UTIC CLUB | ANMCO
CRITICAL CARE COMMUNITY

Miocardite acuta: dal sospetto al supporto avanzato in poche ore

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No Disclosure

Clinical Case

35 years old, male

CV risk factors: none

Medical history: multiple sclerosis well controlled on fourth-line therapy with ofatumumab

Clinical Presentation

Night of 02 Jan 2026: sudden awakening with paroxysmal dyspnea. No prodromal symptoms.

In the Emergency Department

Agitated, confused, cold clamy skin, dyspneic

BP 95/75 mmHg, T 36.8 °C, So2 92%

ECG: Atrial Fibrillation 140 bpm

Laboratory tests:

WBC 18,000 CRP and PCT negative Creatinine 1.3 mg/dL

AST/ALT 58/59 U/L, Troponin I 1593, Lactate 5 mmol/L

Echo fast: DT 42 mm, LVEF 25%, Normal RV function, Mild MR

"Cardiogenic shock in the setting of suspected fulminant myocarditis»

Management

- Pharmacological CV with amiodarone
- Dobutamine 5 µg/kg/min and norepinephrine 0.05 µg/kg/min were initiated.
- Coronary arteries without significant disease
- IABP was inserted

Transfer the patient to our Centre

Fulminant myocarditis

Fulminant myocarditis is a rare (3% to 9% of adult patients admitted with acute myocarditis), rapidly progressive inflammatory myocardial disease characterized by:

- Abrupt onset of **severe myocardial dysfunction**
- Rapid evolution to **cardiogenic shock**
- Arrhythmias or sudden cardiac death

High short-term mortality without prompt intervention

ECG findings are heterogeneous and dynamic:

- Sinus tachycardia
- Atrial or ventricular arrhythmias
- ST-segment elevation or depression
- Advanced atrio-ventricular block

Typical echocardiographic features:

- **Severe (bi)ventricular systolic dysfunction**
- **Non-dilated ventricles**
- Increased wall thickness (myocardial edema)
- Reduced stroke volume and cardiac output

Fulminant Myocarditis

Eur Heart J 2025: 00, 1–15

Clinical characteristics

Overall study population: 271 cases of fulminant myocarditis	LM 99	EM 18	NEM 3	GCM 26	Inconclusive EMB 48	No EMB 77
Chest pain, n (%)	29 (29)	5 (28)	1 (33)	11 (42)	9 (19)	24 (31)
Dyspnoea, n (%)	67 (68)	11 (61)	1 (33)	16 (62)	32 (67)	50 (65)
Cardiac arrest, n (%)	13 (13)	2 (11)	0 (0)	4 (15)	12 (25)	20 (26)
Sustained VA, n (%)	10 (10)	2 (11)	0 (0)	5 (19)	2 (4)	16 (21)
LVEF, median [IQR]	17.5 [15.0, 30.0]	23.5 [15.0, 28.8]	15.0 [15.0, 17.5]	20.5 [15.0, 28.8]	20.0 [14.2, 25.0]	20.0 [15.0, 35.0]
RV dysfunction, n (%)	64 (65)	11 (61)	2 (67)	12 (46)	30 (62)	37 (48)
SAPS II, median [IQR]	39 [20, 56]	45 [27, 51]	38 [37, 60]	45 [23, 65]	43 [26, 56]	46 [28, 68]

Fulminant Myocarditis

Overall study population: 271 cases of fulminant myocarditis

Outcomes

	LM (99)	EM (18)	NEM (3)	GCM (26)	Inconclusive EMB (48)	No EMB (77)
In-hospital mortality, n (%)	24 (24)	4 (22)	0 (0)	13 (50)	12 (25)	32 (42)
One-year mortality, n (%)	25 (25)	5 (28)	1 (33)	14 (54)	13 (27)	33 (43)

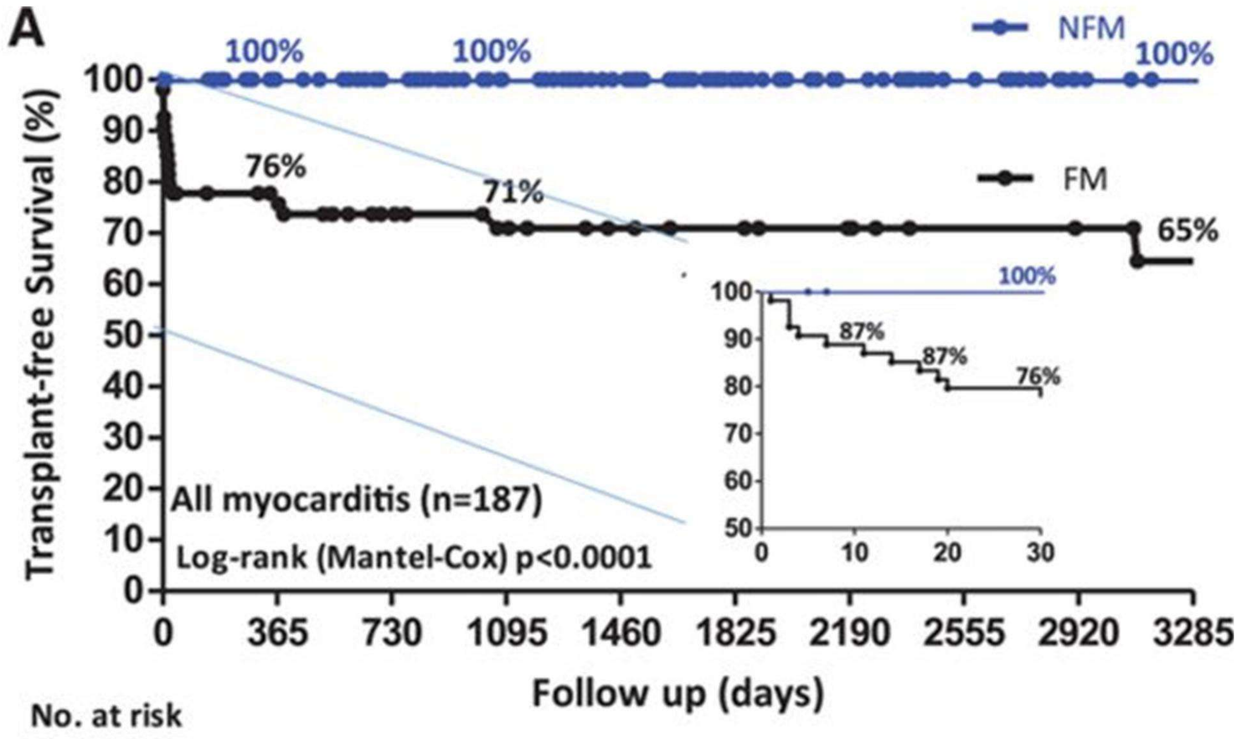
Eur Heart J 2025: 00, 1–15

Challenging diagnosis

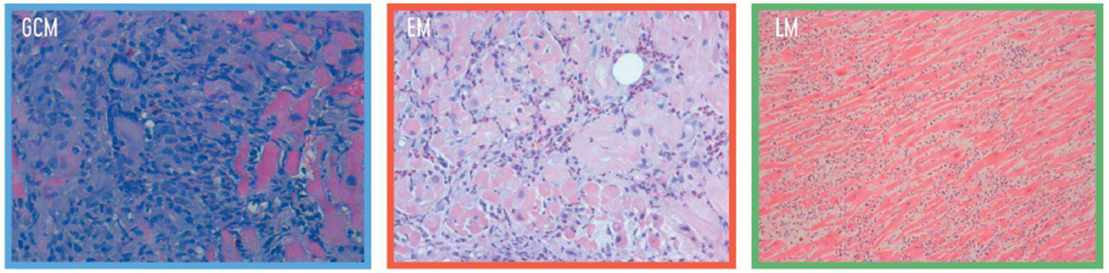
- non specific clinical presentation
- potential overlap with other cardiovascular diseases
- general lack of awareness

