



Choix des amines dans le choc cardiogénique

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INTRODUCTION

- **Choc cardiogénique: (CC)** syndrome qui regroupe les manifestations d'une détérioration **aigue** et **durable** de l'oxygénation tissulaire en rapport avec une défaillance prépondérante ou le plus souvent exclusive de la pompe cardiaque.
- Débit cardiaque effondré.
- Urgence Diagnostique et thérapeutique.

DÉFINITIONS- CLASSIFICATIONS

Clinical Definition	SHOCK Trial ¹⁴	IABP-SHOCK II ¹⁴	ESC HF Guidelines ¹⁵
Cardiac disorder that results in both clinical and biochemical evidence of tissue hypoperfusion	Clinical criteria: SBP <90 mmHg for ≥30 min OR Support to maintain SBP ≥90 mmHg AND End-organ hypoperfusion (urine output <30 mL/h or cool extremities)	Clinical criteria: SBP <90 mmHg for ≥30 min OR Catecholamines to maintain SBP >90 mmHg AND Clinical pulmonary congestion AND	SBP <90 mmHg with adequate volume and clinical or laboratory signs of hypoperfusion Clinical hypoperfusion: Cold extremities, oliguria, mental confusion, disorientation, narrow pulse pressure Elevated serum lactate, >2 mmol/L

Hypotension (PAS < 90 mmHg)

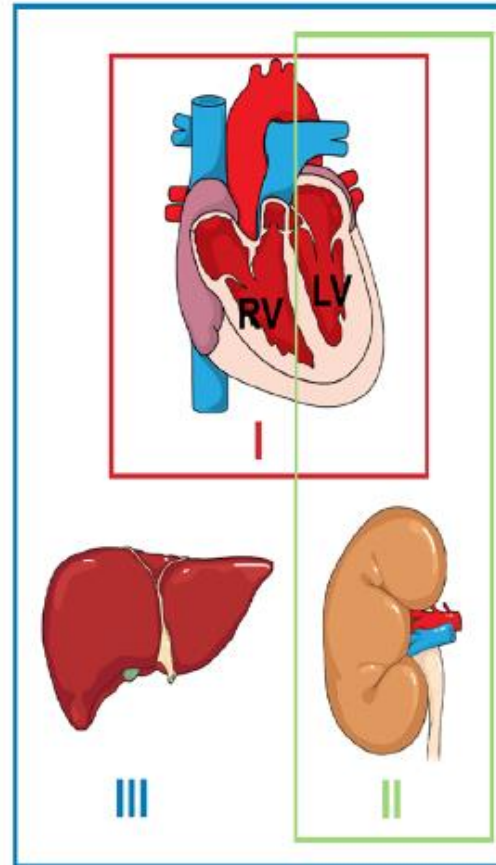
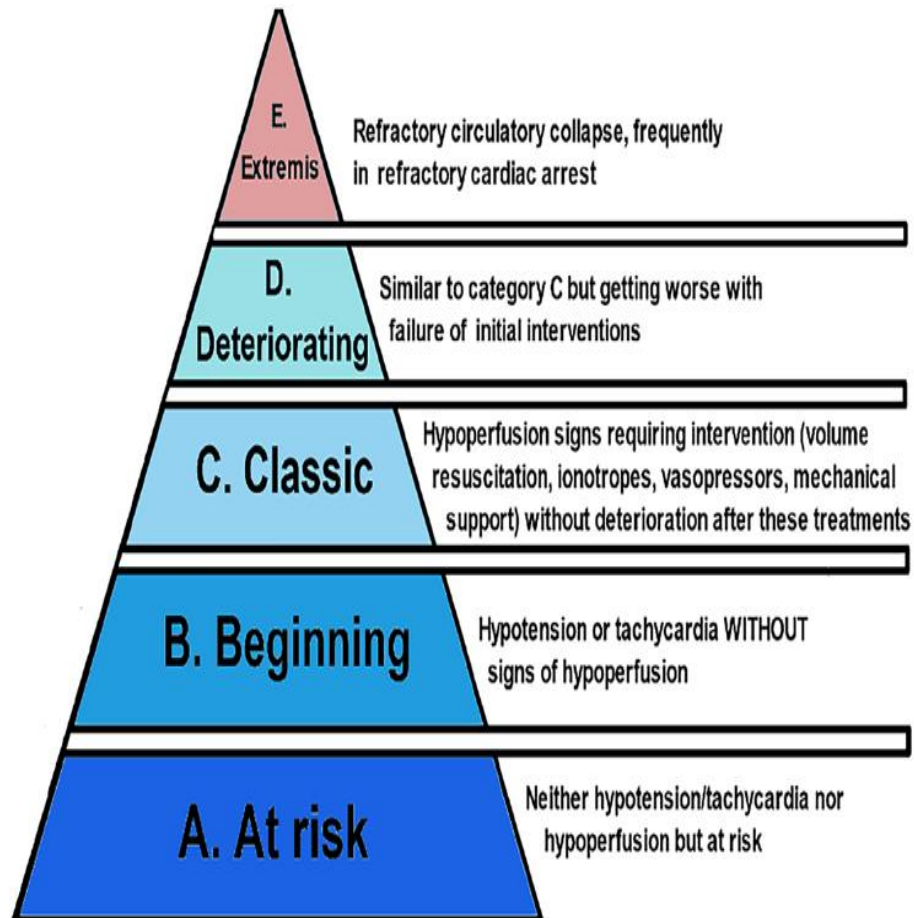
+

