Lo shock cardiogeno: una sfida continua

Il supporto meccanico nell'insufficienza ventricolare destra

Serafina Valente
AOUS

Circulation

AHA SCIENTIFIC STATEMENT

Evaluation and Management of Right-Sided Heart Failure

A Scientific Statement From the American Heart Association

Endorsed by the Heart Failure Society of America and International Society for Heart and Lung Transplantation

	Decreased RV Contractility	RV Volume Overload	RV Pressure Overload
Acute	Sepsis		Acidosis
	LVAD support		Hypoxia
	RVMI	Excessive transfusion	PE
	Myocarditis		ARDS
	Perioperative injury/ischemia (postcardiotomy)		Positive pressure ventilation
Chronic	RV cardiomyopathy	LH disease	
	ARVC	Single ventricle	
	Ebstein anomaly		Pericardial disease
		PR	PAH
		TGA	Chronic thromboembolic PH
		TR	PS
			Left-sided valvular heart disease
			Restrictive cardiomyopathy

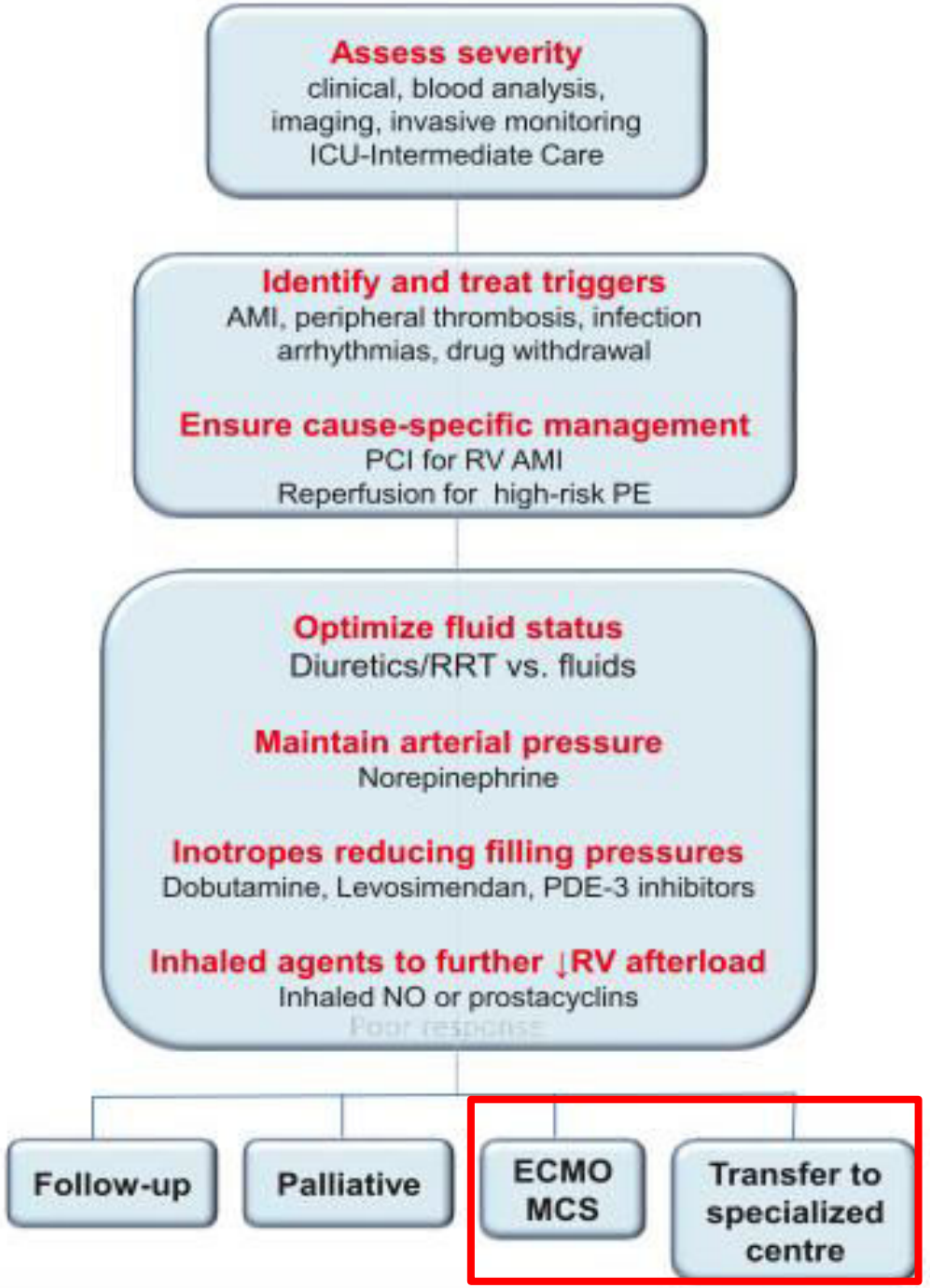
Circulation. 2018;137:e578–e622.

ESC European Society of Cardiology
European Heart Journal: Acute Cardiovascular Care (2022) 11, 173–185
https://doi.org/10.1093/ehjacc/zuab122
EDUCATIONAL PAPER

Acute Heart Failure in the 2021 ESC Heart Failure Guidelines: a scientific statement from the Association for Acute CardioVascular Care (ACVC) of the European Society of Cardiology

Josep Masip[1]*, W. Frank Peacok[2], Mattia Arrigo[3,4], Xavier Rossello[5,6], Elke Platz[7], Louise Cullen[8], Alexandre Mebazaa[9], Susanna Price [10], Héctor Bueno[11,12,13,14], Salvatore Di Somma[15], Mucio Tavares[16], Martin R. Cowie[17], Alan Maisel[18], Christian Mueller[19], and Òsar Miró[20]; on behalf of the Acute Heart Failure Study Group of the Association for Acute Cardiovascular Care (ACVC) of the European Society of Cardiology

General approach to patients with isolated right ventricular failure based on steps



Hemodynamic and Echocardiographic Data that may be Supportive of RV Failure

Cardiac index <2.2 L/min/m^2 despite continuous high dose inotropes or >1 inotrope or vasopressor medication + any of the following criteria:	
Severe RV dysfunction	CVP >15 mm Hg
	CVP/PCWP ratio >0.8
	PAPi <1.5
	RVSWI <300 mm Hg*mL/m^2
Clinical	Ascites
	Edema
	Bilirubin elevation
	Creatinine elevation