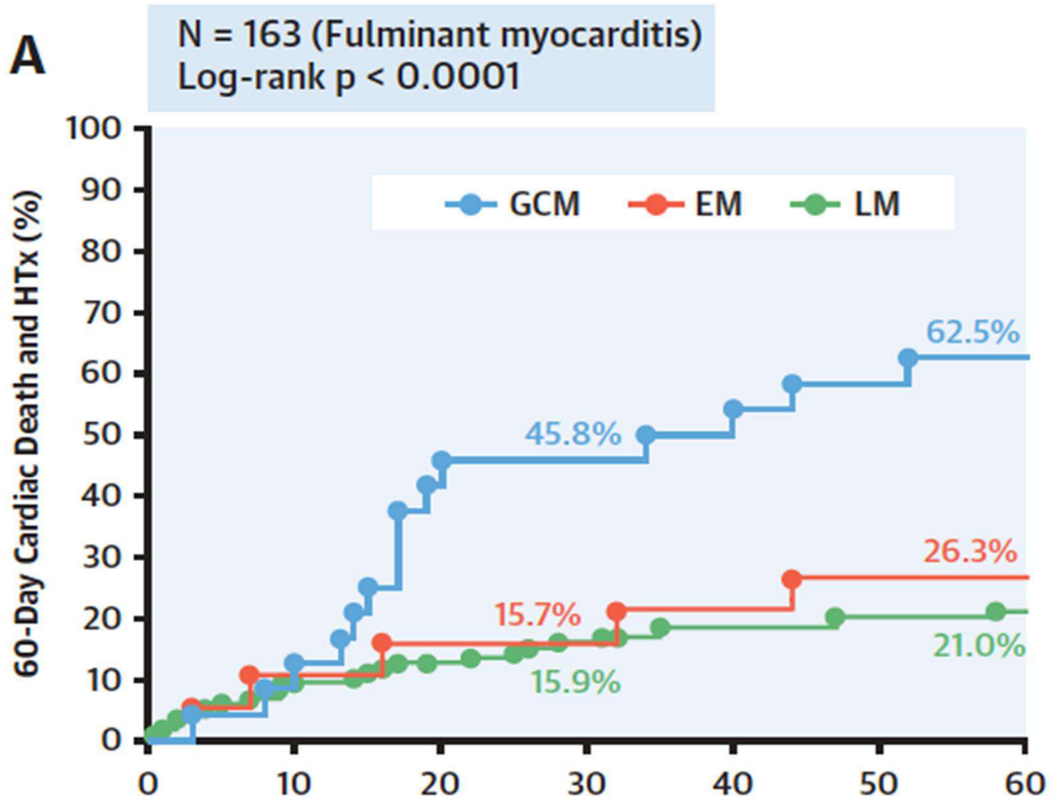
Early Suspicion is essential

Survival in Fulminant Myocarditis

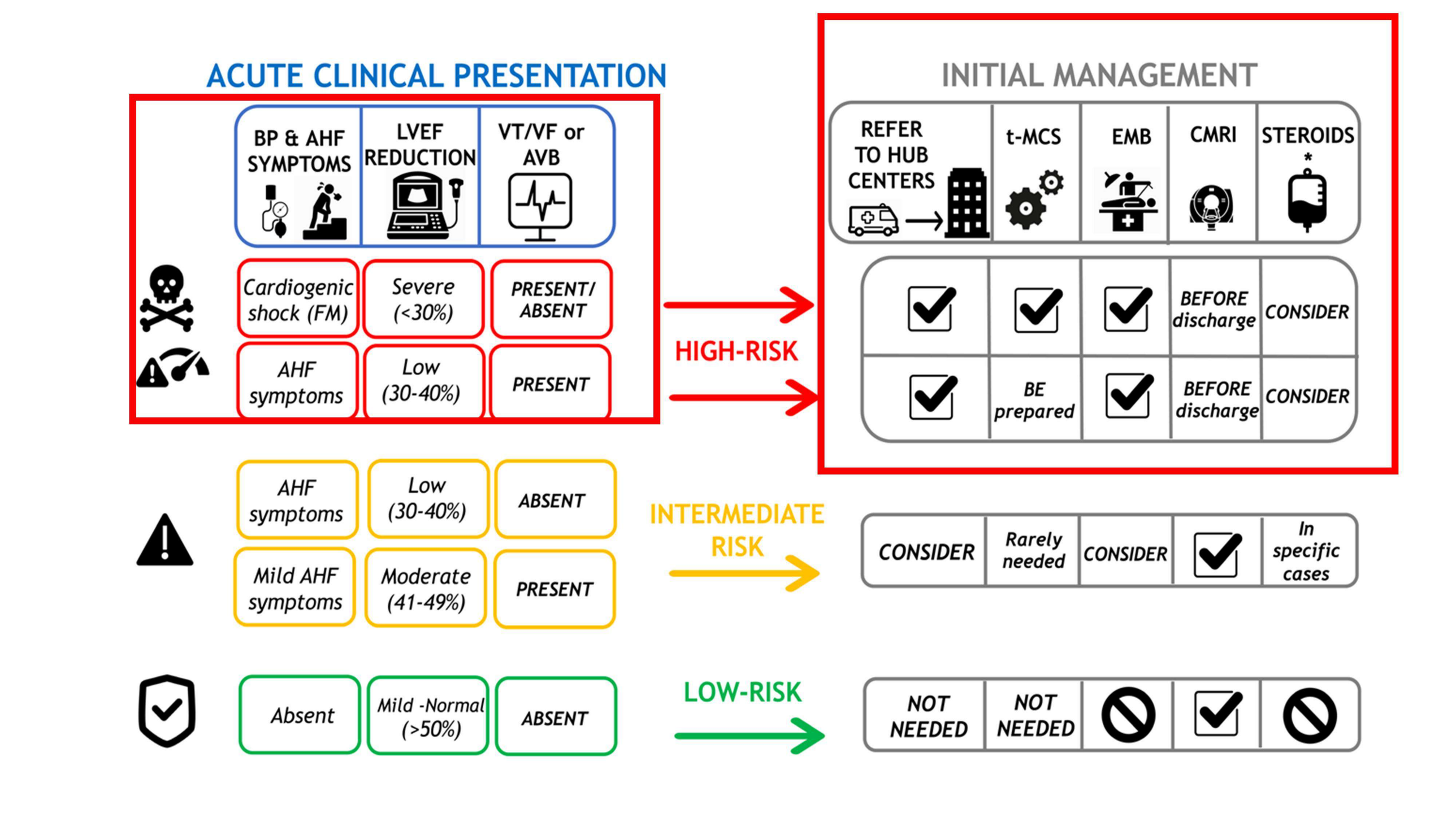


Circulation 2017;136:529–545



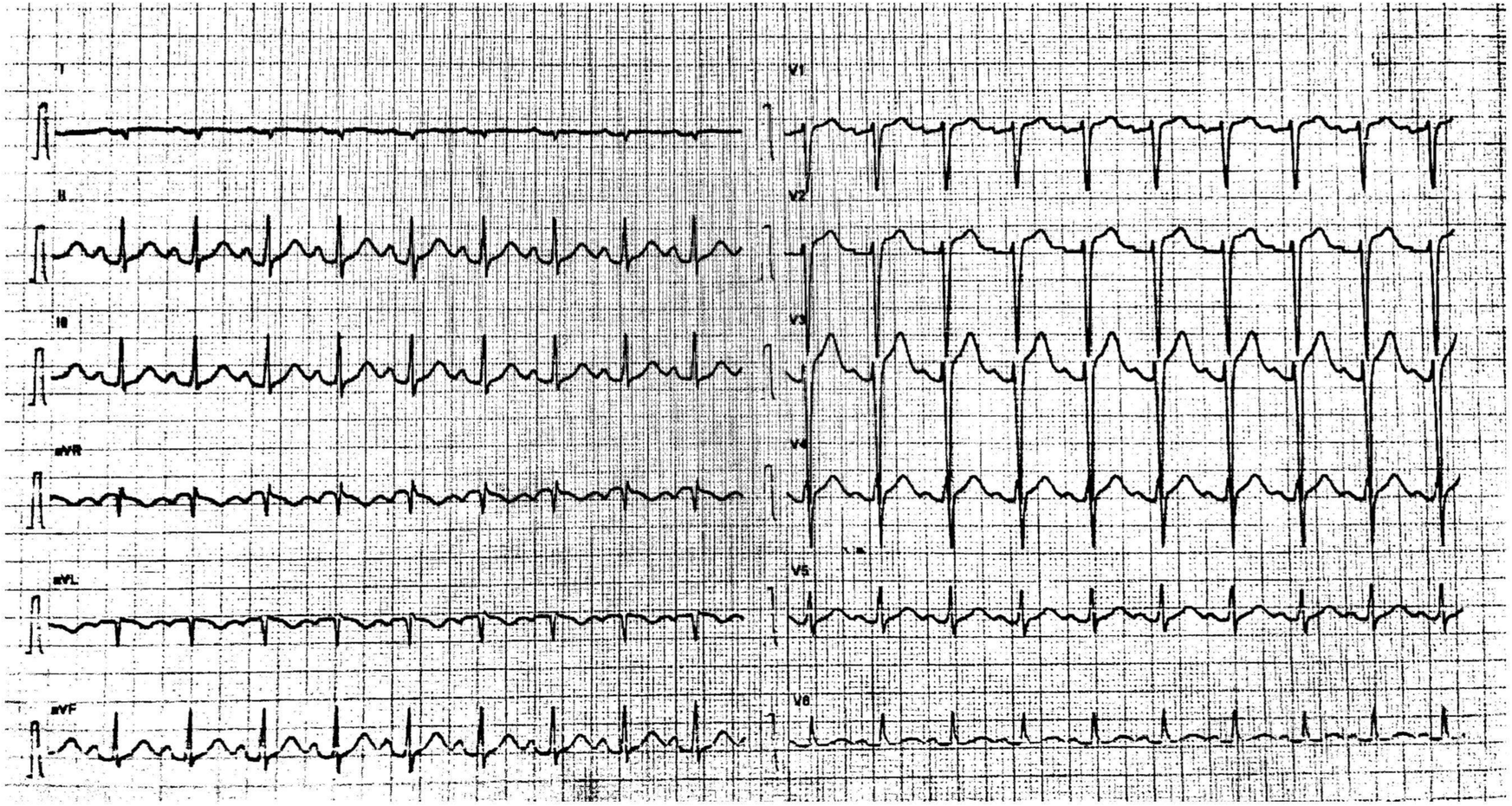


JACC 2019;74:299–311

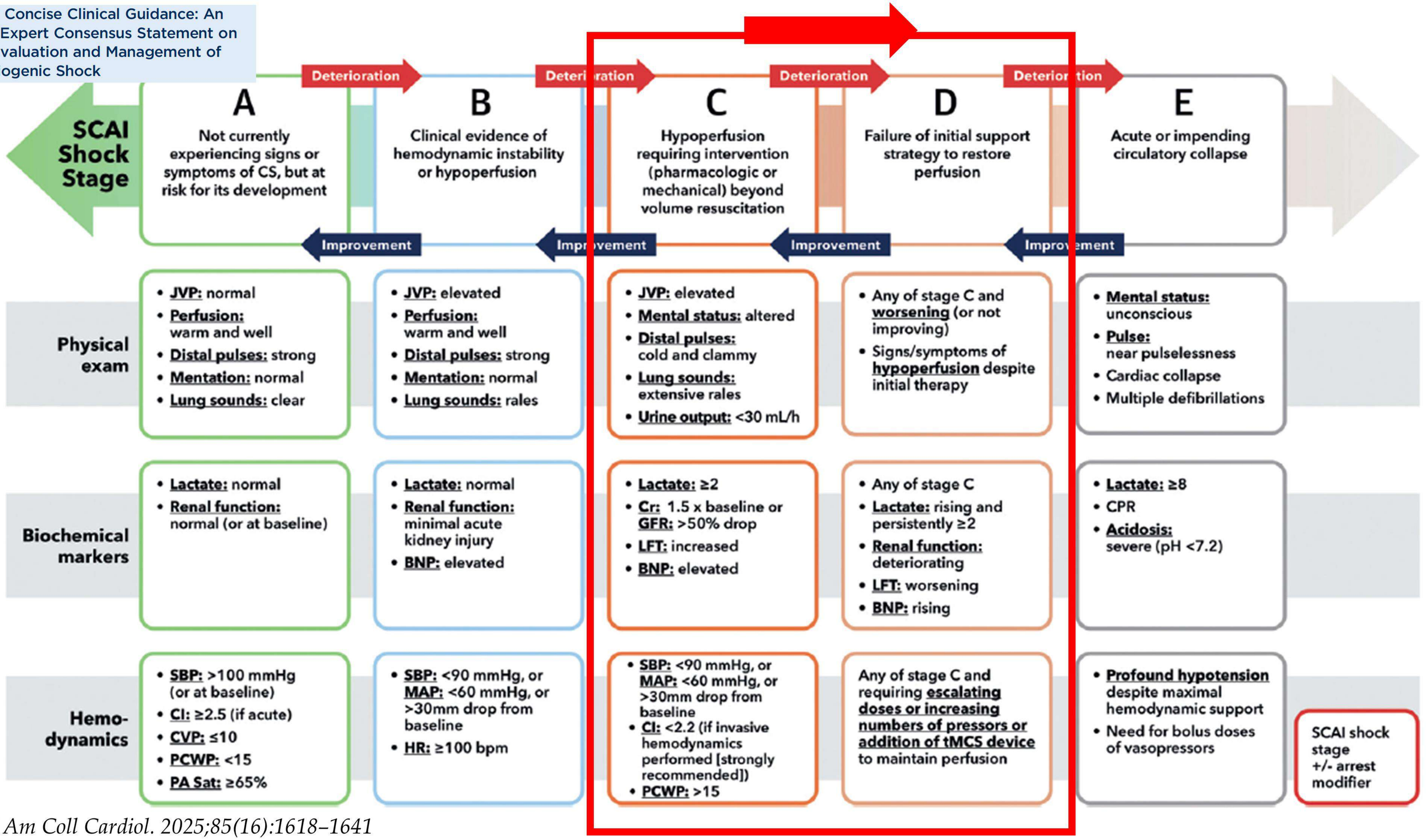

ACUTE CLINICAL PRESENTATION
BP & AHF SYMPTOMS
LVEF REDUCTION
VT/VF or AVB
Cardiogenic shock (FM)
Severe (<30%)
PRESENT/ ABSENT
AHF symptoms
Low (30-40%)
PRESENT
HIGH-RISK
INITIAL MANAGEMENT
REFER TO HUB CENTERS
t-MCS
EMB
CMRI
STEROIDS *
BEFORE discharge
CONSIDER
BE prepared
BEFORE discharge
CONSIDER
AHF symptoms
Low (30-40%)
ABSENT
Mild AHF symptoms
Moderate (41-49%)
PRESENT
INTERMEDIATE RISK
CONSIDER
Rarely needed
CONSIDER
In specific cases
Absent
Mild -Normal (>50%)
ABSENT
LOW-RISK
NOT NEEDED
NOT NEEDED

…..Clinical Case - Initial Management

- BP S/D/D_{IND} 90/40/105 mmHg
- HR 130 bpm
- Blood gas analysis (FIO2 40%): pH 7,33, pO2 187, pCO2 37, lactate 7,
- LVEF 15%, LVOT VTI 8 cm, TAPSE 16 mm, FAC 32%



2025 Concise Clinical Guidance: An ACC Expert Consensus Statement on the Evaluation and Management of Cardiogenic Shock



J Am Coll Cardiol. 2025;85(16):1618–1641

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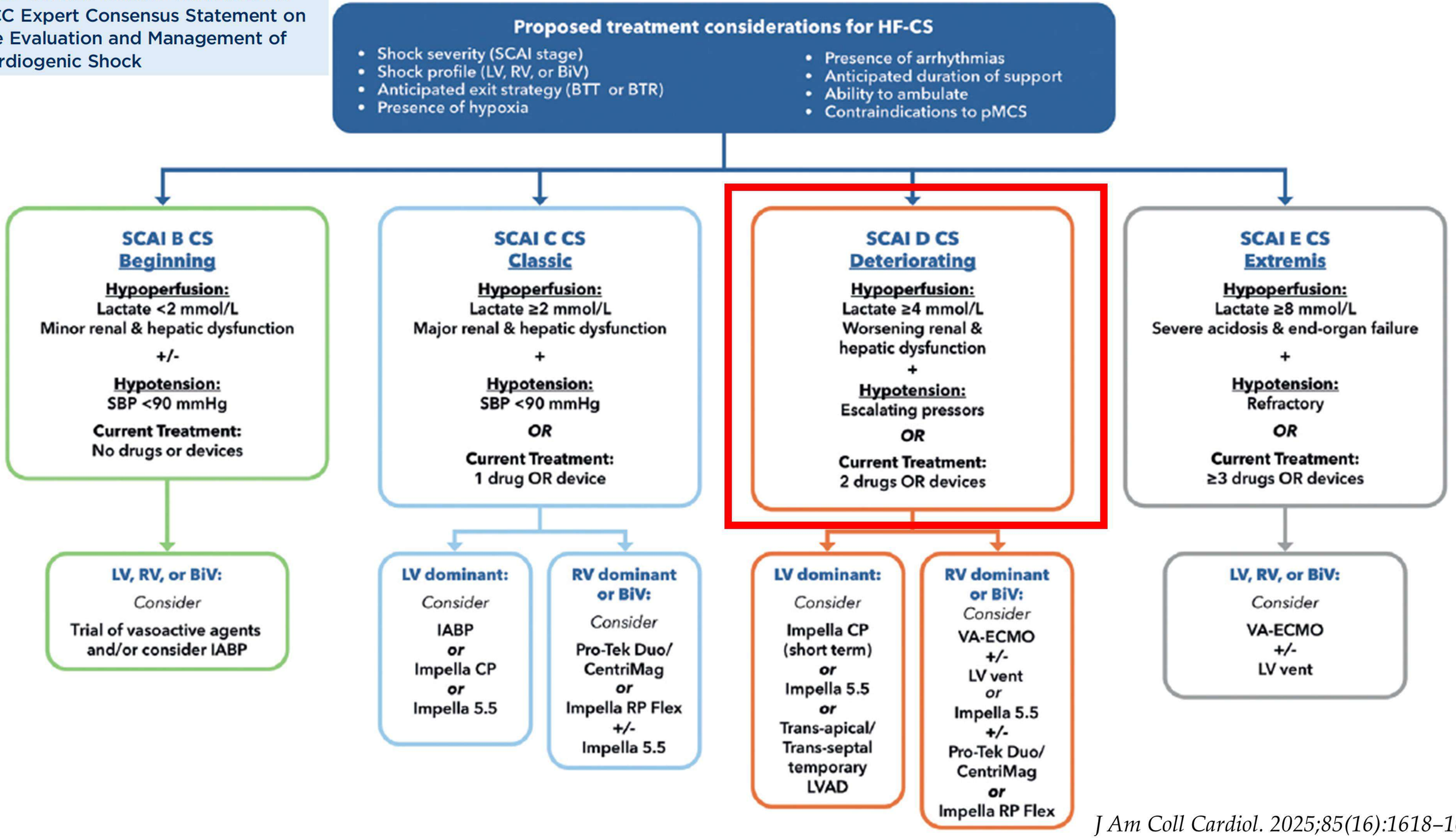
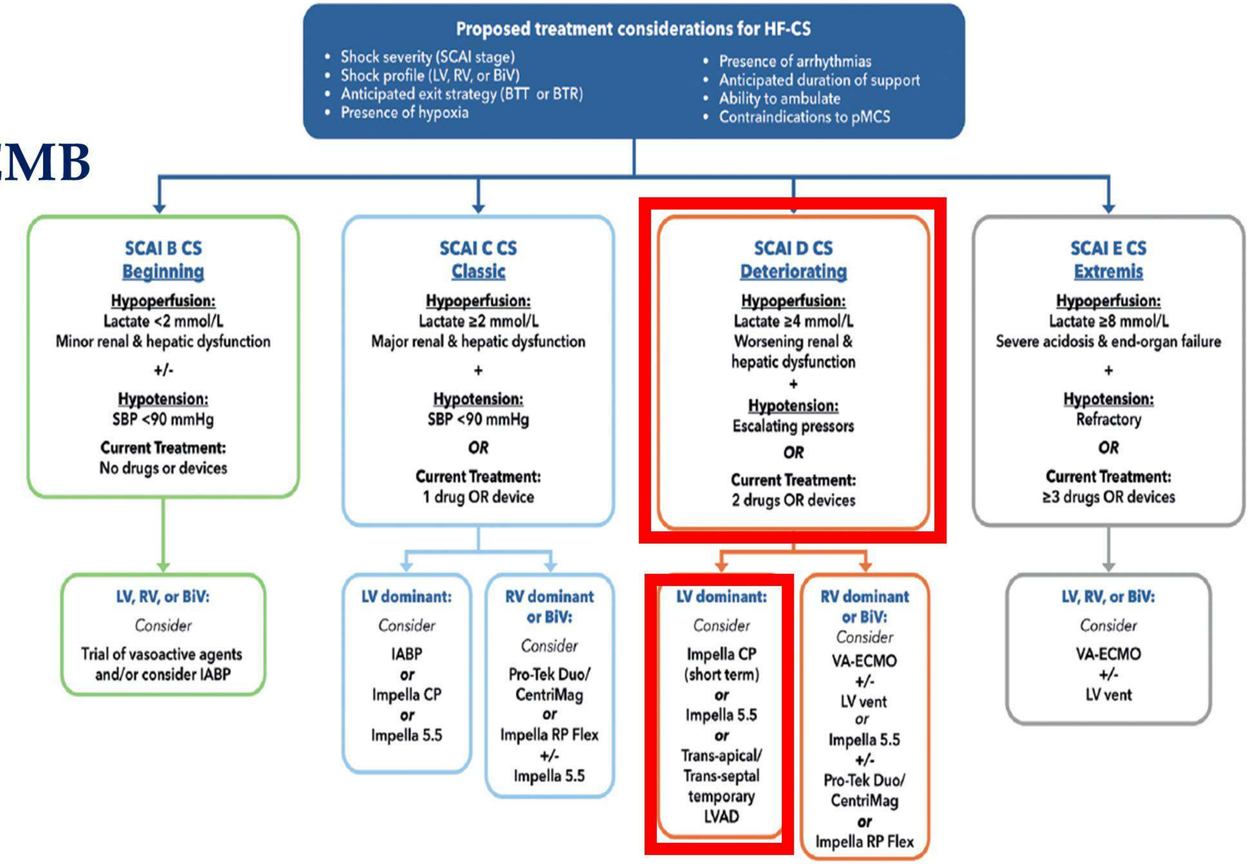


