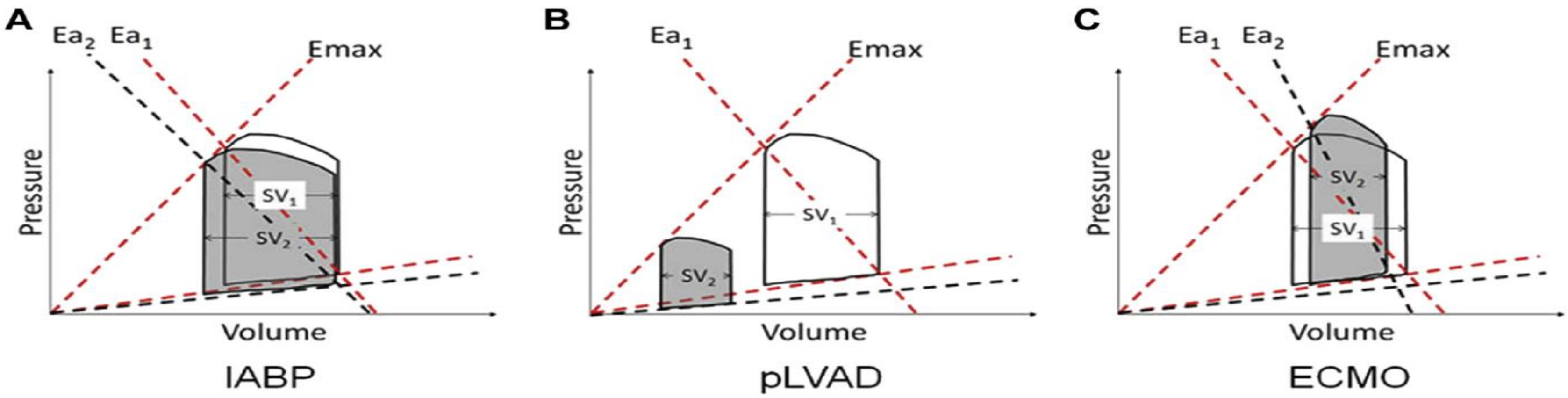
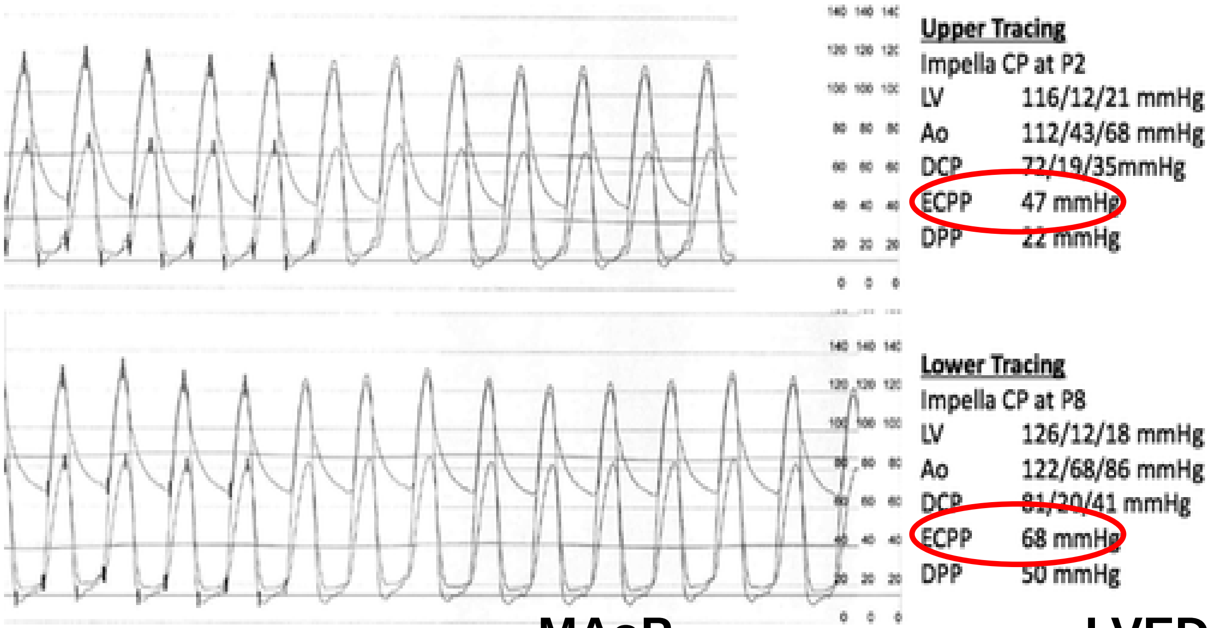
Left ventricular overload on ECMO