Journal of Cardiac Failure Vol. 29 No. 3 2023

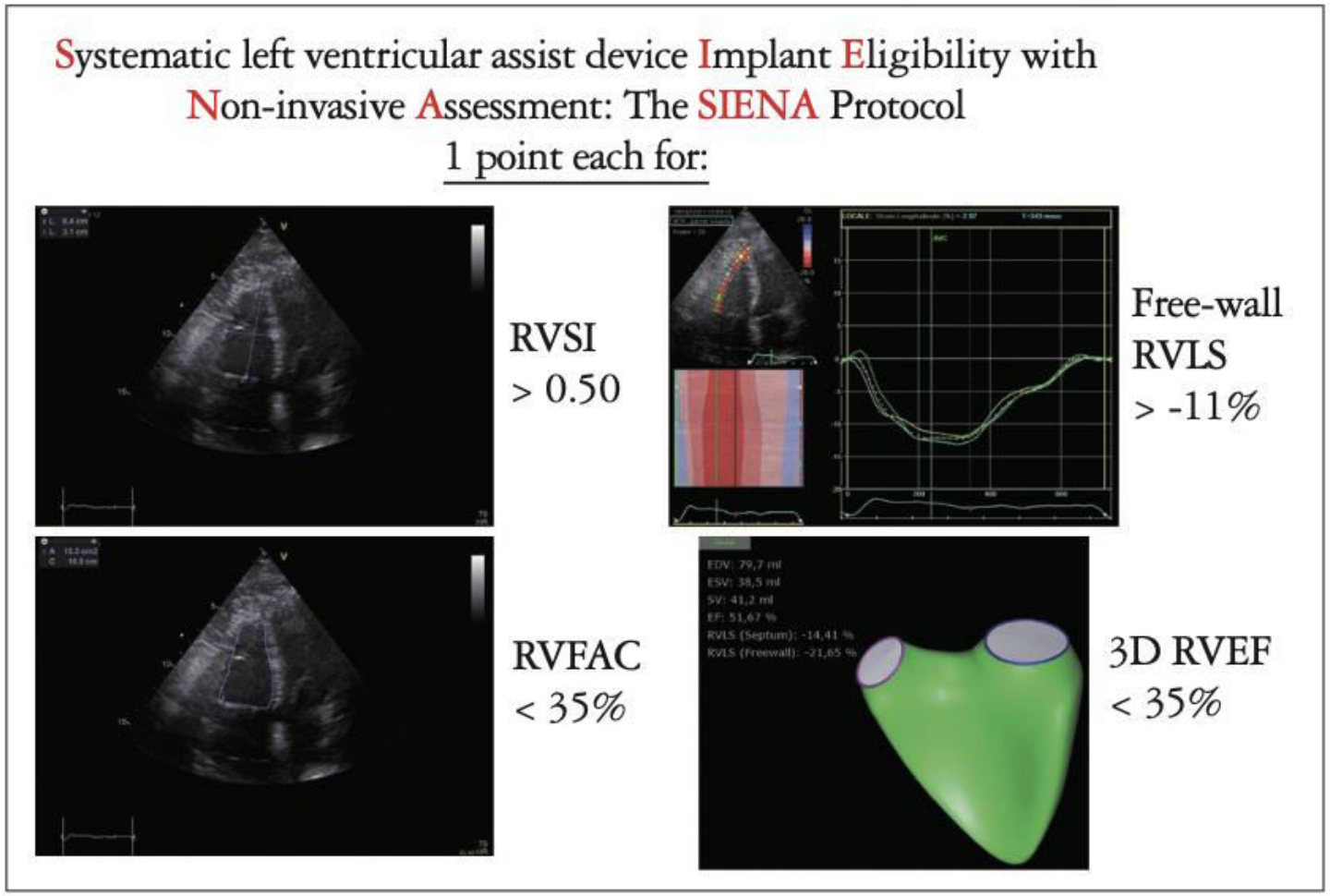
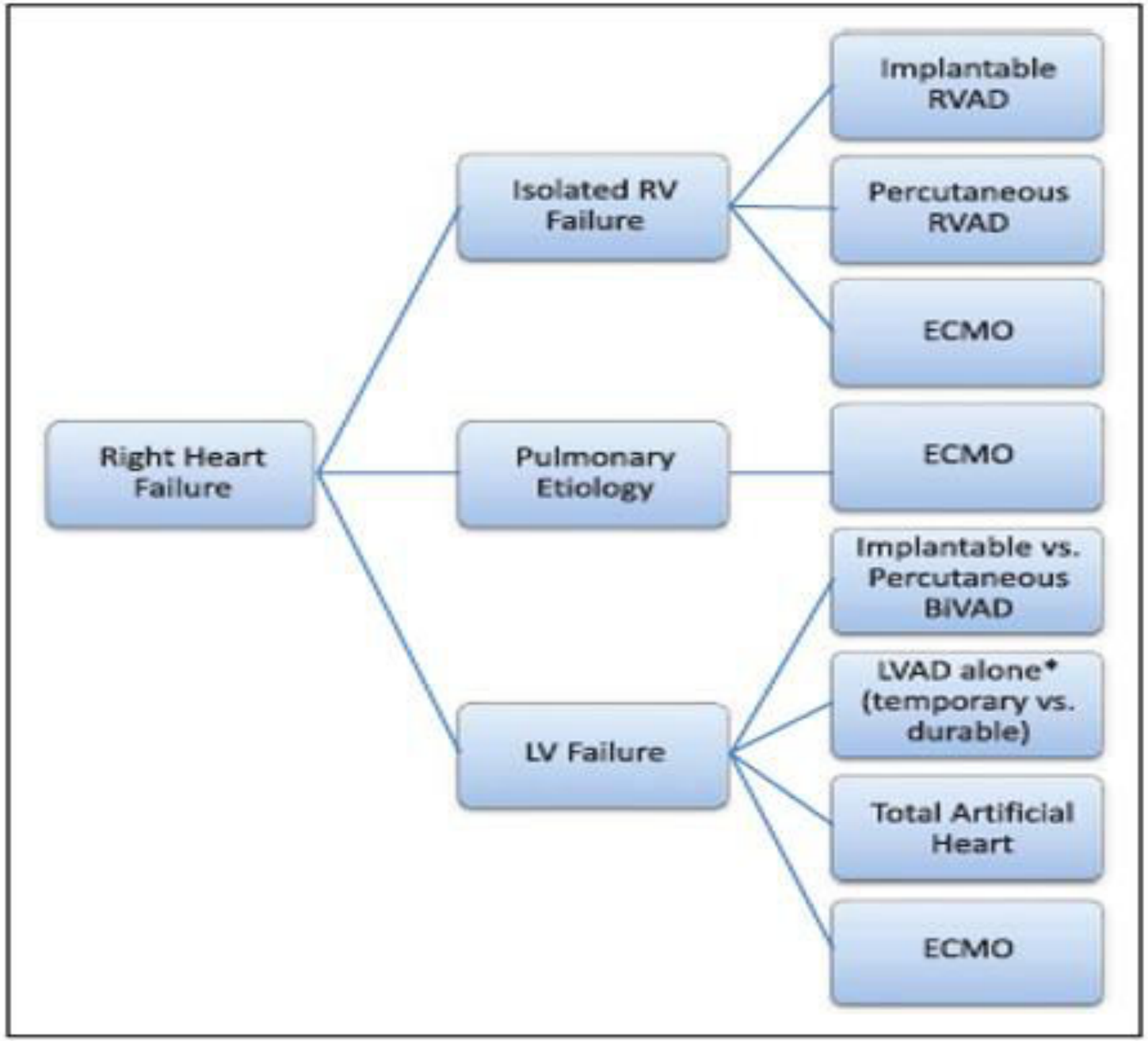


Fig. 5. A visual summary of the echocardiographic parameters included in the SIENA protocol. RVSI: right ventricular sphericity index, RVFAC: right ventricular fractional area change, RVLS: right ventricular longitudinal strain, RVEF: right ventricular ejection fraction.