J Am Coll Cardiol. 2025;85(16):1618–1641

...Clinical Case

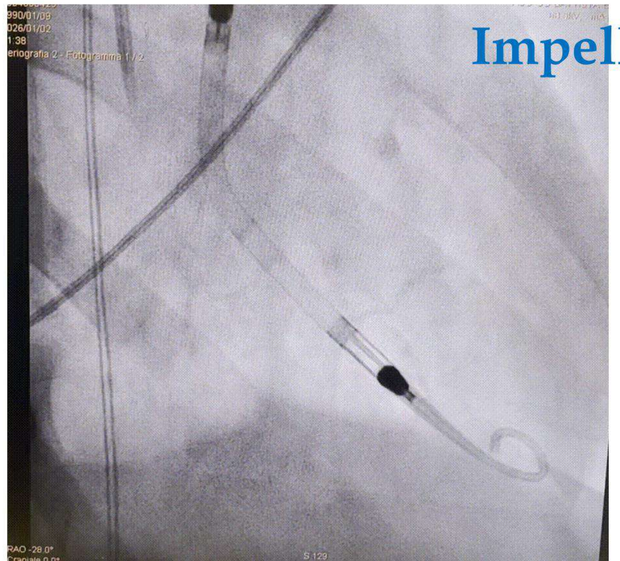
Right Heart Right Heart Catheterization and EMB

- PAP 25/13/17 mmHg
- WP 10 mmHg
- RAP 3 mmHg
- CO 3.5 l/min
- CI 2.1 l/min/mq
- PAPi 4
- RAP/WP 0.3



Medical treatment:

- Epinephrine 0.05 µg/kg/min
- STOP dobutamine and norepinephrine
- Methylprednisolone 1gr ev



Impella CP

Monitoring of the CS Patient in the Intensive Care Unit

Electrocardiography
- ECG monitoring
- Atrial fibrillation
- Ventricular arrhythmias

Respiratory
- Oxygen saturation (SpO_2 and PaO_2)
- PaO_2/FiO_2 ratio
- Work of breathing, respiratory rate
- Ventilator FiO_2, PEEP, static compliance

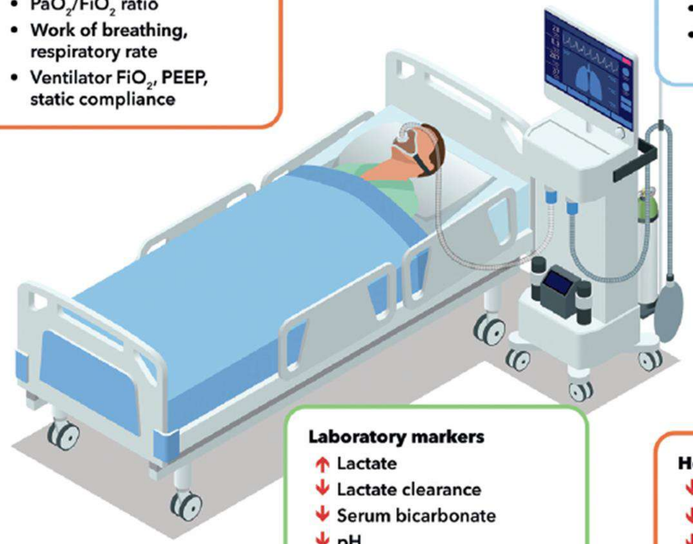
tMCS
- Device-specific monitoring

Neurologic
- Mental status
- Glasgow Coma Scale
- Delirium
- Cerebral saturation (ECMO only)

Echocardiography
- LV and RV size and function
- Valvular abnormalities
- Noninvasive filling pressure estimates

Renal markers
- ↓ Urine output

Physical exam
- ↑ HR
- ↓ BP, MAP
- ↑ JVP, HJR
- "Cold" extremities



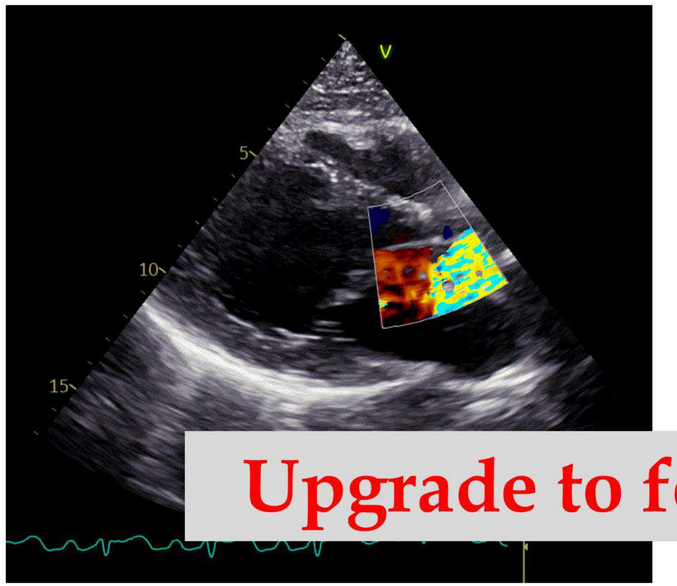
Laboratory markers
- ↑ Lactate
- ↓ Lactate clearance
- ↓ Serum bicarbonate
- ↓ pH
- ↑ ALT, AST
- ↑ BUN, Cr

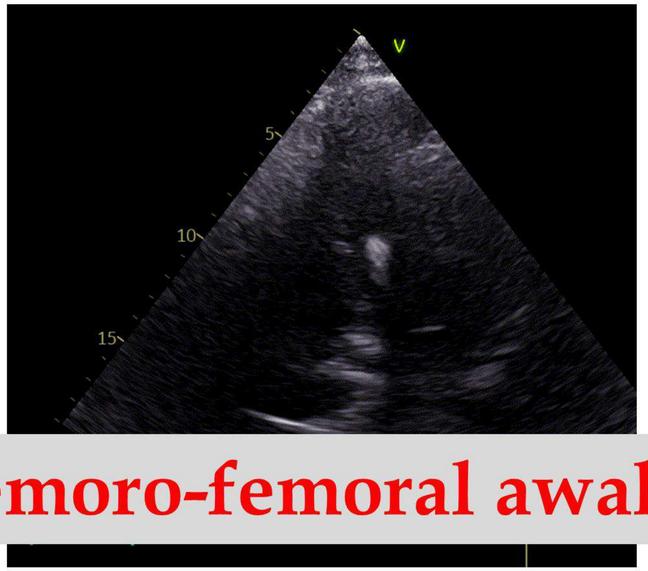
Hemodynamics
- ↓ $ScvO_2/SvO_2$
- ↓ CI
- ↓ PAPi
- ↑ RAP/PCWP

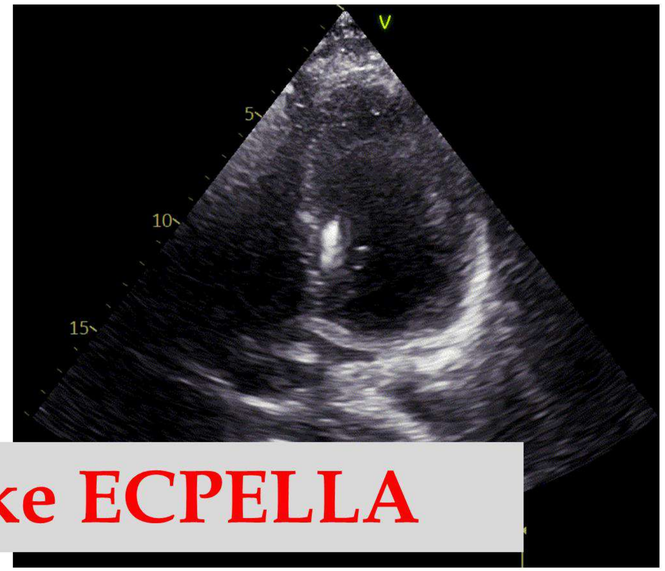
2 hours after….

- PAP: **20/10/14 mmHg ↓**
- PCWP: **6 mmHg ↓**
- RAP: **2 mmHg ↓**
- CO: **2.6 L/min ↓**
- CI: **1.4 L/min/m² ↓**

- **Lactate: 13 mmol/L ↑**







Upgrade to femoro-femoral awake ECPELLA

VA-ECMO for Suspected Acute Myocarditis

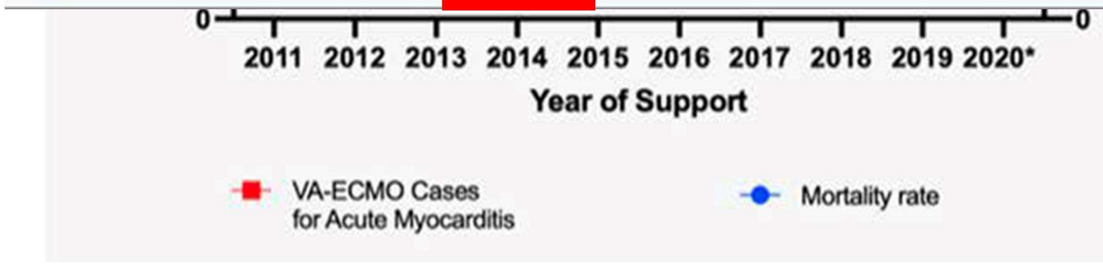
ELSO registry

- 850 pz
- Mean age 41 years, 52% male
- Mortality 34.9%
- Htx 1.9%
- LVAD 2.4%

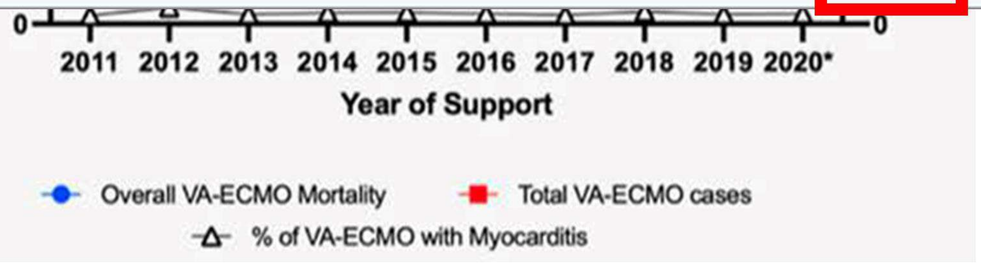
Circ Heart Fail. 2023;16:e010152

A VA-ECMO for Acute Myocarditis

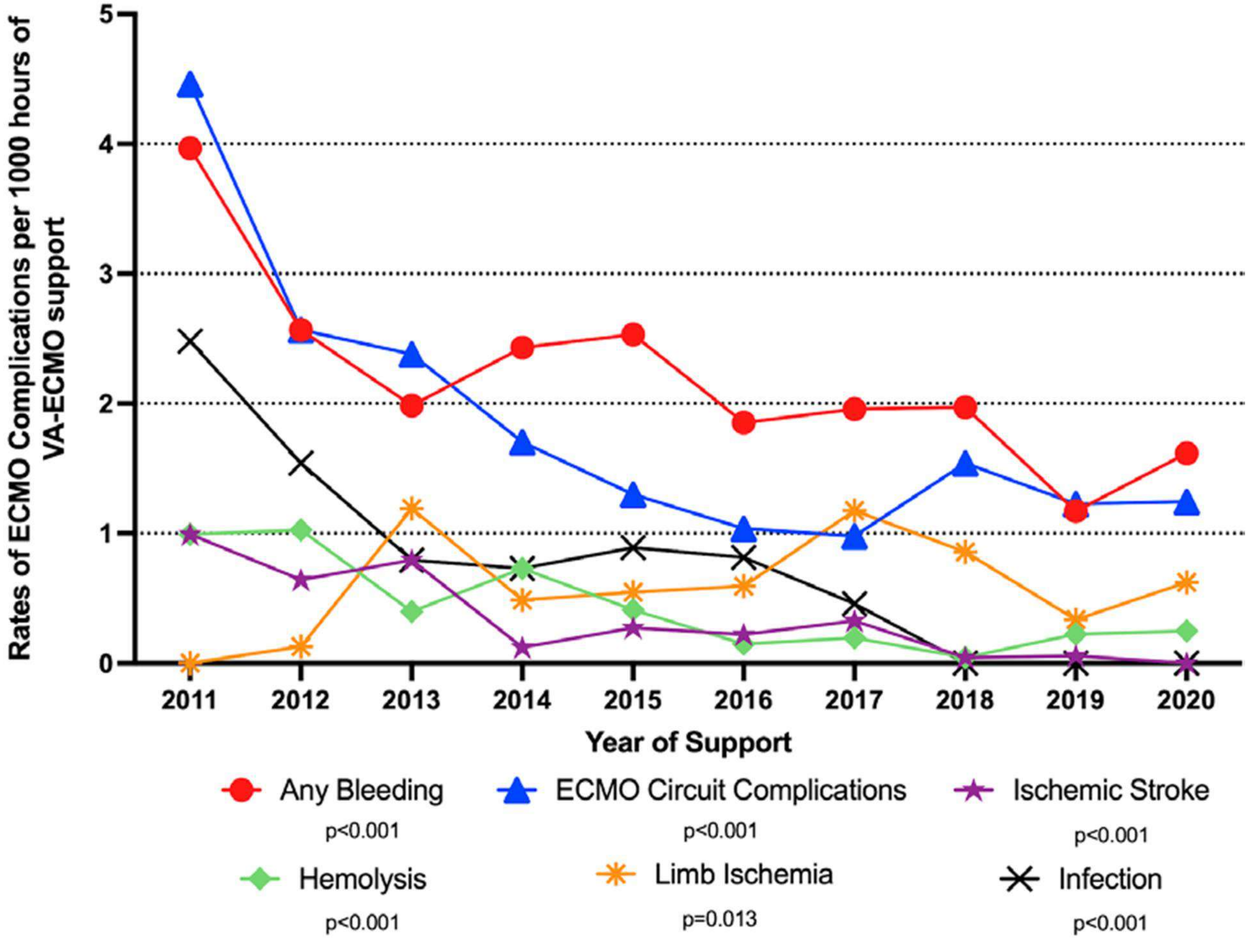
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020*
Total VA-ECMO Cases	817	1374	1831	2396	3384	4046	5305	5969	6919	7743
Overall VA-ECMO mortality	65.1%	61.6%	60.6%	59.2%	59.7%	59.6%	58.7%	57.4%	55.6%	56.3%
Myocarditis VA-ECMO Cases	16	53	40	60	88	95	111	168	152	181
VA-ECMO Myocarditis Mortality	43.8%	49.1%	42.5%	46.7%	39.8%	36.8%	27.9%	31%	30.9%	28.4%