Unloading and Coronary perfusion



ECPP (Effective Coronary Perfusion Pressure) = **MAoP** (Mean Ao Pressure) **-** **LVEDP** (LV end-diastolic pressure)

Mohammad Alqarqaz. **Circulation**:
Cardiovascular Interventions. Effects of Impella on Coronary Perfusion in Patients With Critical Coronary Artery Stenosis

Turin Experience 2011- 2019

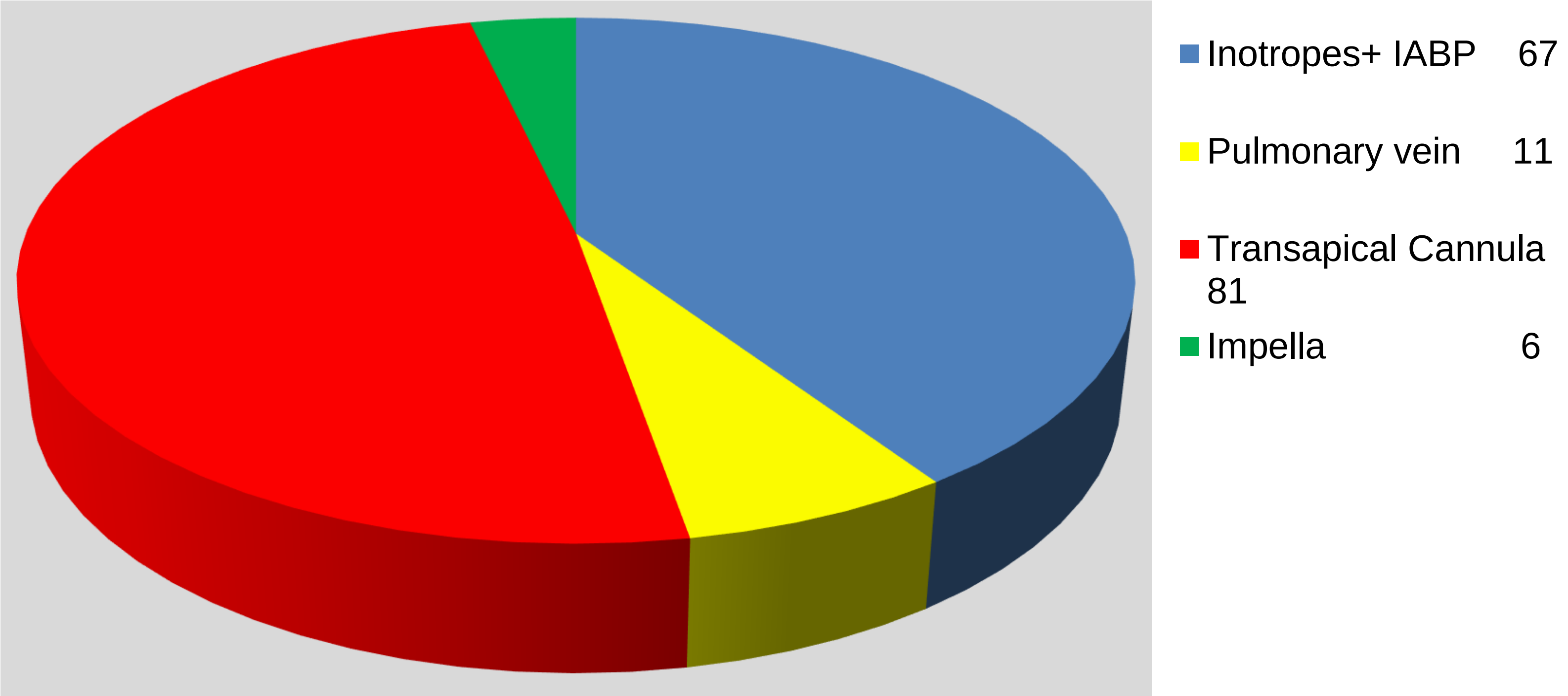
VA ECMO number of implants = 171

Intermacs 1 level

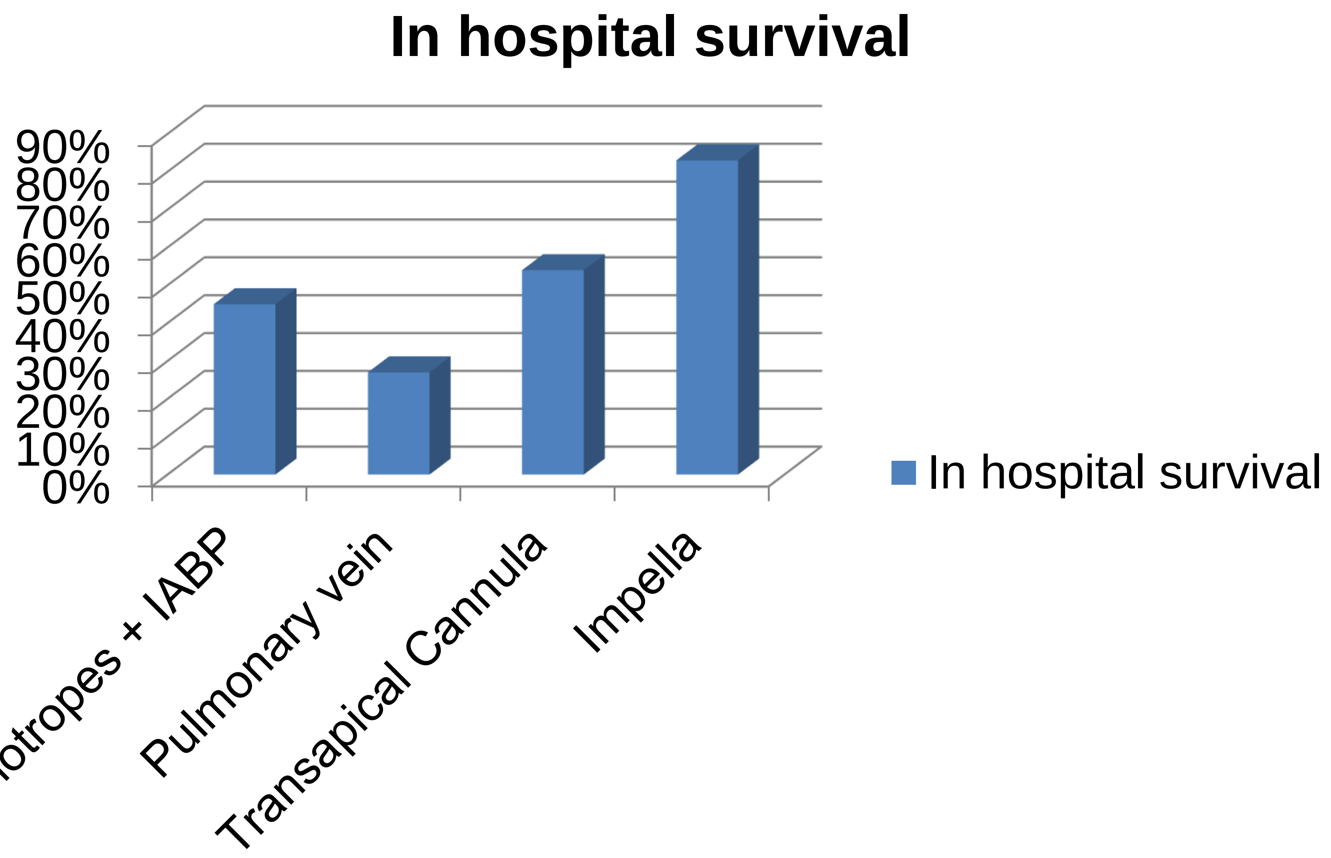
Mean age of 50,4 years

20% previous cardiac arrest

Unloading Strategy



Turin Experience 2011- 2019



Turin experience 2011-2019
VA ECMO+ LV vent N= 81 patients