Left Ventricular Assist Device Implant Eligibility with Non-Invasive Assessment: The SIENA Protocol. Cameli et al



Konstam et al Evaluation and Management of Right-Sided Heart Failure. Circulation. 2018;137

Journal of Cardiac Failure Vol. 29 No. 3 2023

The International Society for Heart and Lung Transplantation/Heart Failure Society of America Guideline on Acute Mechanical Circulatory Support

Recommendations for Right-sided Devices

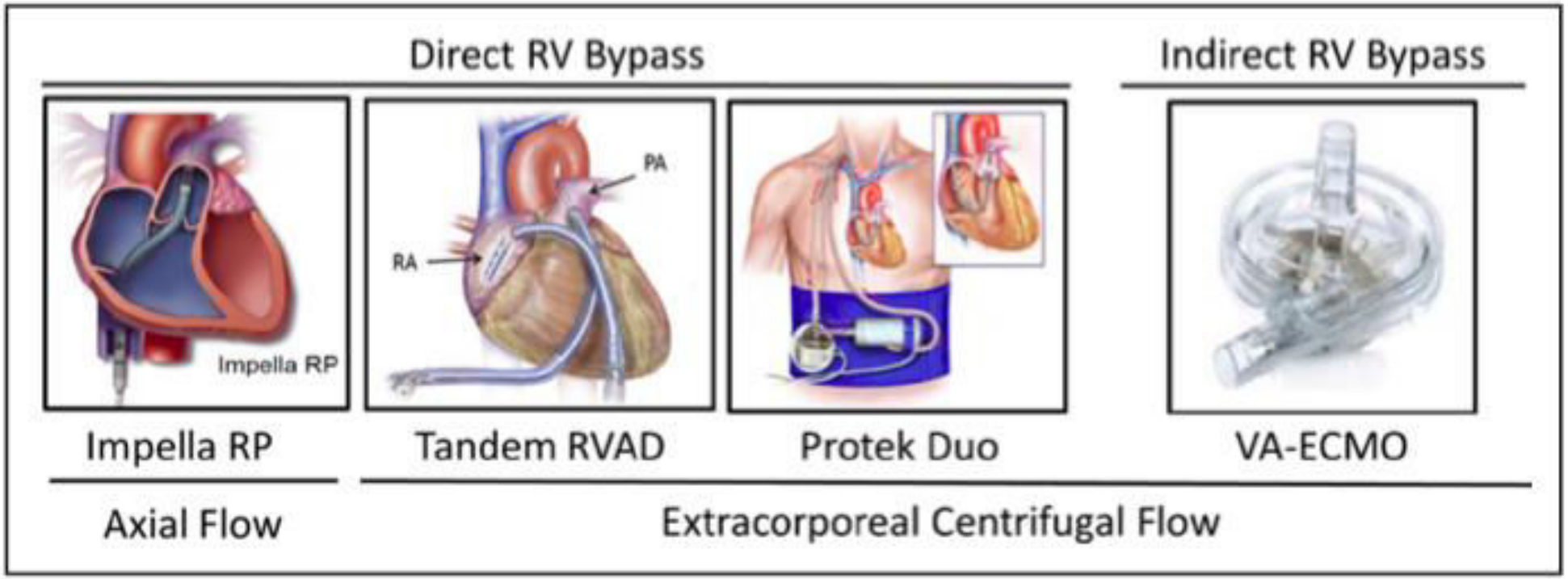
Recommendation	Class	Level
ProtekDuo or Impella RP can be considered for acute RV failure.	II	B
Use of imaging to ensure precise positioning and to prevent outflow graft kinking, twisting and obstruction is recommended.	I	C

Commercially Available Right Ventricular Assist Devices

Device	Mechanism/Configuration	Advantages	Disadvantages	Optimal Use
ProtekDuo RVAD (LivaNova)	• Centrifugal flow, extracorporeal • Percutaneously implanted (coaxial dual-lumen cannula) • RA/RV to PA blood flow	• Percutaneously deployed • Single access site • Blood flow up to 4–5 l/min	• May cause SVC syndrome with larger cannula size	RV failure following durable LVAD implantation
Impella RP (Abiomed)	• Microaxial-flow • Percutaneously implanted • RA/IVC to PA blood flow	• Percutaneously deployed • Single access site • Blood flow up to 4-5 l/min	• Obligate femoral venous access • Risk of thrombosis at lower levels of anticoagulation	RV infarct or RV failure following durable LVAD implantation
Surgical CentriMag RVAD (Abbott)	• Centrifugal flow, extracorporeal • Surgically implanted • RA/IVC/SVC/RV to PA blood flow	• Blood flow up to 7 l/min • Lower rate of red blood cell destruction	• Surgical implantation	In combination with Centrimag LVAD use
Veno-arterial ECMO	• Centrifugal flow, extra-corporeal • Percutaneously or surgically implanted • RA/IVC/SVC to aorta blood flow	• Percutaneous deployment possible • Emergent/bedside deployment • Blood flow up to 3–5 l/min	• Increases LV afterload • Systemic arterial embolic events • Risk of limb ischaemia	Massive pulmonary embolus or decompensated pulmonary hypertension
HeartMate 3 (Abbott)	• Centrifugal flow • Surgically implanted • RA/RV to PA blood flow	• Fully implantable device (i.e. dischargeable) • Blood flow up to 4–6 l/min	• Surgical implantation	In combination with durable LVAD implantation for dischargeable patient

Cardiac Failure Review 2022;8:e14.

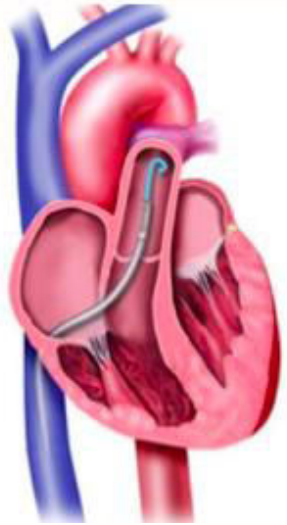
Mechanical Circulatory Support Devices for Acute Right Ventricular Failure