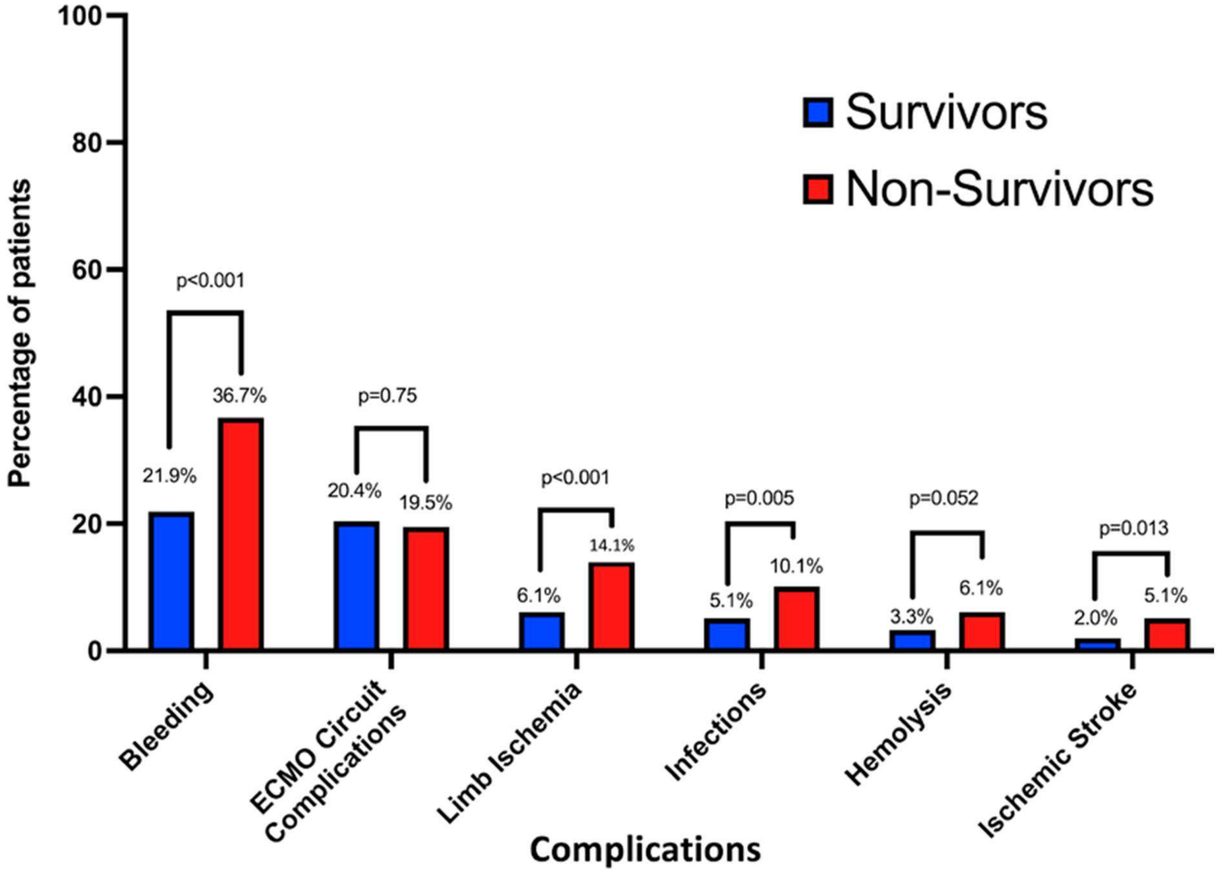


B Total VA-ECMO



VA-ECMO for Suspected Acute Myocarditis



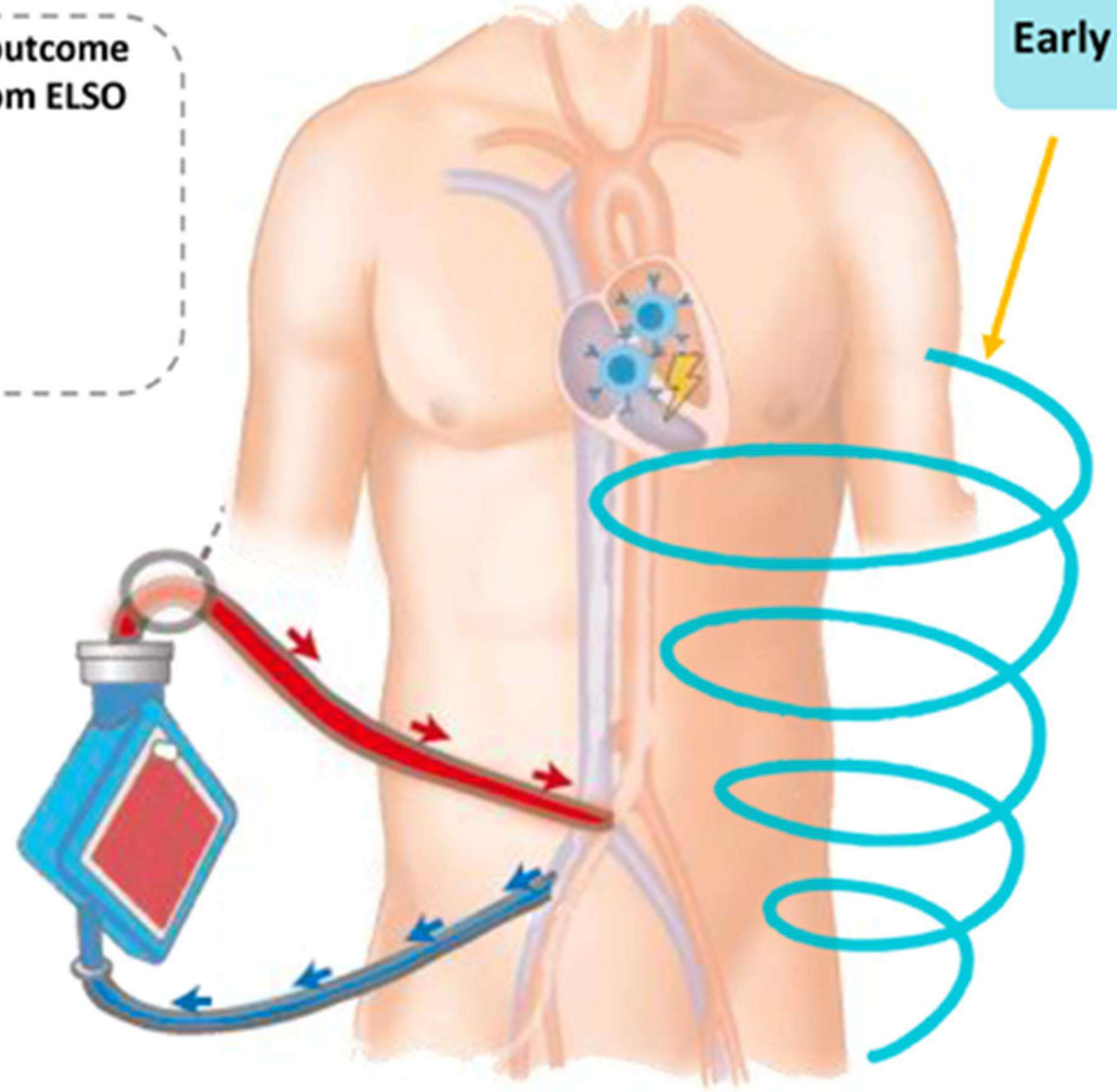


Circ Heart Fail. 2023;16:e010152

Peripheral VA-ECMO for Fulminant Myocarditis

Unmodifiable negative outcome predictors for VA-ECMO from ELSO registry in FM:

- Older age
- Higher weight
- Asian race



Early recognition and ECMO initiation

Negative outcome predictors pre-VA-ECMO from ELSO registry in FM:

- Low pH / high lactate levels
- ECPR / ongoing resuscitation
- Lower MAP
- Ongoing sepsis

Negative outcome predictors from other registries on patients with FM:

- Giant cell myocarditis
- QRS >120 ms on ECG
- VT/VF on initial ECG

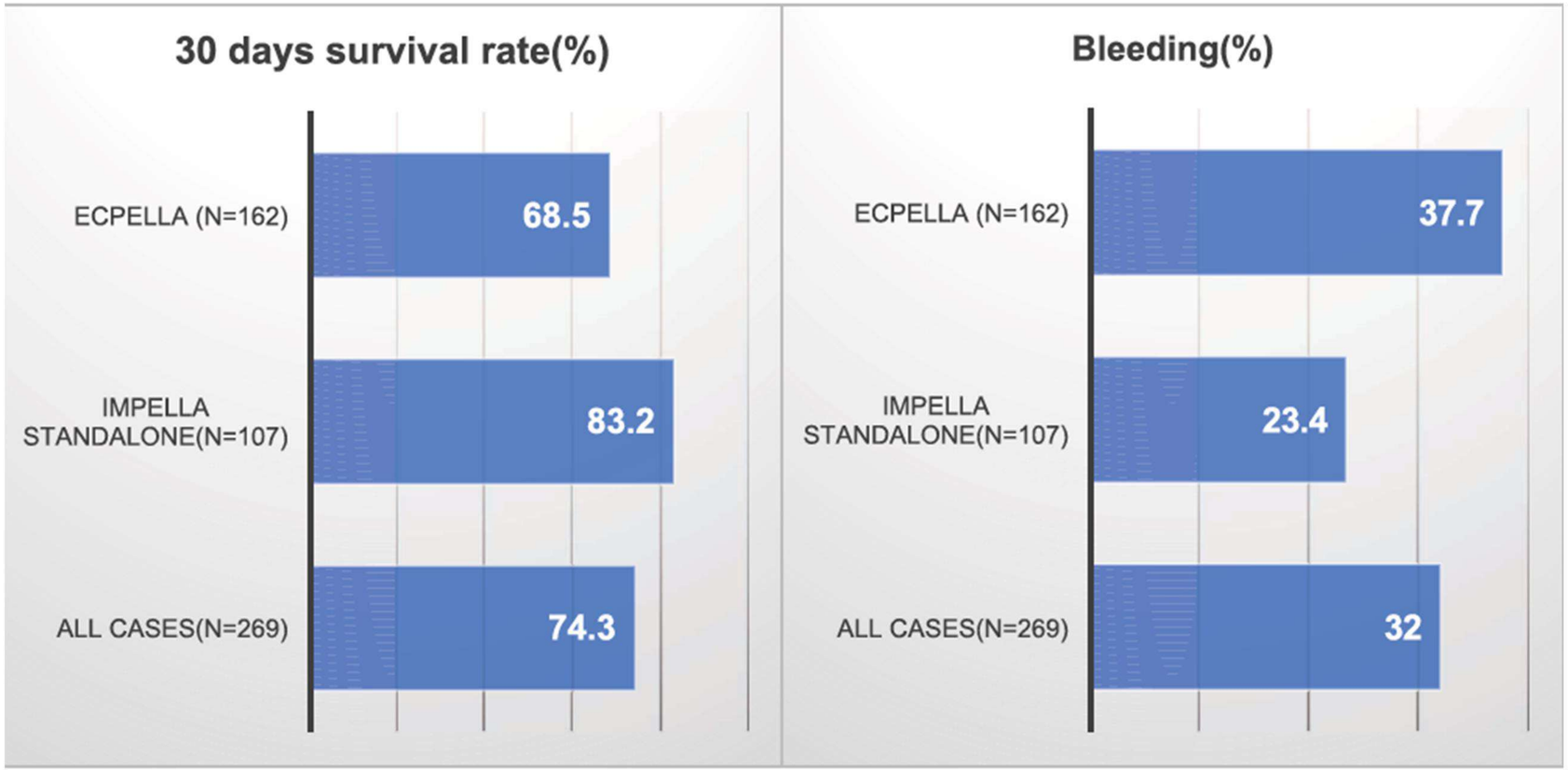
Circ Heart Fail. 2023;16:e010670

Impella in Fulminant Myocarditis

ESC European Society of Cardiology
European Heart Journal: Acute Cardiovascular Care (2024) **13**, 275–283
https://doi.org/10.1093/ehjacc/zuad149
ORIGINAL SCIENTIFIC PAPER
Heart Failure and Cardiomyopathies

Impella device in fulminant myocarditis: Japanese Registry for Percutaneous Ventricular Assist Device (J-PVAD) registry analysis on outcomes and adverse events

269 pts
Impella stand-alone 39.8% vs. ECPELLA 60.2%



Impella stand-alone associated with lower mortality and fewer complications

*Nasu et al. European Heart Journal: Acute Cardiovascular Care 2024: **13**, 275–283*