	Mean time of recovery	In hospital mortality rate	
Fulminant myocarditis	3,9 days	0/12	0%
Acute Myocardial Infarction	5,7 days	13/32	40%
Hydiopathic CMP	6,5 days	7/14	50%
Post HTX	8,4 days	4/6	66%
Postcardiotomy	10,1 days	13/17	76%

UNIVERSITÀ DEGLI STUDI DI TORINO
CITTA' DELLA SALUTE E DELLA SCIENZA DI TORINO

Veno Arterial (VA) ECMO in Fulminant Myocarditis:

which is the best strategy to unload the Left Ventricle?

M. Attisani MD, D. Brenna MD, G. Maraschioni MD, M. Rinaldi MD PhD
Division of Cardiac Surgery - Città della Salute e della Scienza - Molinette, Turin, Italy

CLINICAL CASE

44 years old patient presenting with life - threatening cardiogenic shock and strong suspect of fulminant myocarditis:

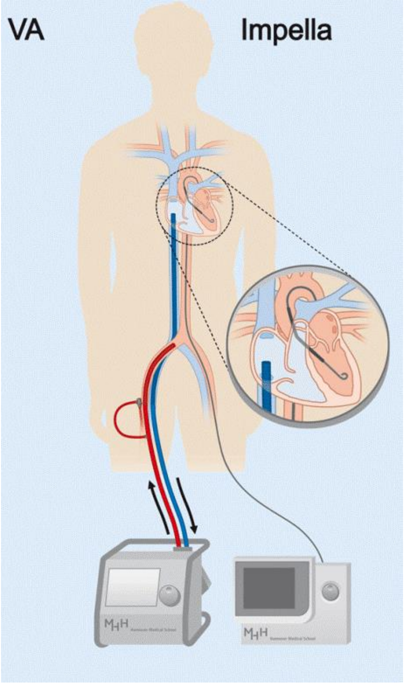
- EF 10%
- Elevated cardiac enzymes (Tn-I 2856 ng/L)
- Very thick oedematous cardiac walls (IVS 20 mm)
- Undamage coronary arteries

In these cases **LV venting by transapical cannulation (TLVV)** can be less effective, burdened by increased risks of **hemolysis**, **bleeding** and **suction events**. We decide to position **Impella® CP.**

CLINICAL CASE

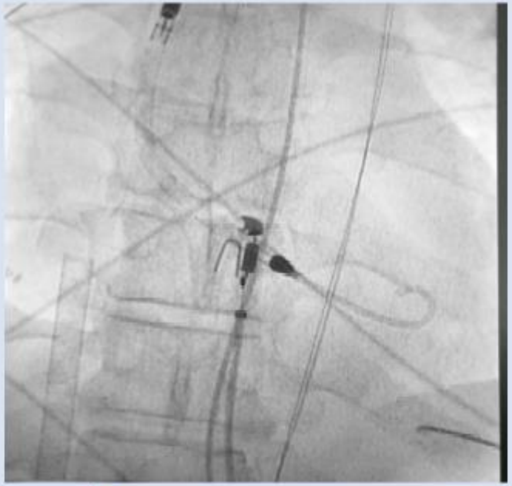
We combine extracorporeal life support (ECLS) with veno-arterial extracorporeal membrane oxygenation (VA-ECMO) with endovascular unloading systems, like Impella®