Circulation. 2017;136:314–326. Navin K. Kapur

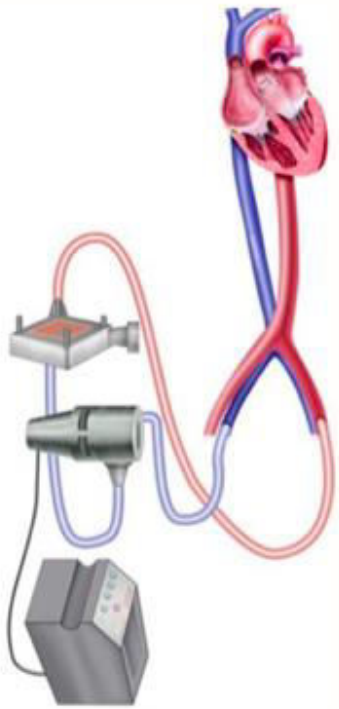
Direct RV bypass – Impella RP

- Axial flowpump
- 22-Fr via femoral vein
- Right atrium-> Pulmonary artery
- Up to 4,5 L/min



Indirect RV bypass – ECMO

- Centrifugal pump
- 17-21 Fr + 21-25 Fr arterial and venous
- Right atrium-> Aorta
- Up to 7,0 L/min
- Oxygenation



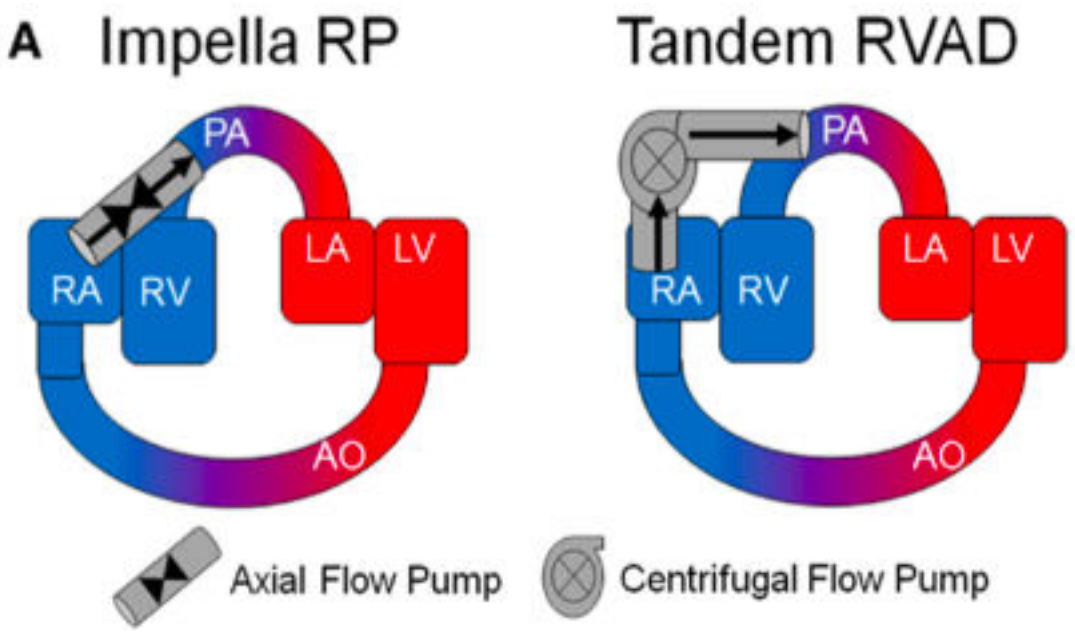
Mandawat A, et al. Circ Cardiovasc Interv. 2017;10(5):e004337.

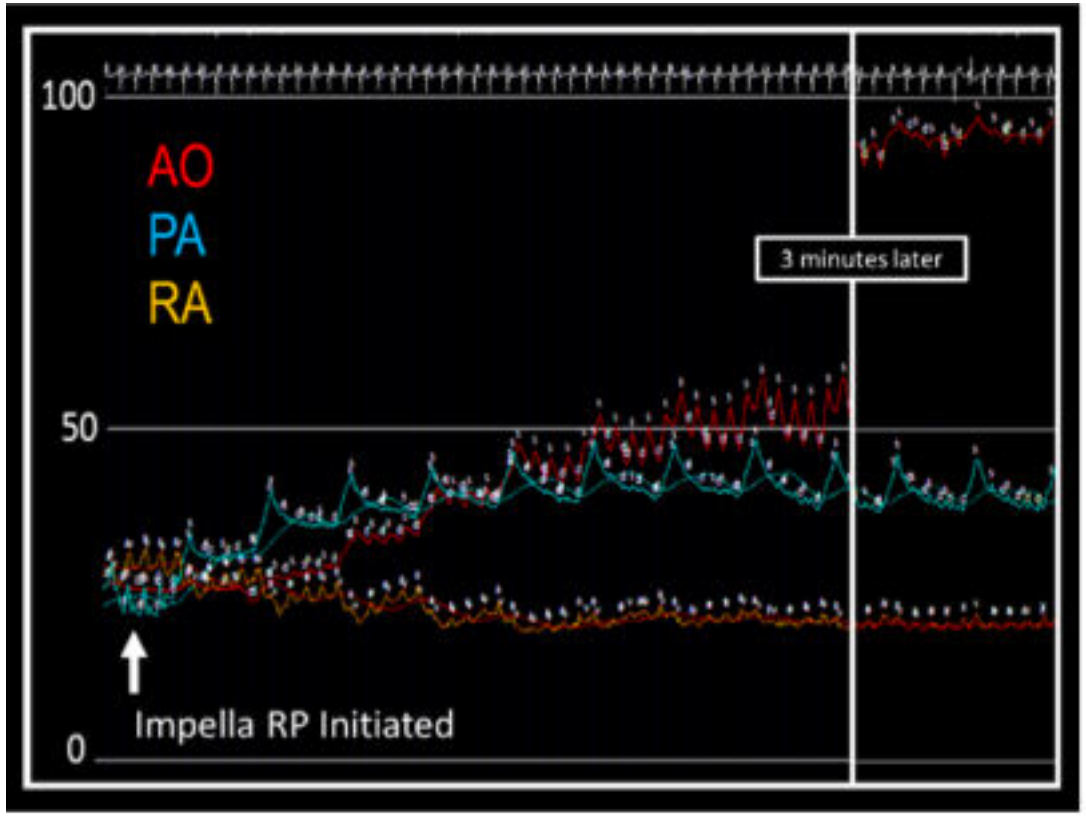
Table 2. Hemodynamic Effects of Acute Right Ventricular Mechanical Circulatory Support Systems for Isolated Right Ventricular Failure or Biventricular Failure

RV-AMCS Device	Device Characteristics			Hemodynamic Effects				
	Inflow	Outflow	Flow Range, L/min	RAP, mm Hg	Mean PAP, mm Hg	PCWP or LVEDP, mm Hg	LV Afterload (MAP)	Native CO
Isolated RV failure								
Impella RP	RA	PA	2–4	↓	↑	↑	Δ	↑
TH-RVAD or Protek	RA	PA	2–4	↓	↑	↑	Δ	↑
VA-ECMO	RA	FA	2–6	↓	Δ↓	↓	↑↑	Δ↓
Biventricular failure								
Impella RP	RA	PA	2–4	↓	↑	↑↑	↑	Δ↑
TH-RVAD or Protek	RA	PA	2–4	↓	↑	↑↑	↑	Δ↑
VA-ECMO	RA	FA	2–6	↓	↑	↑↑	↑↑	Δ↓
Biventricular support devices (ie, Impella CP+RP)	RA	PA	2–4	↓	↑	Δ↓	Δ↑	↓↓
	LV	AO						

Circulation. 2017;136:314–326. Navin K. Kapur

Direct right ventricular bypass systems





Hemodynamic tracings from a patient with RV failure and cardiogenic shock immediately after activation of an Impella RP showing increased aortic (Ao), decreased RA, and increased PA pressures.