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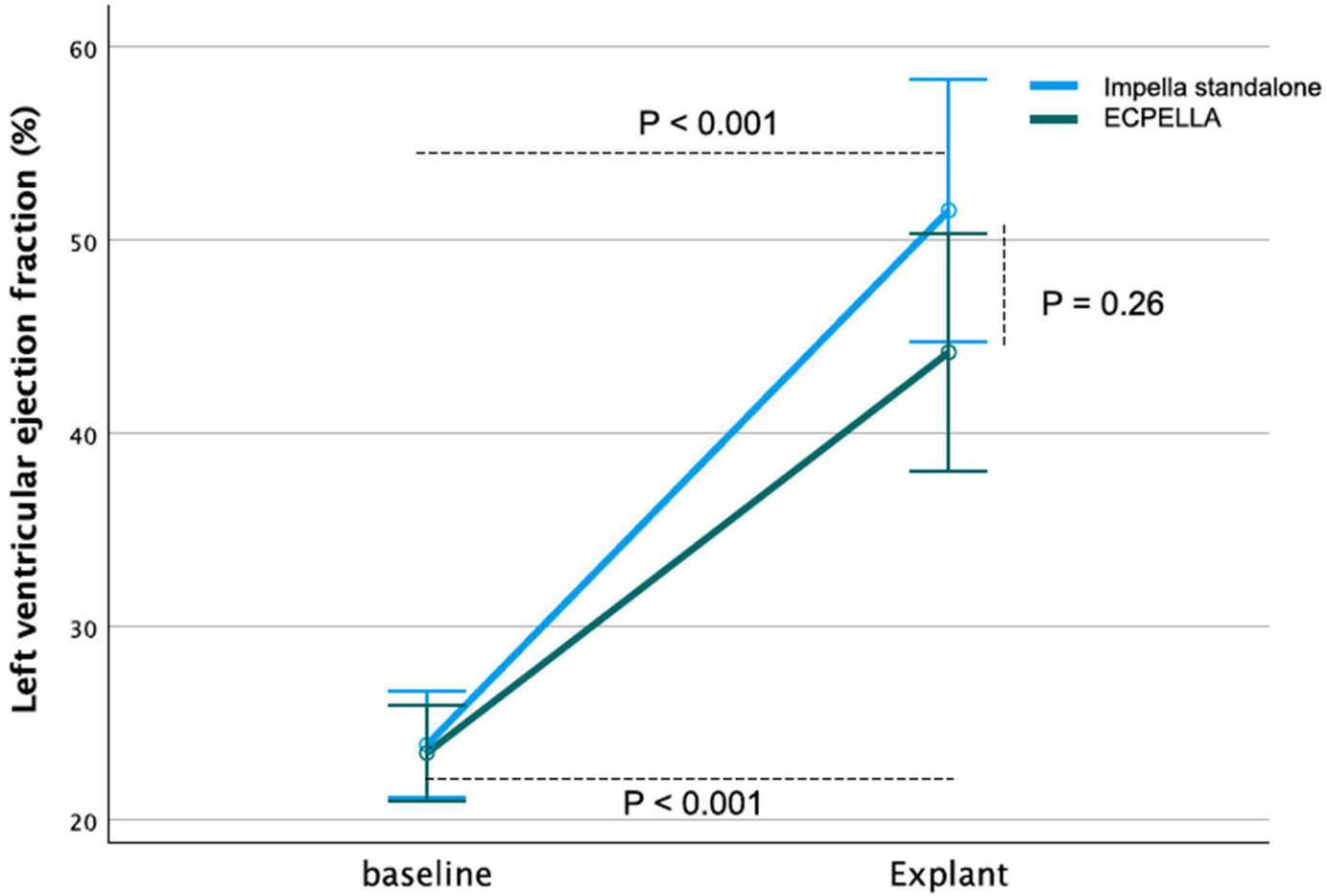
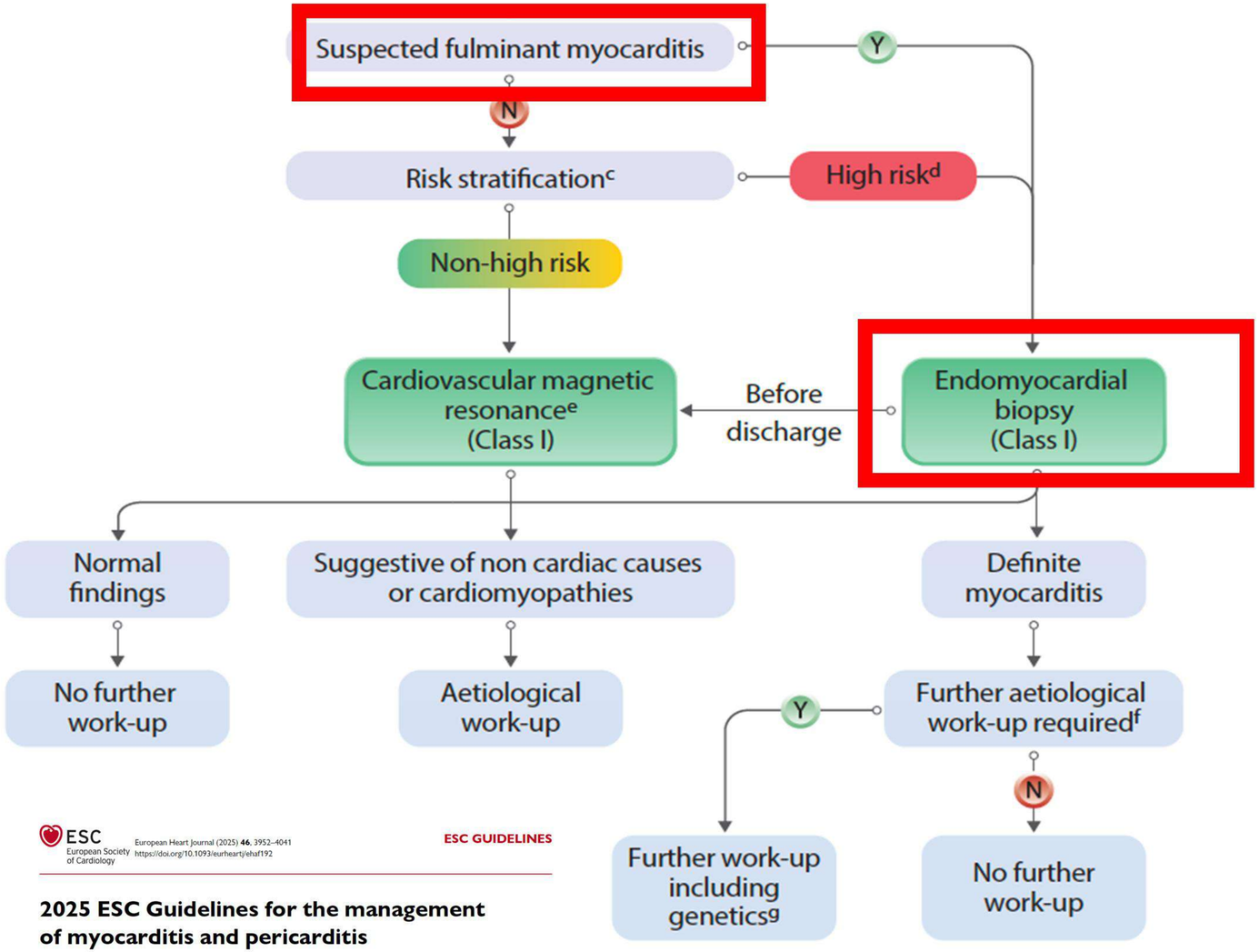


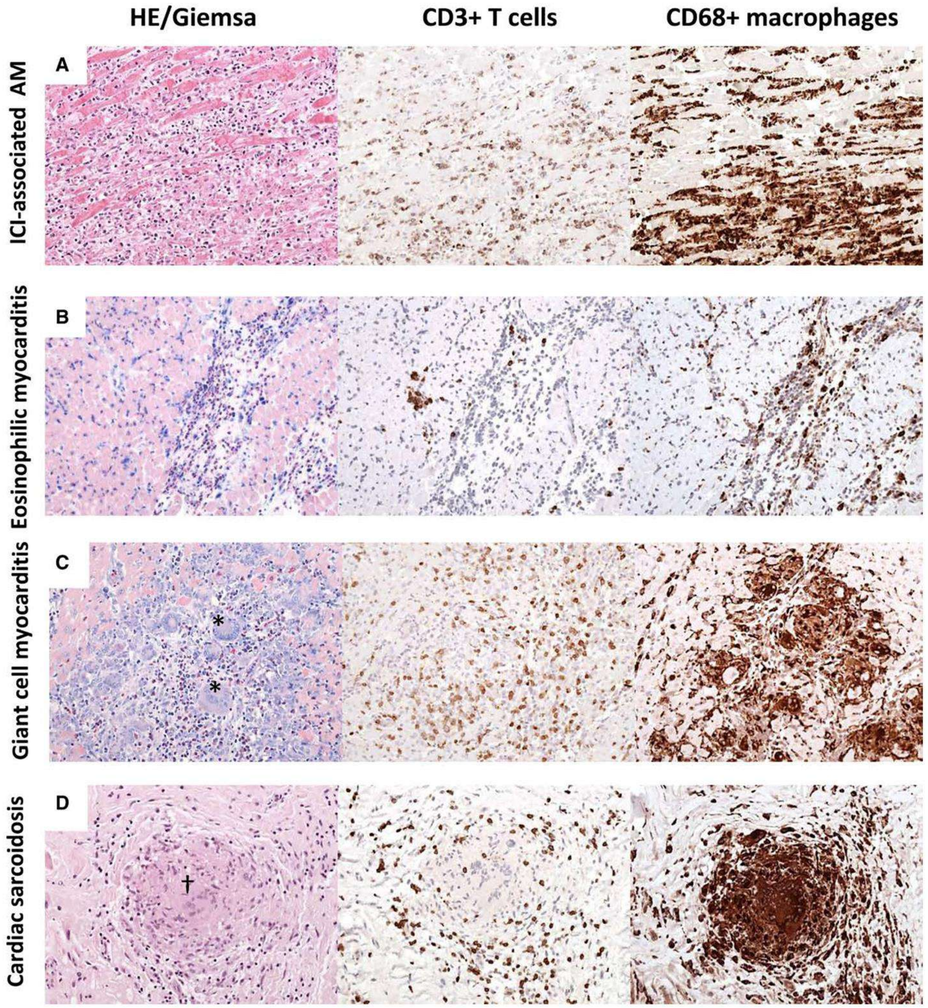
Risk	High risk	Intermediate risk	Low risk
Myocarditis	• Acute HF/cardiogenic shock • Dyspnoea NYHA III–IV refractory to medical therapy • Cardiac arrest/syncope[a] • Ventricular fibrillation/sustained ventricular tachycardia[a] • High-level AV block[a]	• New/progressive dyspnoea • Non-sustained ventricular arrhythmias • Persistent release or relapsing troponin	Stable symptoms or oligosymptomatic



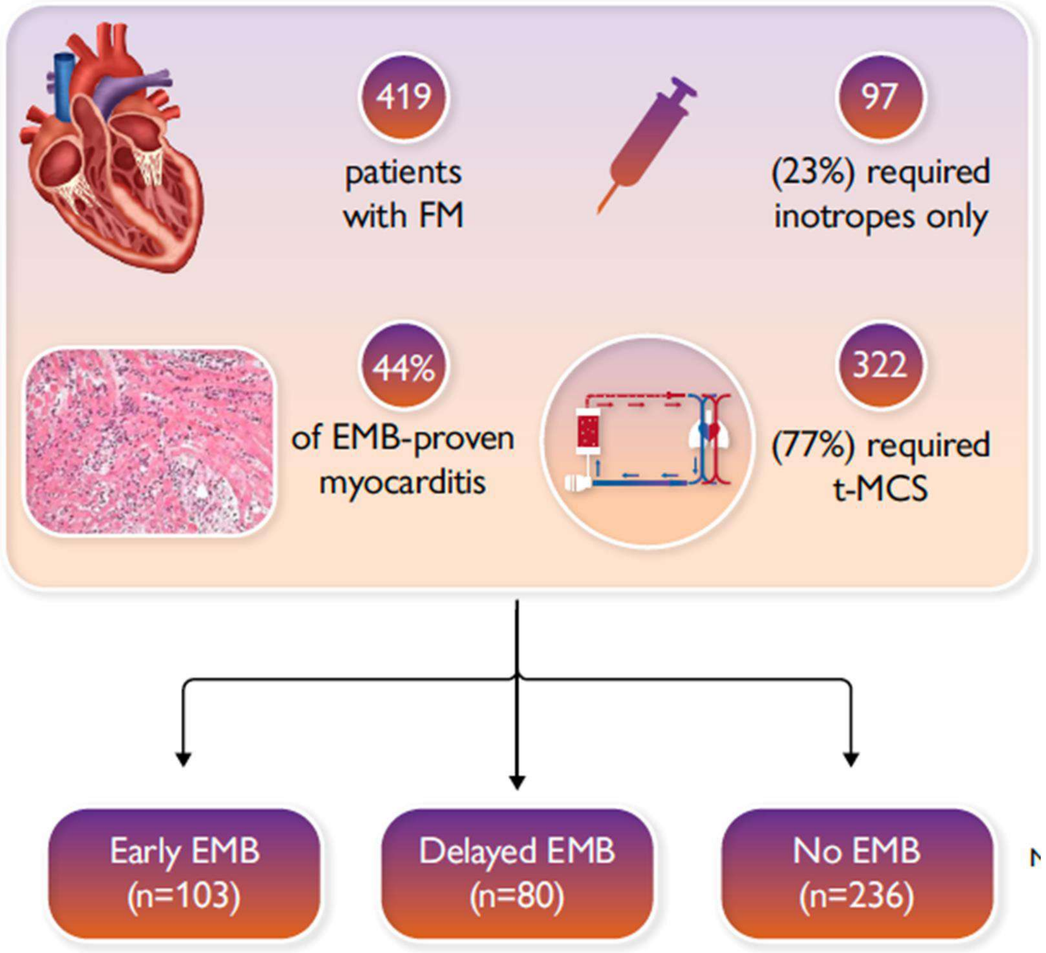
ESC European Society of Cardiology
European Heart Journal (2025) 46, 3952–4041
https://doi.org/10.1093/eurheart/ehaf192
ESC GUIDELINES