ECMO+ Impella
“**ECPELLA Approach**”



ECPELLA in Fulminant Myocarditis

ETT showing left and right ventricles



ECMO cannula and IMPELLA® cannula

Cardiac wall necrosis

RESULTS

Weaning from ECMO in 5 days

Weaning from Impella 10 days

- Complete recovery of right ventricle function
- Complete recovery of the lung
- LV EF 35%
- No clinic or laboratory signs of low cardiac output

Cardiac wall necrosis

Death for sepsis 1month after hospitalization
Post-mortem tissue examination was compatible with **healed Giant-Cell myocarditis.**

Impella RVAD Indications

Post Heart Transplant PGD

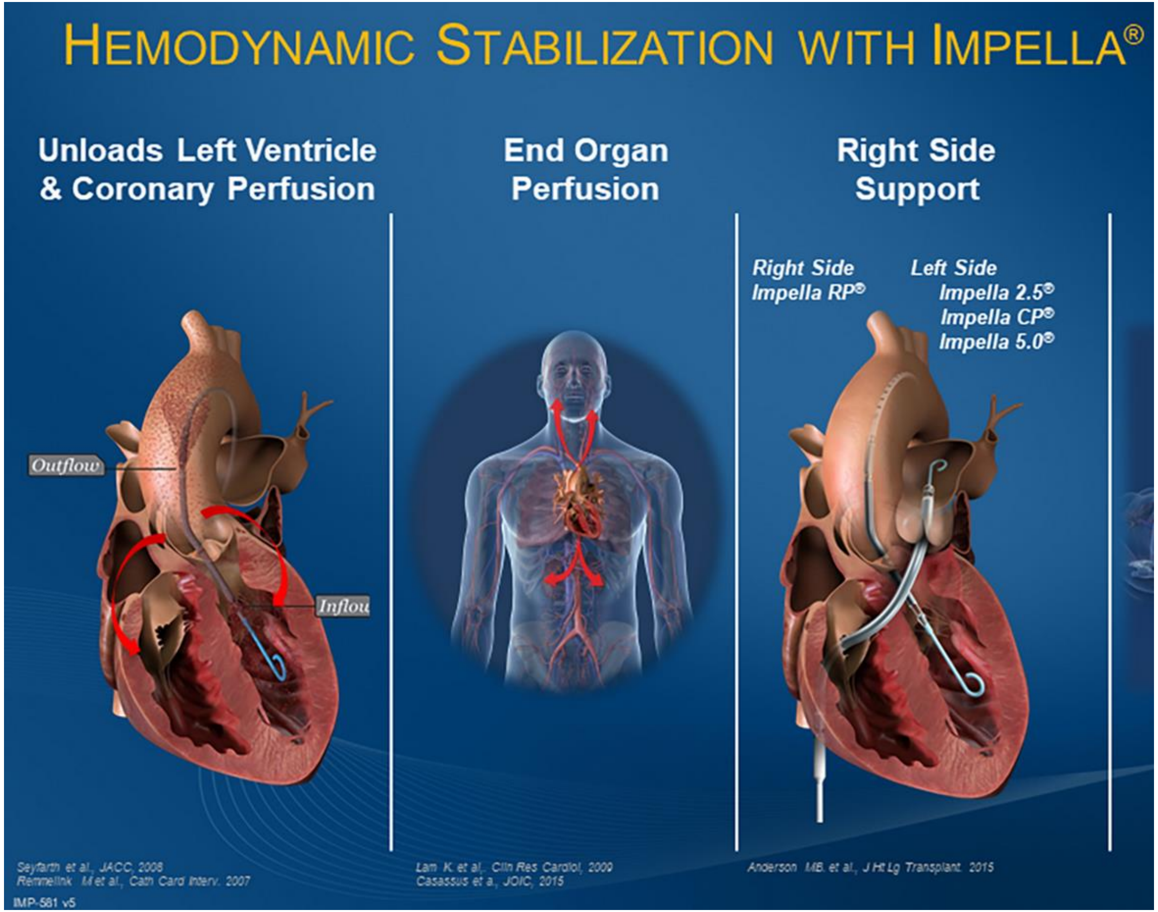
Post LVAD

Post cardiotomy