Circulation. 2017;136:314–326

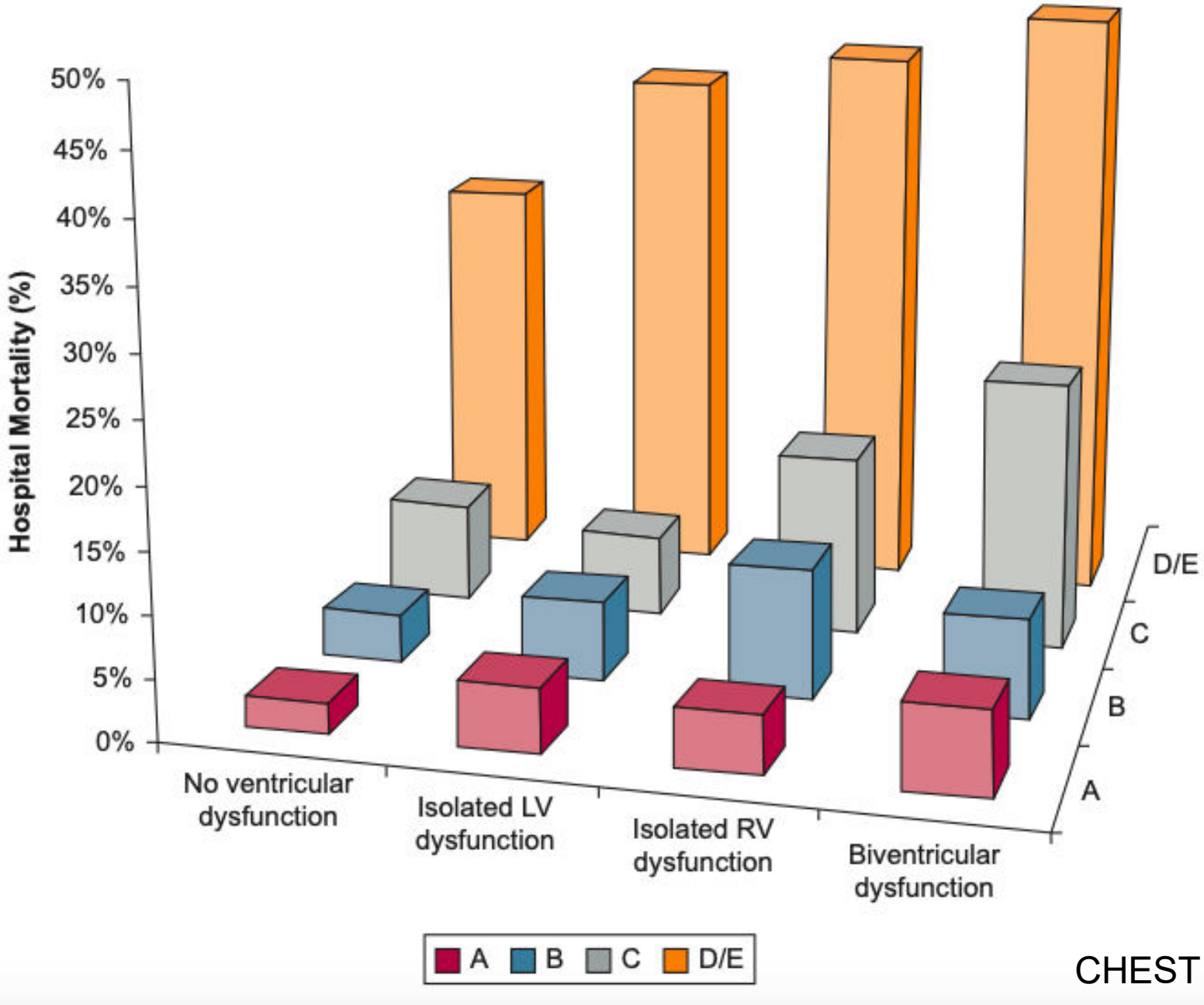
CHEST

Biventricular Function and Shock Severity Predict Mortality in Cardiac ICU Patients

Barry Burstein, MD; Sean van Diepen, MD; Brandon M. Wiley, MD; Nandan S. Anavekar, MBBCh; and Jacob C. Jentzer, MD

RESULTS: The study population included 3,158 patients with a mean ± SD age of 68.2 ± 14.6 years, of which 51.8% had acute coronary syndromes. LVSD was present in 22.3%, RVSD in 11.8%, and BVD in 16.4%. After adjustment for SCAI shock stage, no difference in in-hospital mortality was found between patients with LVSD or RVSD and those without ventricular dysfunction ($P > .05$), but BVD was associated independently with higher in-hospital mortality (adjusted hazard ratio, 1.815; 95% CI, 1.237-2.663; $P = .0023$). The addition of ventricular dysfunction to the SCAI staging criteria increased discrimination for hospital mortality (area under the receiver operating characteristic curve, 0.784 vs 0.766; $P < .001$).

CHEST 2022; 161(3):697-709



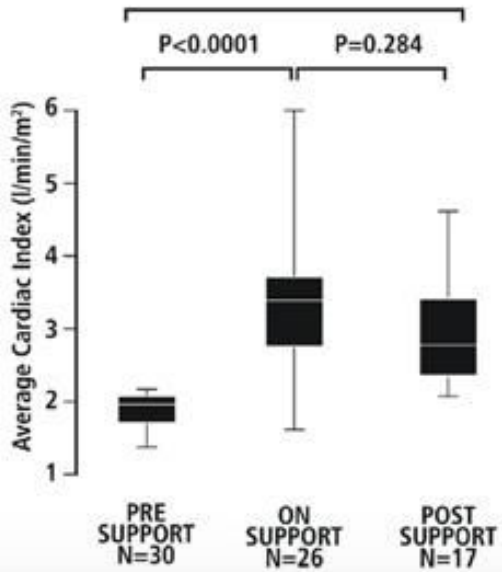
CHEST 2022; 161(3):697-70

Benefits of a novel percutaneous ventricular assist device for right heart failure: The prospective RECOVER RIGHT study of the Impella RP device