2025 ESC Guidelines for the management of myocarditis and pericarditis

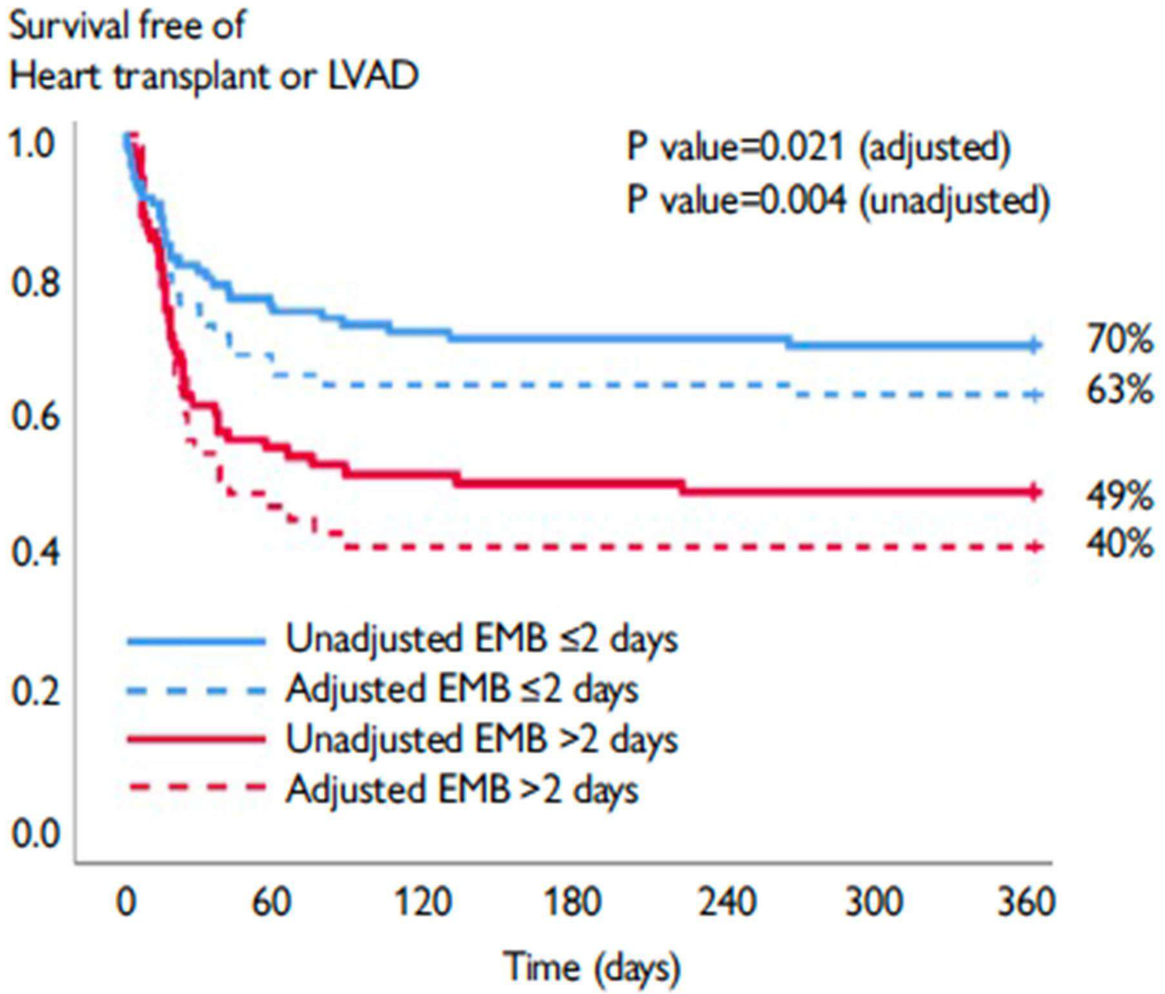
EMB is crucial in detecting the specific histotype of the AM and assessing the immunologic and virologic status of the myocardium through immunohistochemical and biomolecular PCR analyses.



Endomyocardial Biopsy in Fulminant Myocarditis: Timing and Clinical Impact



Overall survival free of heart transplantation or LVAD at one year after ICU admission: 65%



Eur Heart J 2023; ***44:*** *5110–5124*

ESC European Society of Cardiology
European Heart Journal (2025) **46**, 3952–4041|
https://doi.org/10.1093/eurheartj/ehaf192

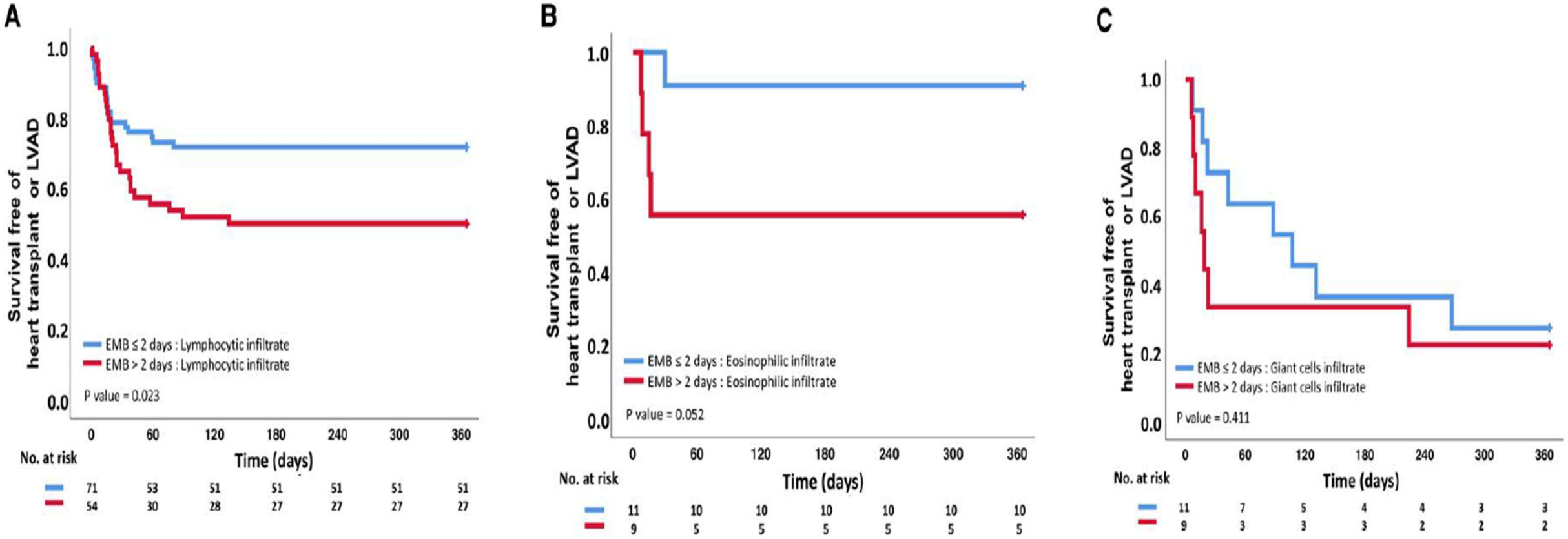
2025 ESC Guidelines for the management of myocarditis and pericarditis

Immunosuppressive therapy		
Corticosteroids should be considered in patients with fulminant, non-infectious forms of myocarditis to stabilize the patients.	**IIa**	**C**

ESC guidelines

- 500 copies/µg of DNA in EMB considered as the threshold for virus-related myocardial inflammation
- In cases of acute cardiac and systemic virus infection, immunosuppressive therapy must be avoided

Endomyocardial Biopsy in Fulminant Myocarditis: Timing and Clinical Impact



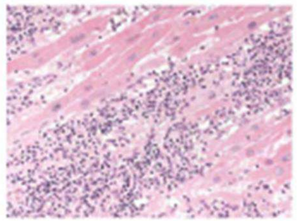
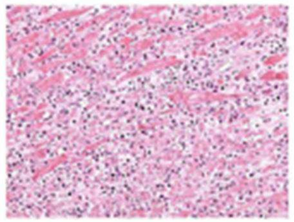
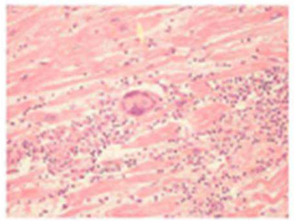
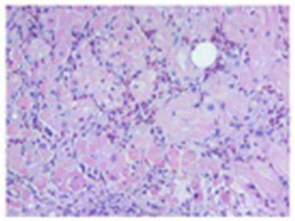
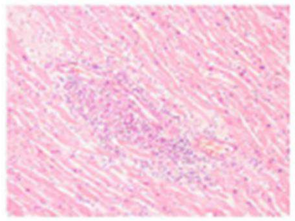
Eur Heart J 2023; 44: 5110–5124

Immune Suppressive Treatment

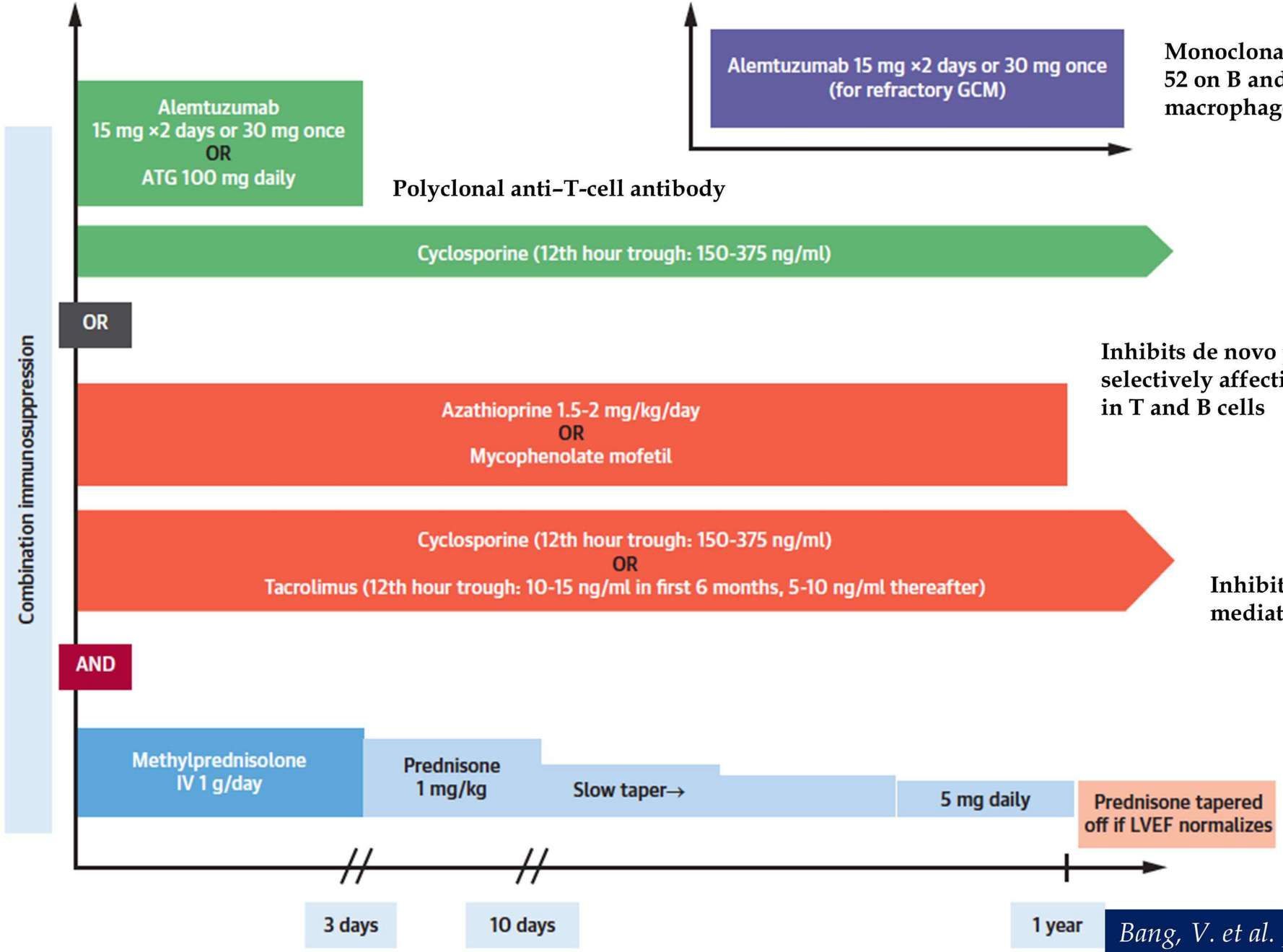
SUSPECTED FULMINANT OR COMPLICATED ACUTE MYOCARDITIS

↓

FIRST-LINE — **i.v. pulse methylprednisolone 7–14 mg/kg/day for 3 d, then 1 mg/kg/day**

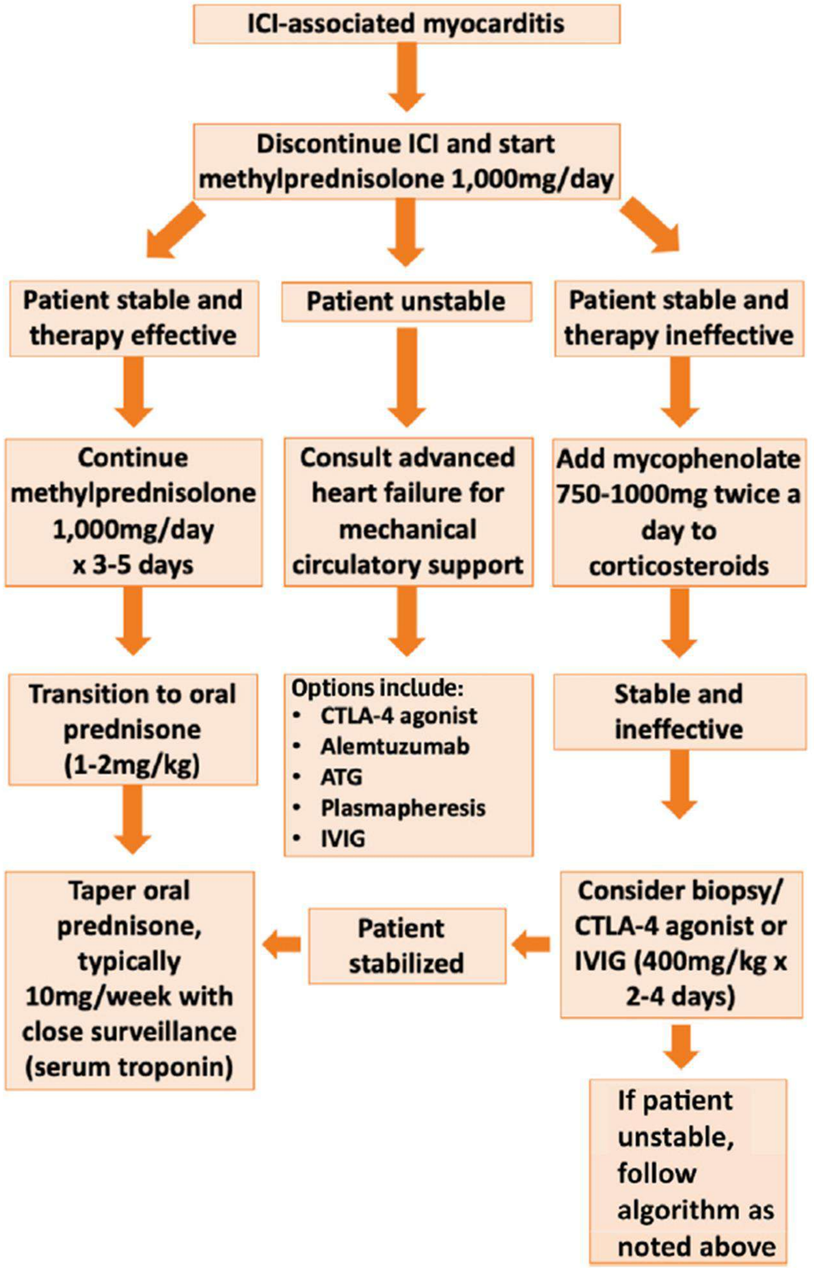
	 **LYMPHOCYTIC**	 **ICI-ASSOCIATED**	 **GIANT CELL**	 **EOSINOPHILIC**	 **SARCOIDOSIS**
ADDITIONAL	- If associated systemic autoimmune disorders (eg. SLE and APS): add aggressive treatment of associated conditions	**Hold ICI** therapy Confirm ICI-myocarditis via definitive imaging and/or endomyocardial biopsy	- If hemodynamically unstable pts: **ATG**, from 1 mg/kg, usually single-dose to 300 mg in 3 days or (alternative) i.v. **alemtuzumab** (anti-CD52 antibody) single dose of 30 mg plus oral **CyA**, BID, target through levels 150–250 ng/mL - If hemodynamically stable pts: only oral **CyA**, BID, target trough levels 150–250 ng/mL	- If EGPA: consider i.v. **cyclophosphamide** (especially in ANCA-positive pts), 600 mg*m² at days 1, 15, and 30 - If clonal (myeloproliferative) HES: **imatinib** 100–400 mg OD - If helminthic infection: **albendazole** 400 mg BID for 2–4 wk - If hypersensitivity reaction: **withdraw suspected drug**	
SECOND-LINE	**IVIG** (2 g/kg), single continuous infusion in 24–48 h or divided in 4 d or **plasmapheresis**, 3–5 sessions in 5–10 d	i.v. **abatacept** (a CTLA- 4 agonist) or **ATG**, 1 mg/kg, usually single dose or i.v. **alemtuzumab** (anti-CD52 antibody), 30 mg, single dose	i.v. **rituximab** 375 mg×m² (BSA) mg (once a wk for 4 wk and then every 4 mo as maintenance therapy) for 1 yr	- If DRESS, EGPA or idiopathic HES: anti-IL5 agents (e.g., **benralizumab** 30 mg s.c./4–8wk or **mepolizumab** 100-300 mg/4wk)	s.c. **methotrexate** 15–20 mg/wk or i.v. **infliximab** 5 mg/kg (up to 500 mg) at time 0 and after 2 and 4 wk and then every 6–8 wk or s.c. **adalimumab** 40 mg/2wk