RV Acute Myocardial Infarction

Pulmonary Thromboembolism

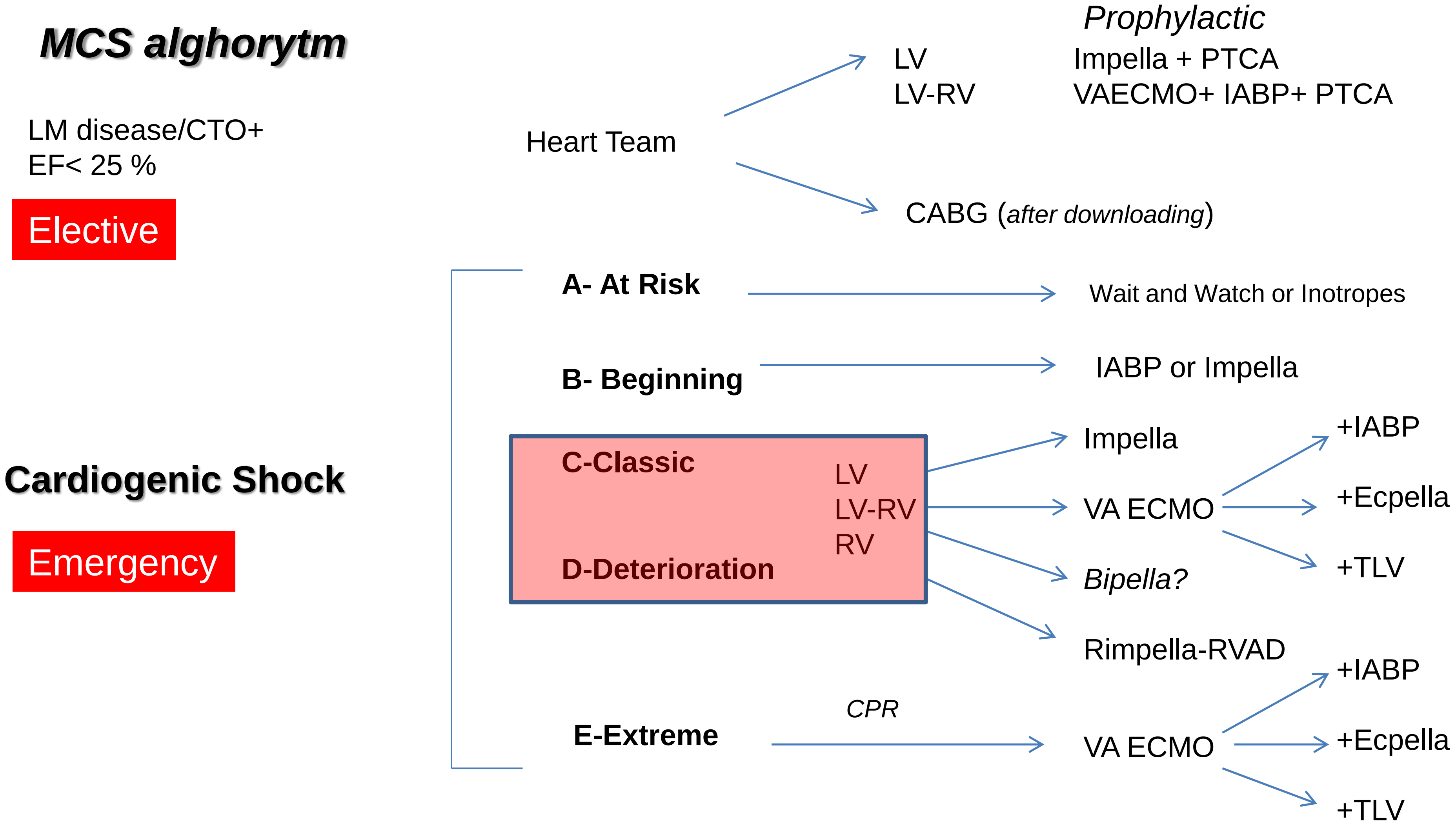
Bipella (BiVAD) Concept



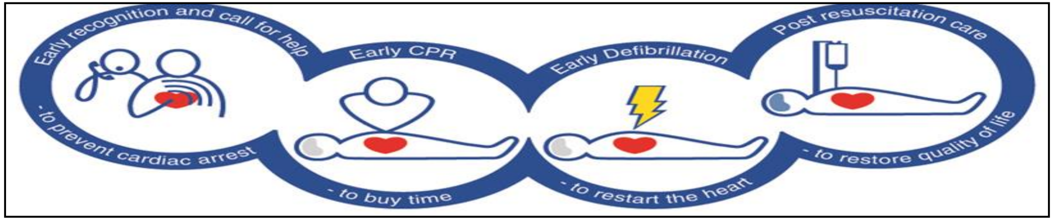
Take home message

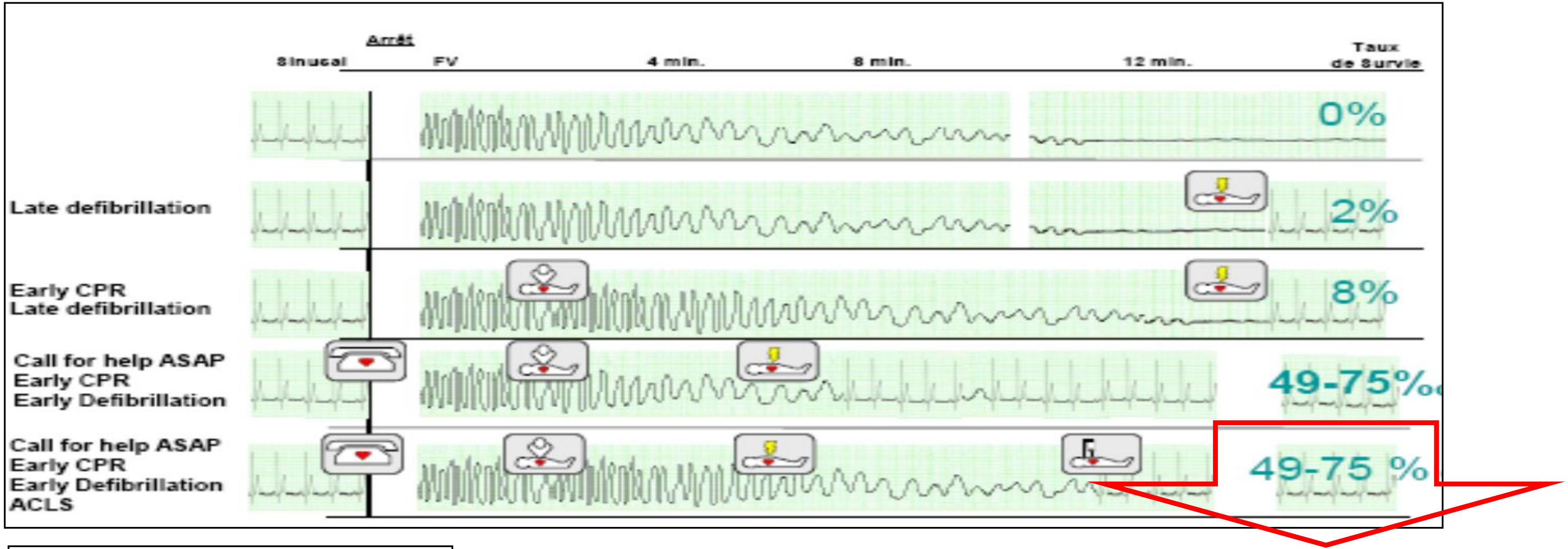
IABP or Impella or VA ECMO ?

MCS alghorytm



Survival Chain





L.Becker, A.H.A. datas

V-A ECMO