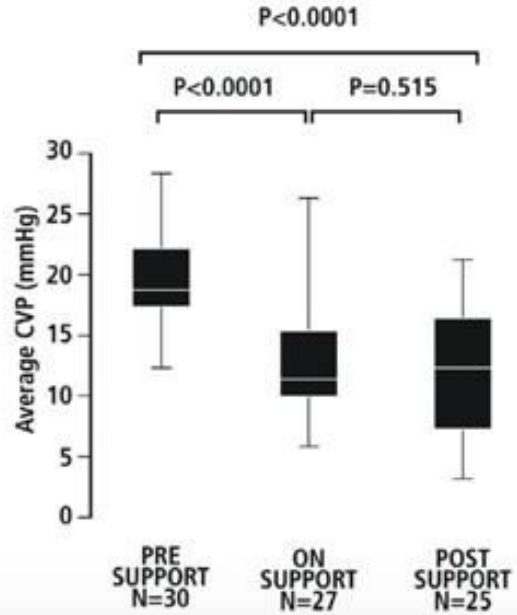
Cohort A
N=18
18 RVF post-LVAD implantation

Cohort B
N=12
5 RVF post AMI-CS
2 RVF post cardiotomy
5 RVF post transplant

CARDIAC INDEX



CENTRAL VENOUS PRESSURE



73%
Survival 30 days

Journal of Personalized Medicine

MDPI

Article

Impella RP for Patients with Acute Right Ventricular Failure and Cardiogenic Shock: A Subanalysis from the IMP-IT Registry

Giulia Botti [1,2], Mario Gramegna [3], Francesco Burzotta [4], Giulia Masiero [5], Carlo Briguori [6], Carlo Trani [4], Massimo Napodano [5], Anna Mara Scandroglio [3], Matteo Montorfano [2], Giuseppe Tarantini [5] and Alaide Chieffo [2,*,†] on behalf of IMP IT Investigators

In 40% of the patients, the main cause was ST-segment elevation myocardial infarction.

Other Concomitant pVAD	Patients (n = 15)
Isolated Impella RP	9 (60.0)
Impella RP + left-side Impella (BiPELLA)	6 (40.0)
Impella 2.5	2 (13.3)
Impella CP	4 (26.7)
Impella 5.0	-
Intra-aortic balloon pump	7 (46.7)
Inotropes	7 (46.7)
Mechanical ventilation	13 (86.7)
Duration of Impella support, hours	156.0 ± 92.1
Length of mechanical ventilation, hours	96 (48–252)
Intensive care length of stay, days	15 (10–27)

J. Pers. Med. 2022, 12, 1481

Journal of Personalized Medicine

MDPI

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	Patients (n = 15)
Death	7 (46.7)
Life-threatening or severe bleeding	-
Number of red blood cell transfusions	8.79 ± 9.6
Device-related complications	
Access-site bleeding	-
Haemolysis	4 (26.6)
Limb ischaemia	3 (20.0)
Sepsis	9 (60.0)
Acute kidney injury *	10 (66.7)
Need for renal replacement therapy	7 (46.7)
Escalation therapy	2 (13.3)
LVEF at discharge, %	35.8 ± 17.7