Combination and Duration of Immunosuppressive Therapy in GCM



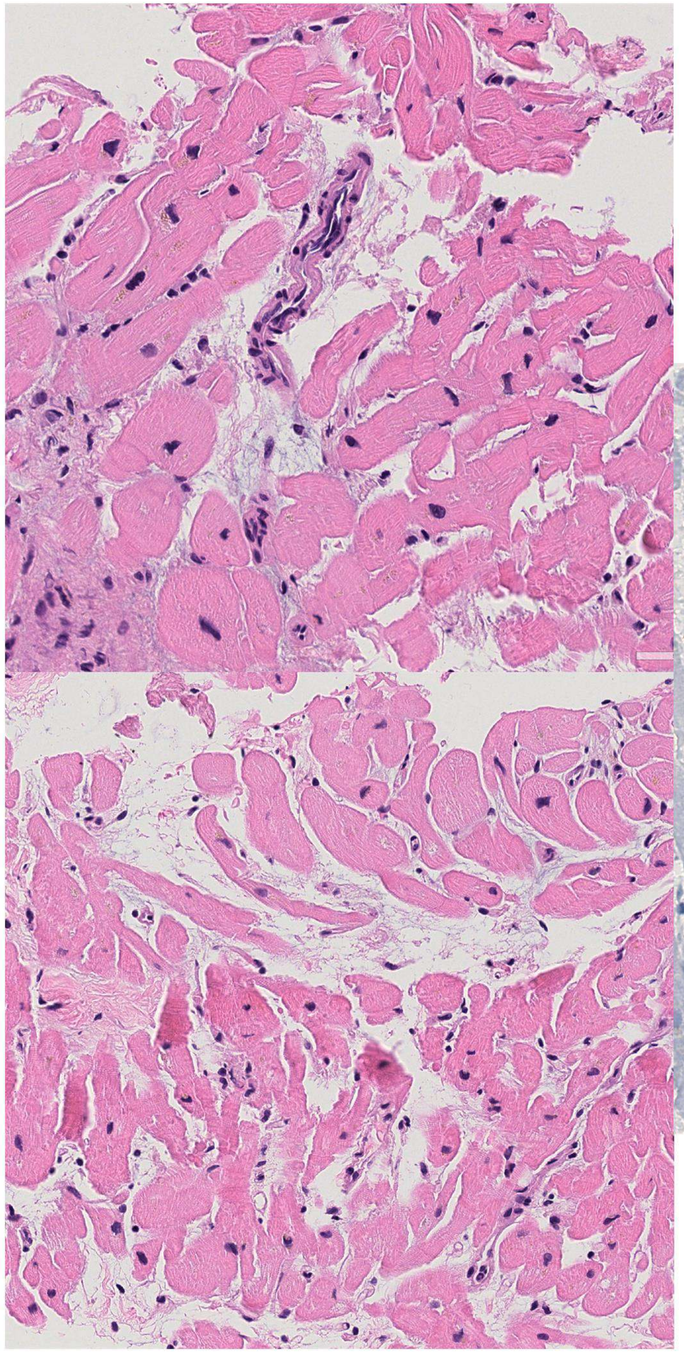
Bang, V. et al. JACC 2021;77(8):1122–34

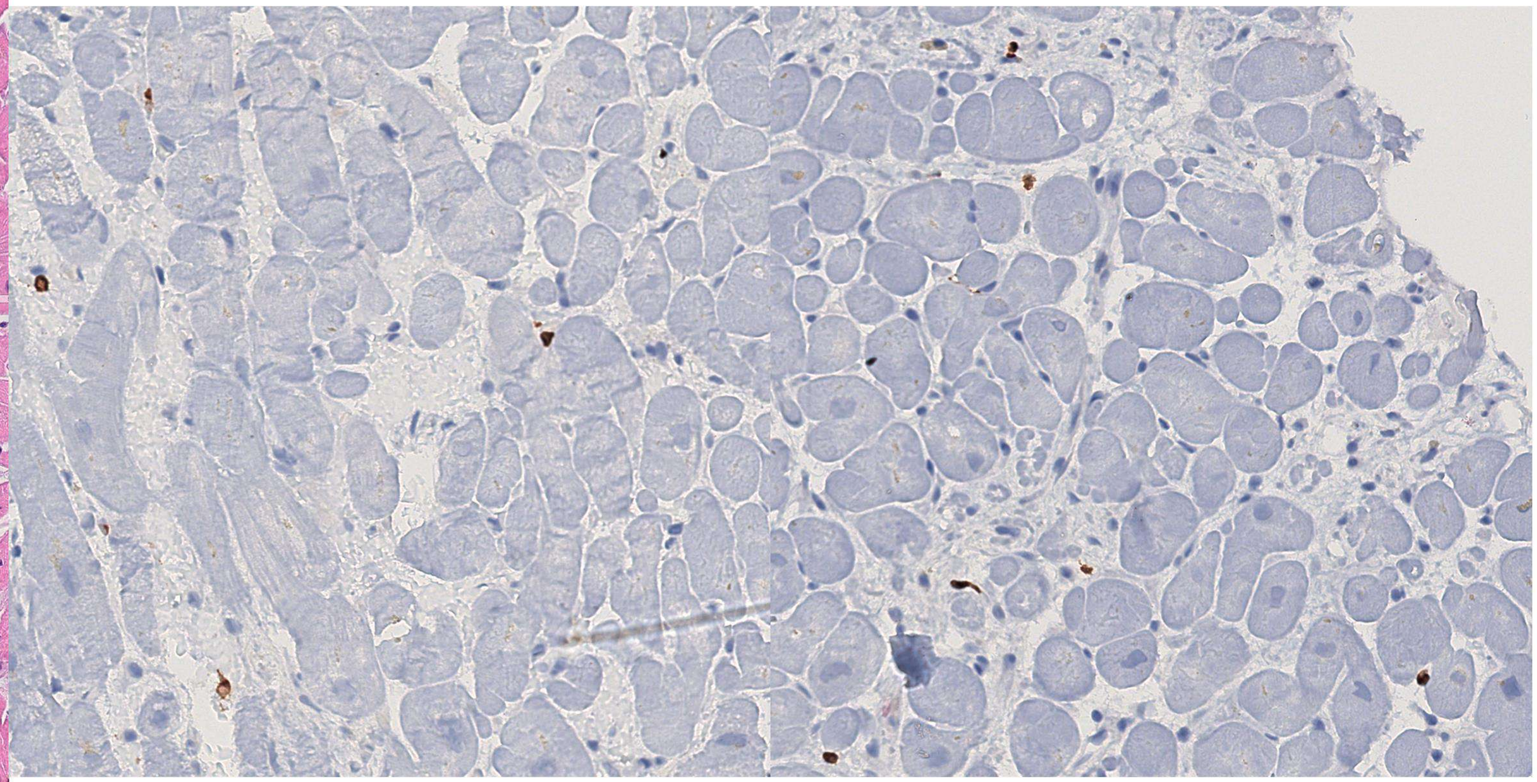
Proposed Treatment Algorithm for ICi-Associated Myocarditis



J Am Coll Cardiol CardioOnc 2021;3:35–47

…….Clinical case - EMB



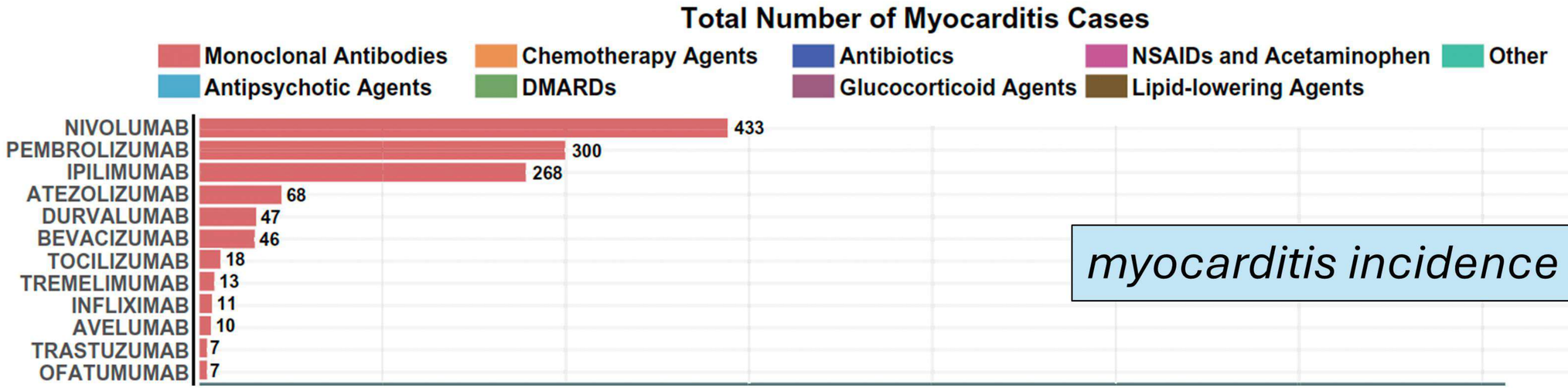


Virus negative

Journal of the American Heart Association

ORIGINAL RESEARCH

Evolving Trends and Drug Class Dynamics in Drug-Induced Myocarditis: A 2-Decade Comparative Analysis of Pharmacovigilance Data