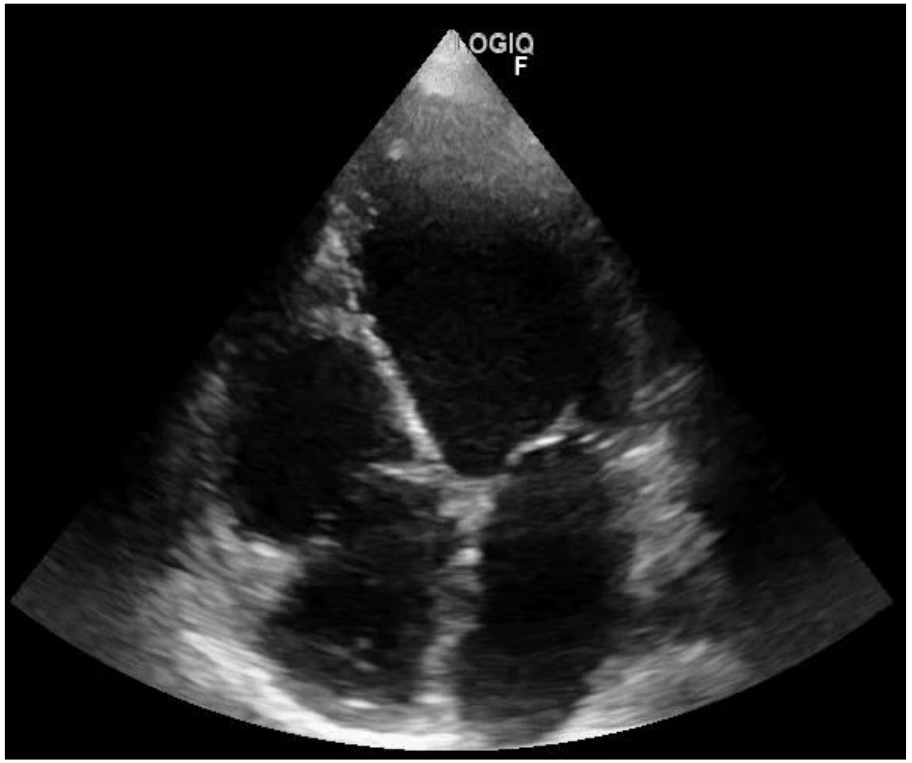
J. Pers. Med. 2022, 12, 1481

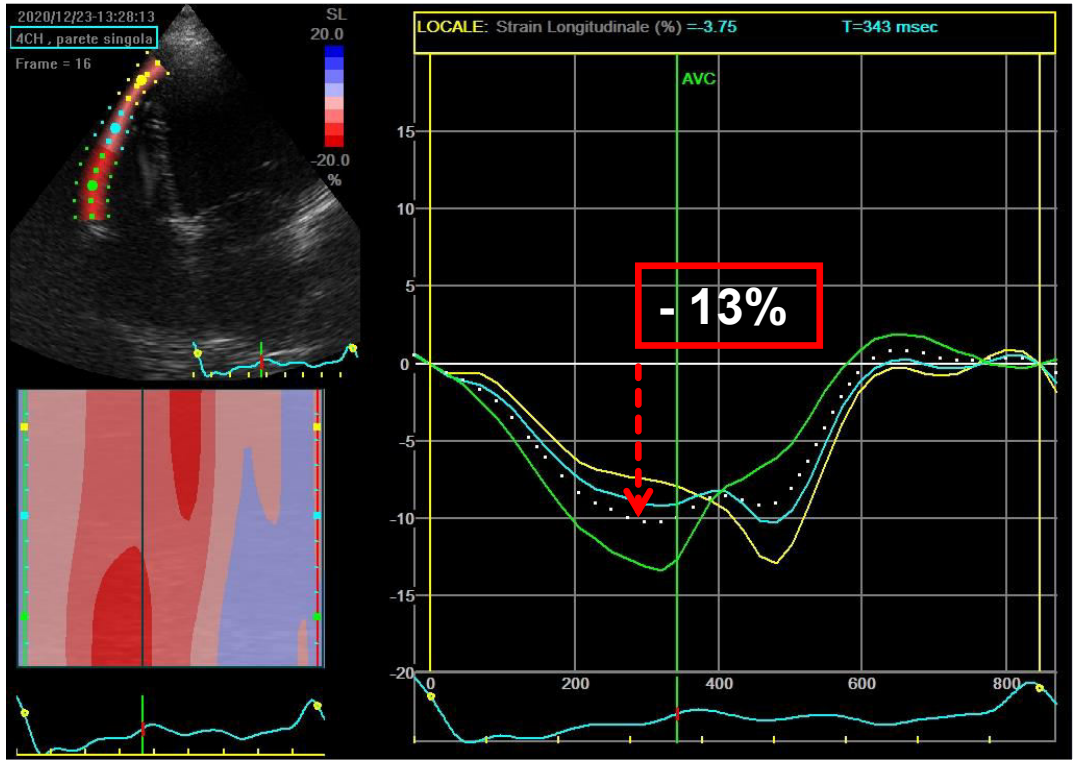
CASE PRESENTATION

- Man, 69 Y
- In ***July 2022***: admission for ADHF in advanced HFrEF (cardiogenic shock in STEMI in 2020)
- NYHA IV, lung and peripheral congestion
- BP: 90/60 mmHg, HR 90/min (sinus rhythm), SpO_2 90%

CHEMISTRY

Hemoglobin	10.2 g/dl
Creatinine	2.02 mg/dl
GFR	35 ml/min
Sodium	132 mEq/L
AST/ALT	100/123 UI/L
Total Bilirubin	1.8 mg/dl
GGT	180 UI/L
INR	1.6
NT-proBNP	9500 pg/mL