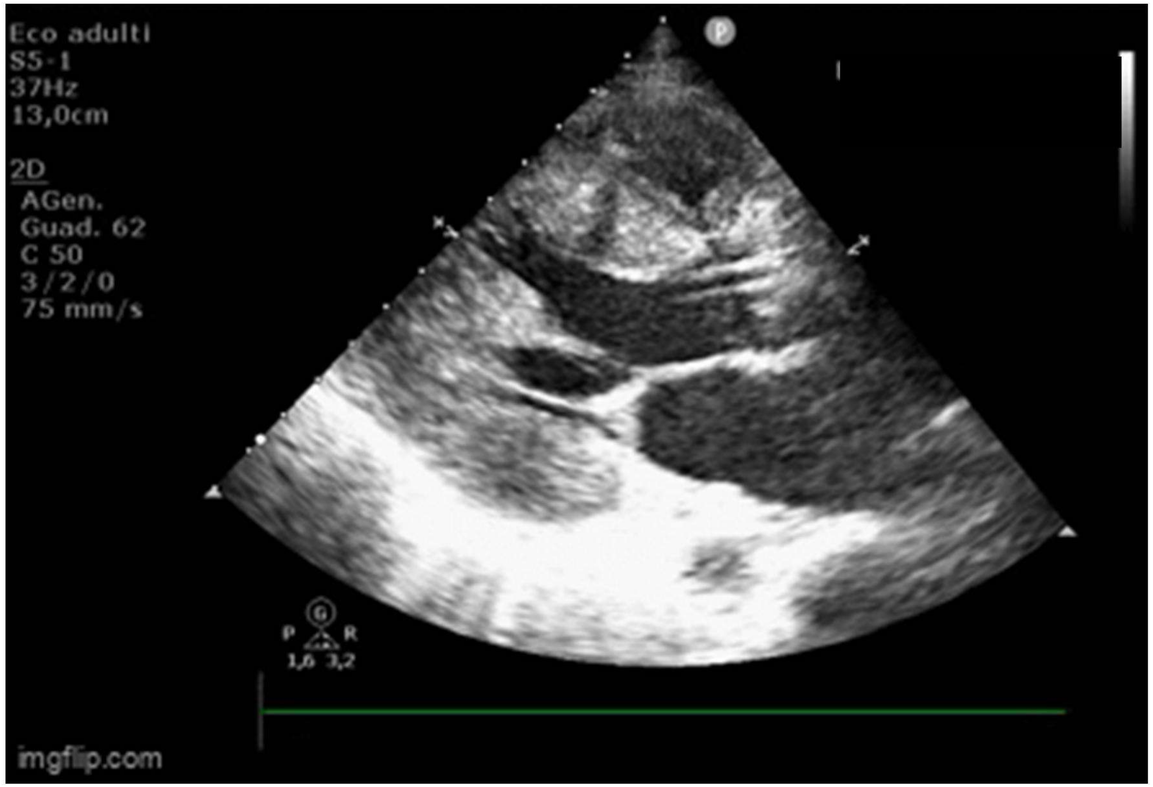
myocarditis incidence rate: 2.9%

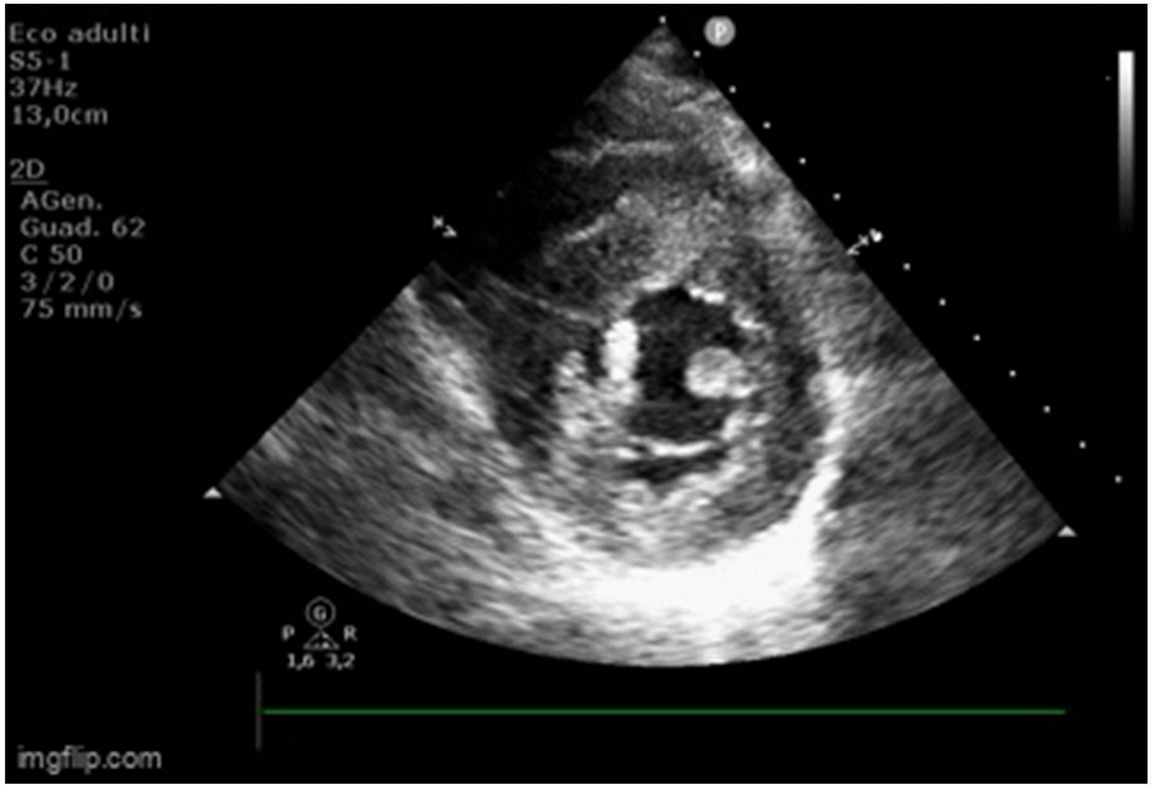
Table 2. Top 50 Drugs Associated With Reports of Myocarditis to the JADER From 2004 to 2023

Drug name and rank	Total adverse event reports	Myocarditis reports (‰)	Maximum annual reports (y)	Median, y [IQR]*	Female sex (%), n=3638†
45. Ofatumumab	237	7 (29.54)	7 (2014)	2014 [2014–2014]	0 (0.00)

Linping Si et al. J Am Heart Assoc. 2025;14:e043064.

Clinical case – ECMO WEANING (DAY 8)





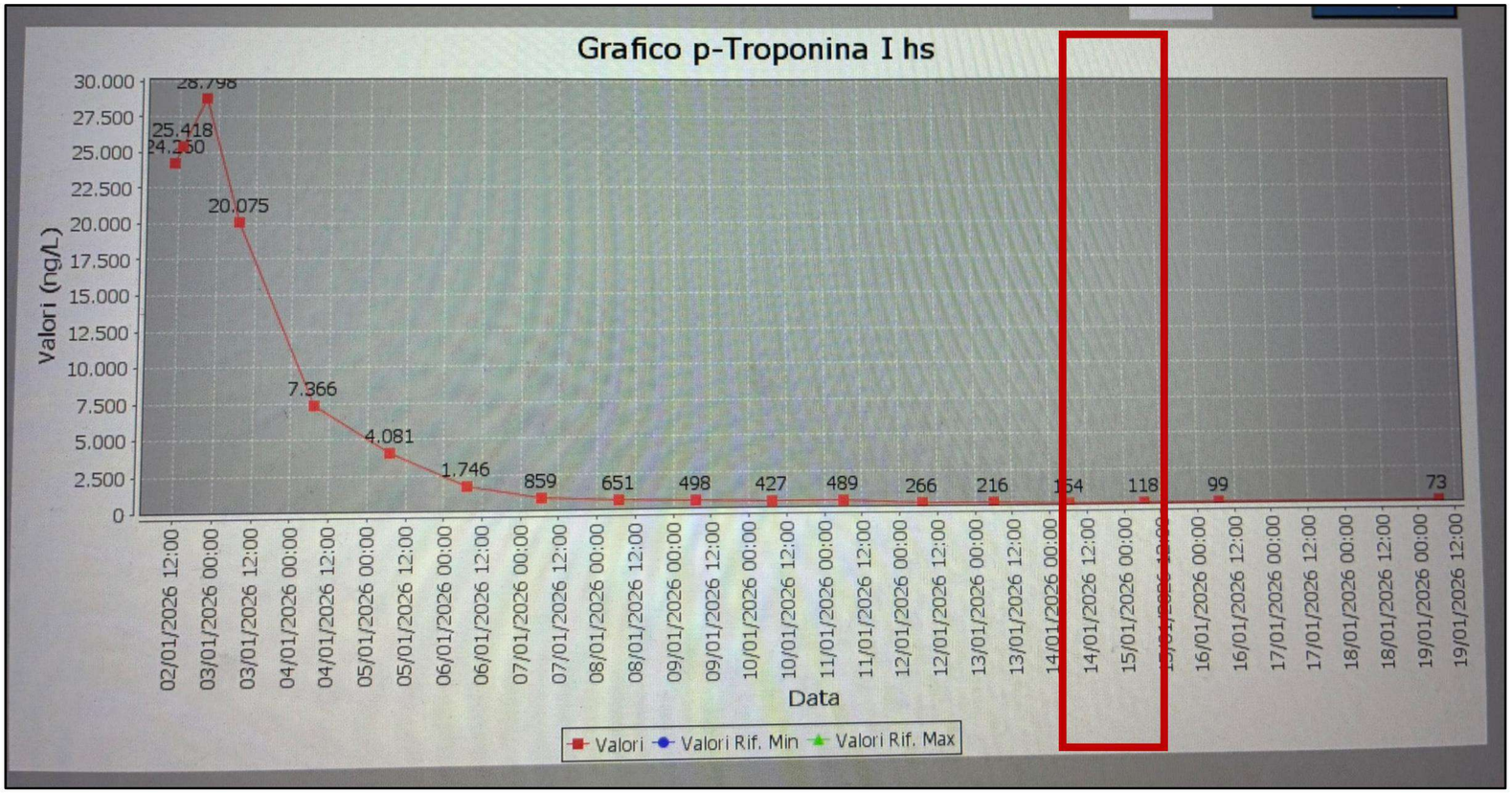
- Epinephrine 0.05 µg/kg/min
- Impella P4

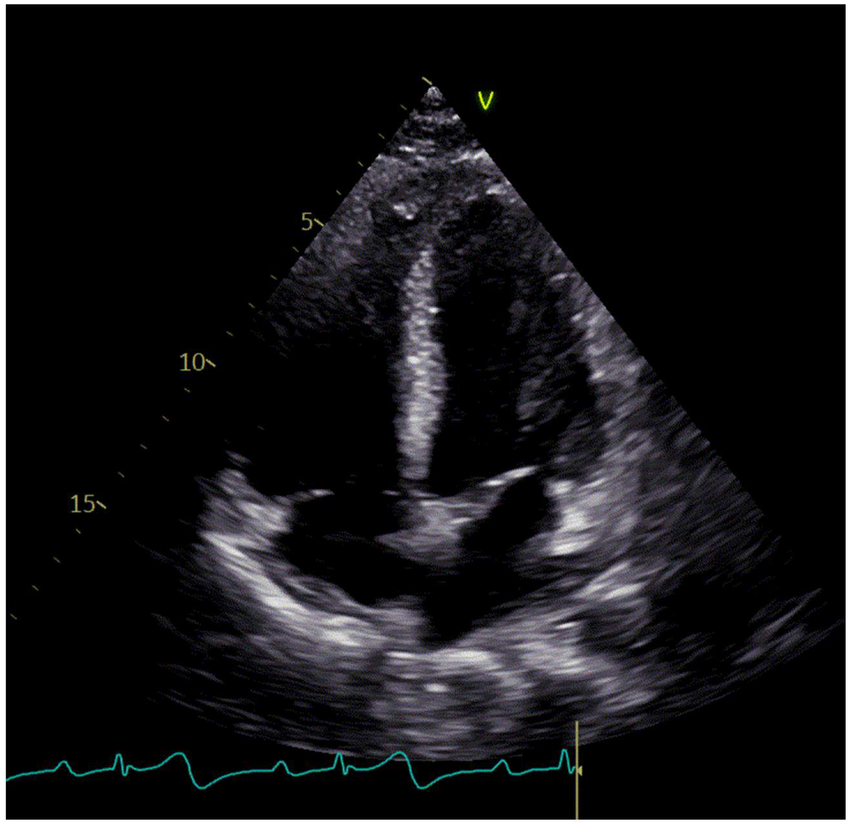
Right femoral access hematoma

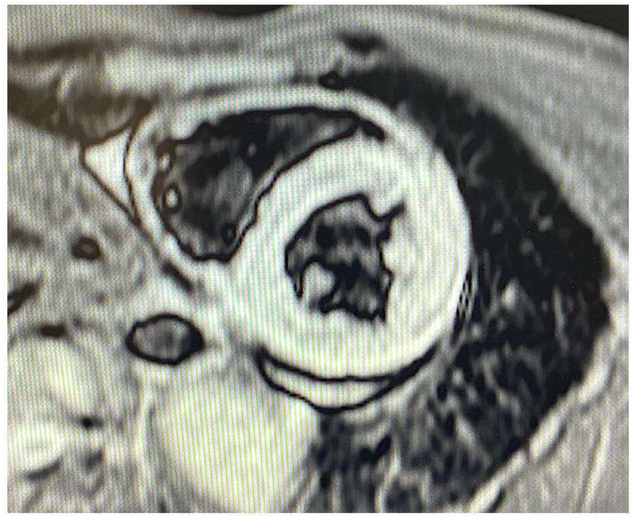
Clinical case – Impella weaning (day 11)

Day 14

- Troponine 118, creatinine 0.7
- Ramipril 2.5 mg, Bisoprololo 5 mg, Colchicina 1 mg







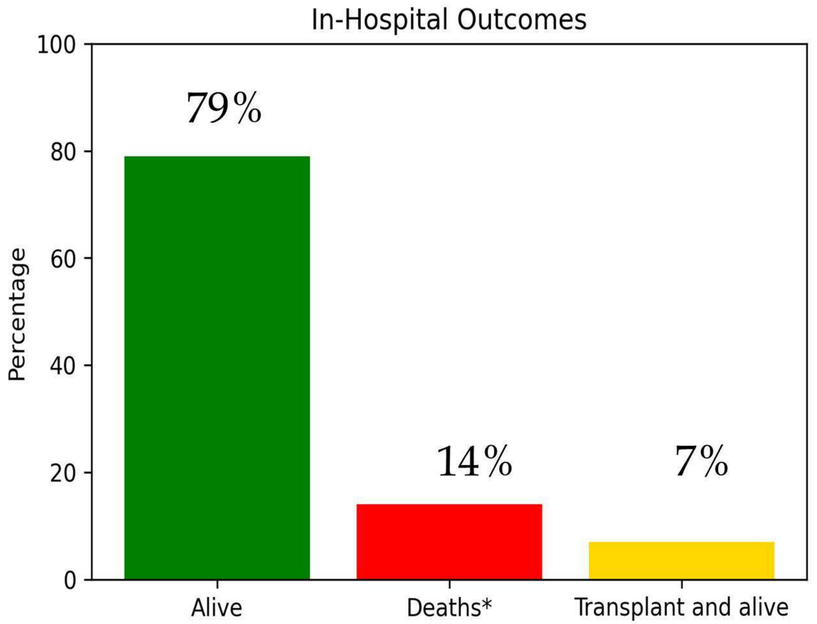
- T2: 68 msec, (v.n. <55 msec)
- ECV 40.5% (v.n. 20-30%)
- Mild midwall LGE infero-lateral

Fulminant Myocarditis Hub-and-Spoke Network (Molinette) – Real-World Data 2024–2025

	N=14
Baseline Characteristics	
Male sex	57% (8)
Age	50 anni (IQR 40-56)
LVEF at presentation	20% (IQR 15-30%)
Lactate	4 mmol/L (IQR 3-12)
Clinical managment	
Endomyocardial biopsy	93% (13)
Inotropes	100% (14)
MCS	57% (8)
IABP	36% (7)
Impella	39% (4)
ECMO	57% (8)
Invasive mechanical ventilation	43% (6)
Immunosoppressive therapy	86% (12)
Corticosteroids	86% (12)
Other agents:	36% (5)

Centre	N=14
Molinette	5
Aosta	1
Moncalieri	2
Ciriè	1
Gradenigo	1
Ivrea	1
Biella	1
Verduno	1
Mondovi	1

Diagnosi	N=13
Lymphocytic, virus-negative myocarditis	5
Giant cell myocarditis	1
Eosinophilic myocarditis	2
ICI-related	2
Anti-CD20 related	2
LES-related	1



*n = 1 transplant + death

Survival to hospital discharge: 86%

LVEF at ICU discharge: 45% (IQR 37–49)

Take-Home Messages

- Fulminant myocarditis is a time-critical syndrome with rapidly evolving clinical course
- Outcomes are driven by early clinical suspicion and prompt referral within an integrated Hub-and-Spoke network
- Hemodynamic stabilization and timely deployment of mechanical circulatory support are essential pre-requisites for survival
- Early endomyocardial biopsy is pivotal for precision medicine, enabling etiology-driven therapeutic strategies
- Shock Team–based decision making converts complexity into coordinated, life-saving care