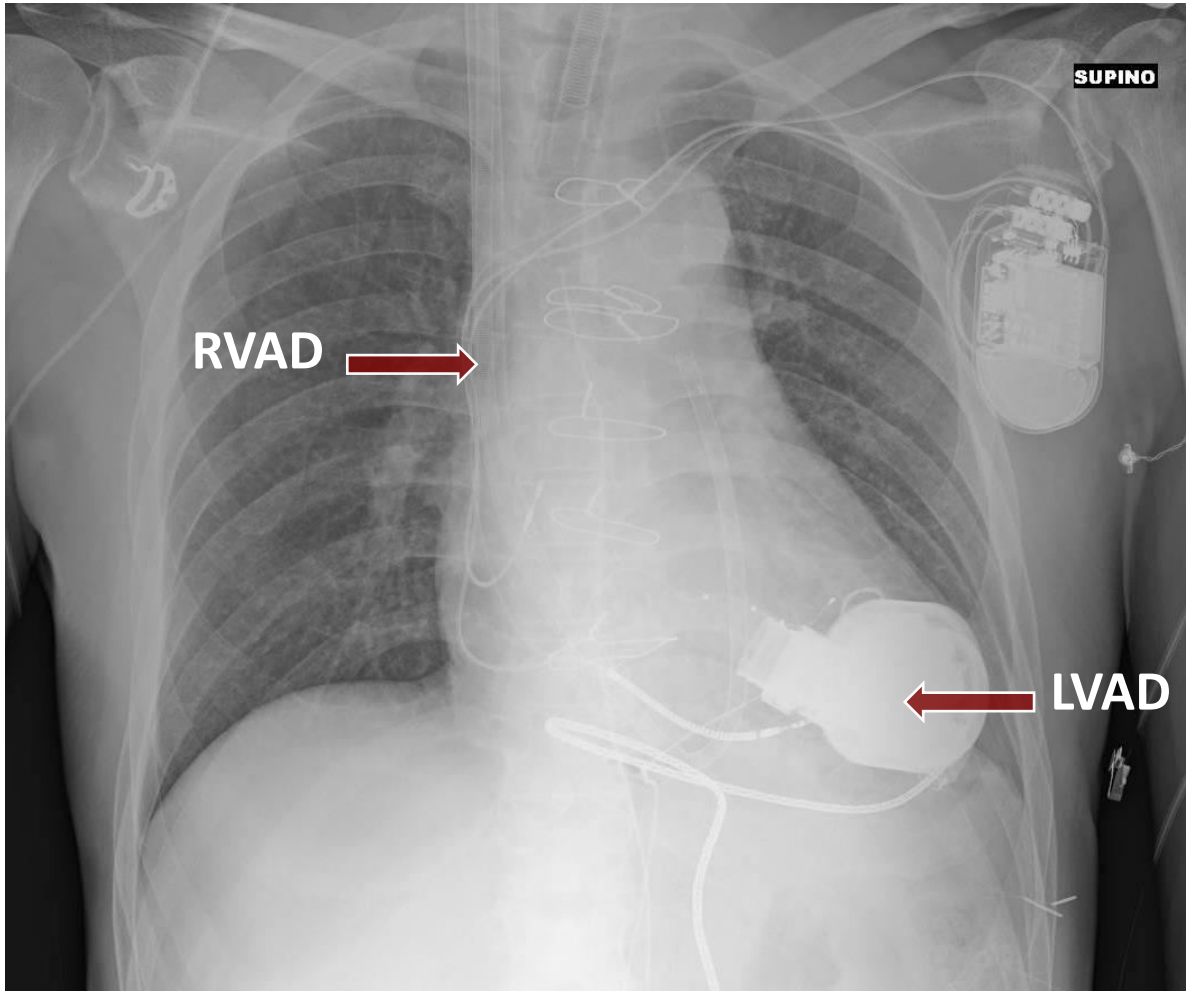


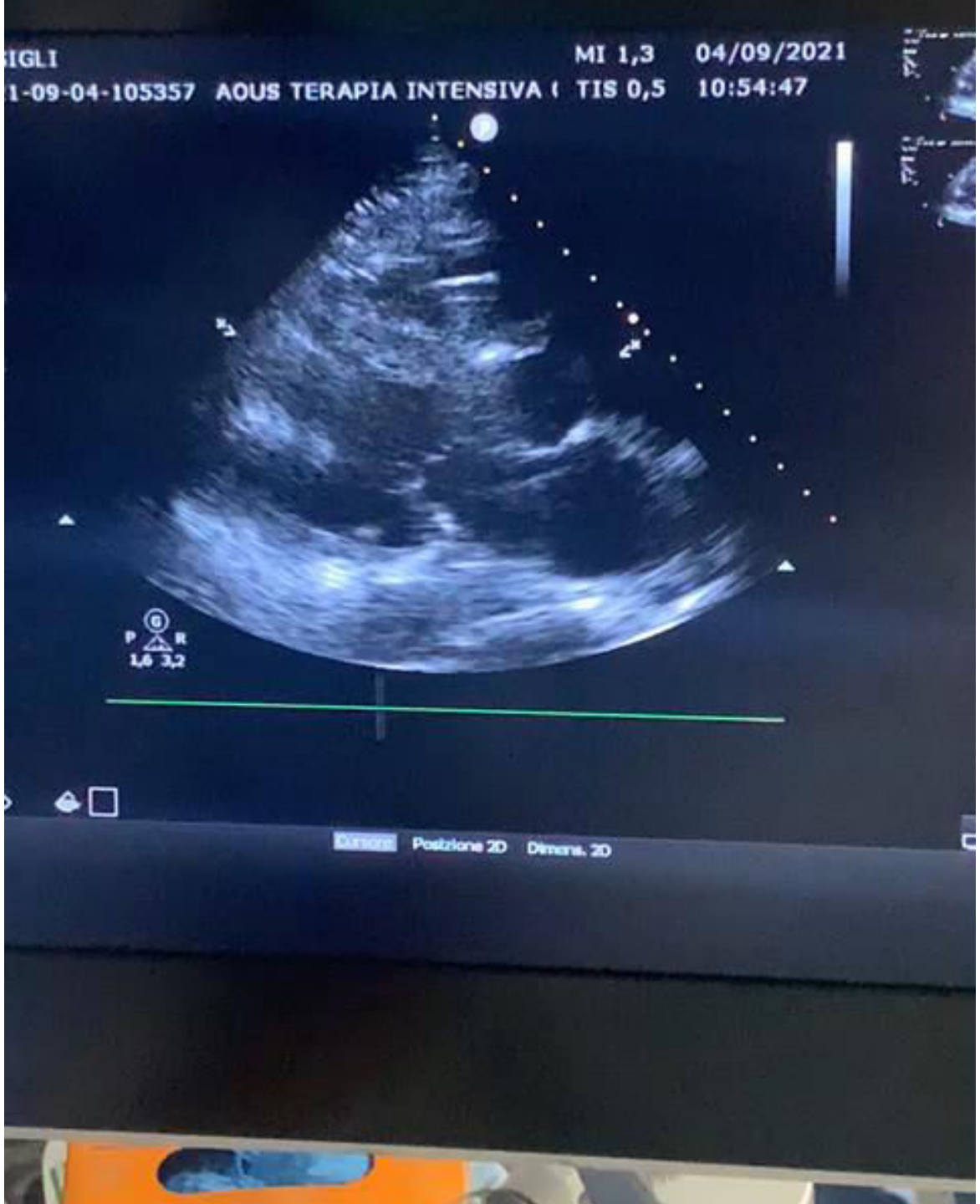
- EDDm 36 mm, EDDb 42 mm, SI 0.45
- RVFAC 30%
- TR 1+, Vel 3.3 m/sec
- TAPSE 17 mm
- S’ 0.10 m/sec
- Free-wall RVLS – 13%

LVAD implantation as “Destination Therapy”

and

Temporary percutaneous **RV MCS** as perioperative RV support


SUPINO
RVAD
LVAD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1-09-04-105357 AOUS TERAPIA INTENSIVA (
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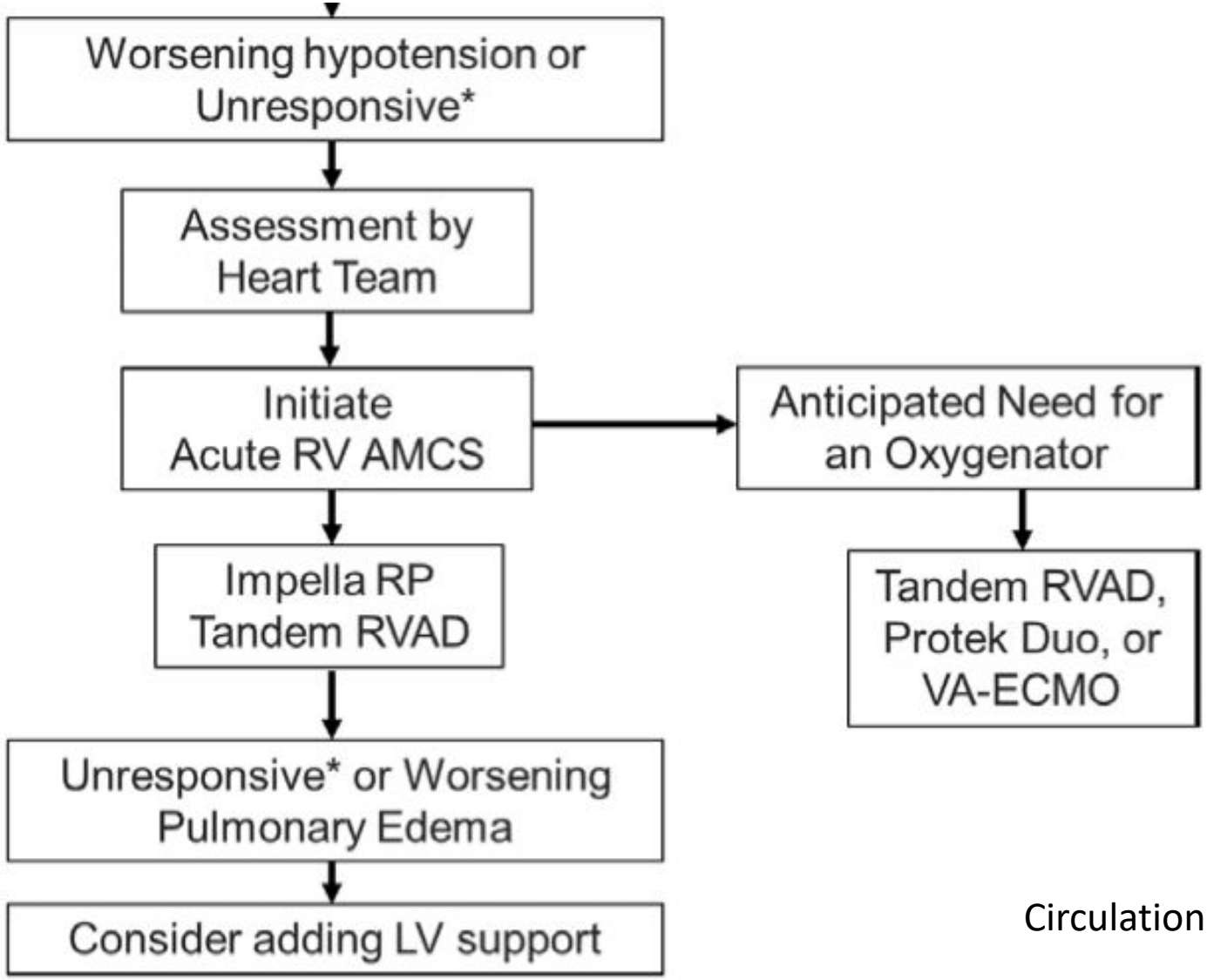
Proposed algorithm for right ventricular acute mechanical circulatory support device use in RV failure



Circulation. 2017;136:314–326

Conclusioni

- Il supporto meccanico nell'insufficienza ventricolare destra è ancora limitato a pochi centri, con CCH e con programma TC/VAD
- Referall precoce dei pazienti : shock center, shock team
- Terapia «Tailored» sul profilo emodinamico (ecografico e con PAC)
- Scegliere il device più idoneo con valutazione multiparametrica
- Stabilire , quando possibile , l'obiettivo del device: recovery, bridge to VAD/CT,