Pressions de remplissage normales ou augmentées

+

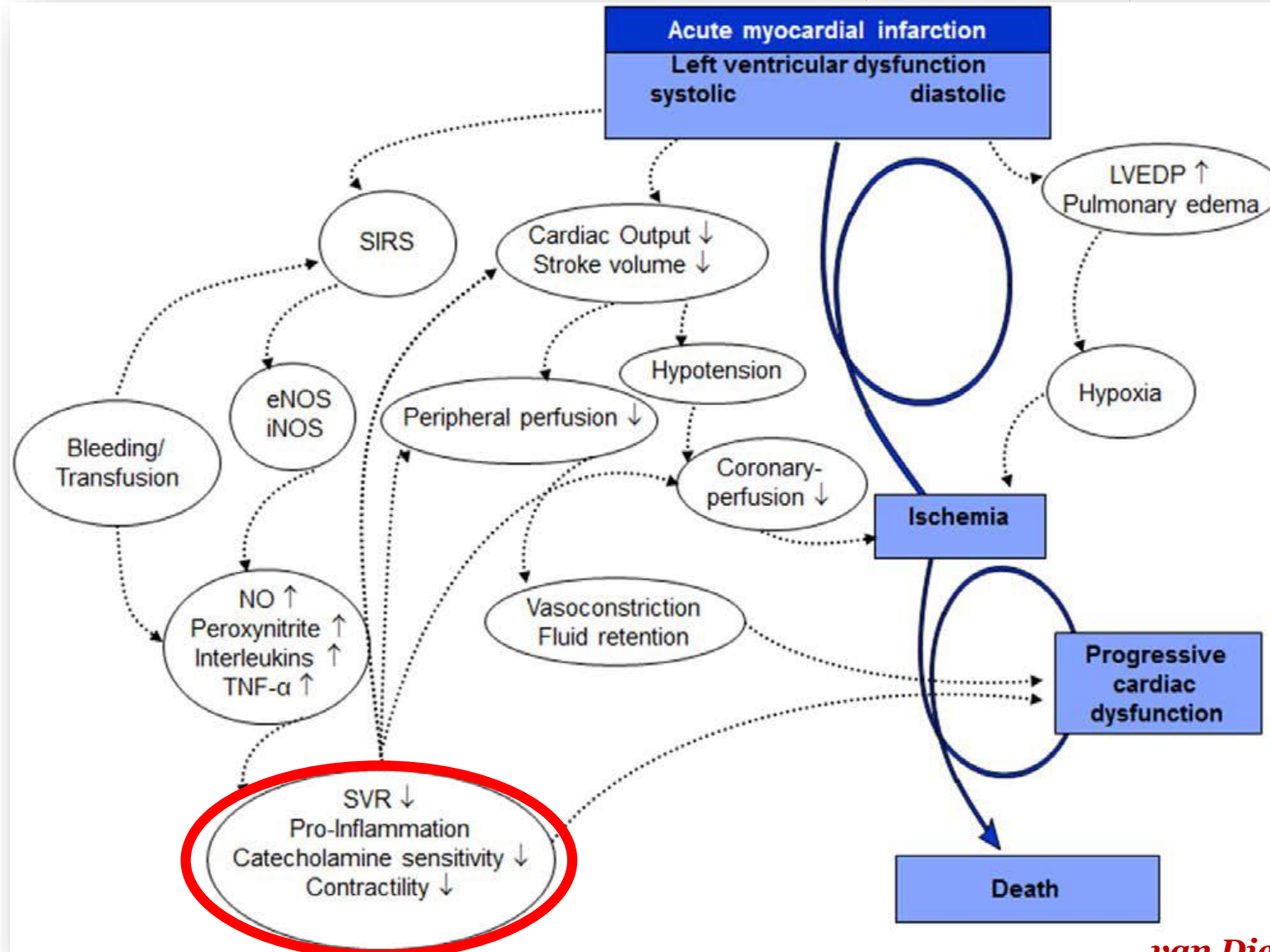
Signes d'hypoperfusion d'organes

DÉFINITIONS- CLASSIFICATIONS

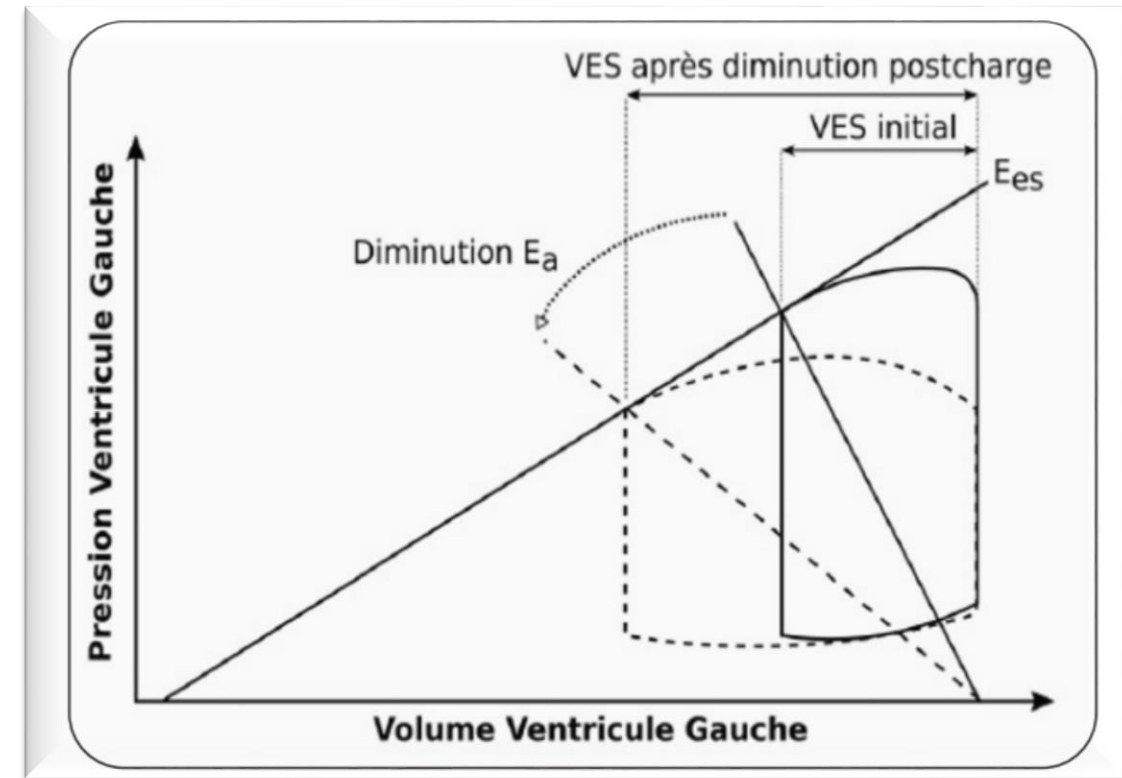
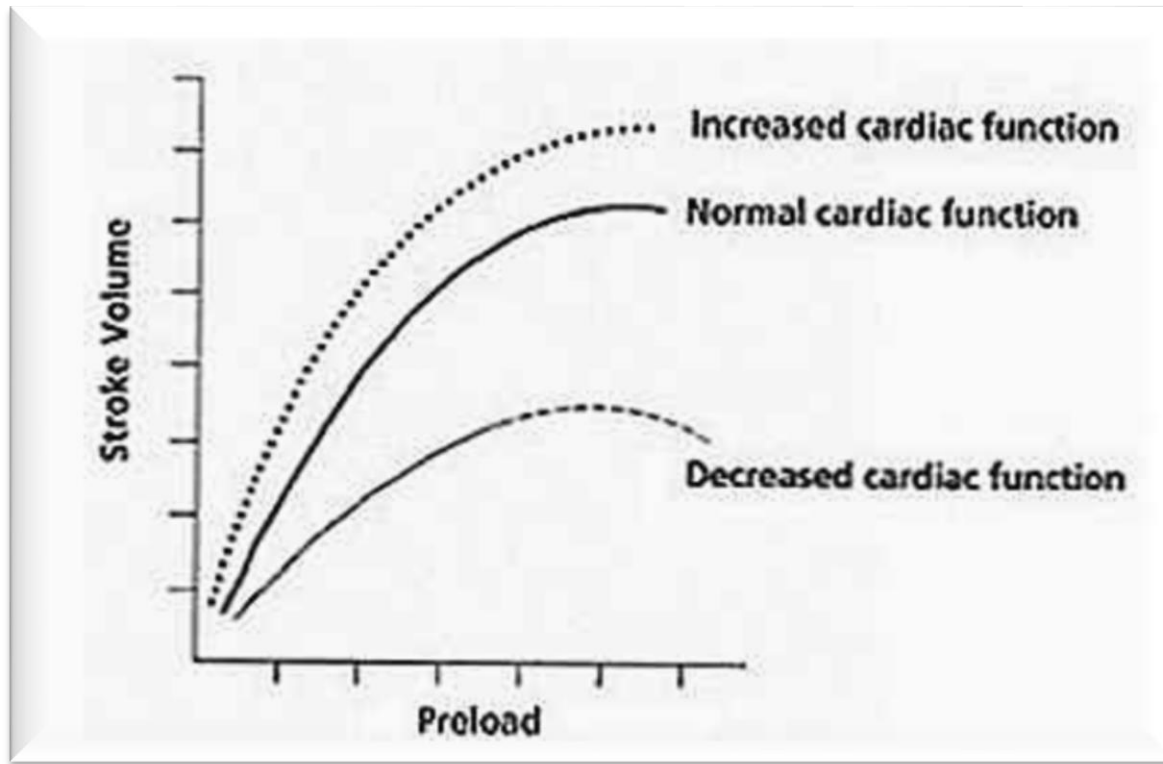


		Volume Status	
		Wet	Dry
Peripheral Circulation	Cold	$\downarrow$ CI $\uparrow$ SVRI $\uparrow$ PCWP Classical Cardiogenic shock	$\downarrow$ CI $\uparrow$ SVRI $\leftrightarrow$ PCWP Euvolemic Cardiogenic shock
	Warm	$\downarrow$ CI $\downarrow/\leftrightarrow$ SVRI $\uparrow$ PCWP Vasodilatory Cardiogenic shock or Mixed shock	$\uparrow$ CI $\downarrow$ SVRI $\downarrow$ PCWP Vasodilatory shock Not cardiogenic shock

RÉPONSE INFLAMMATOIRE LORS DU CC



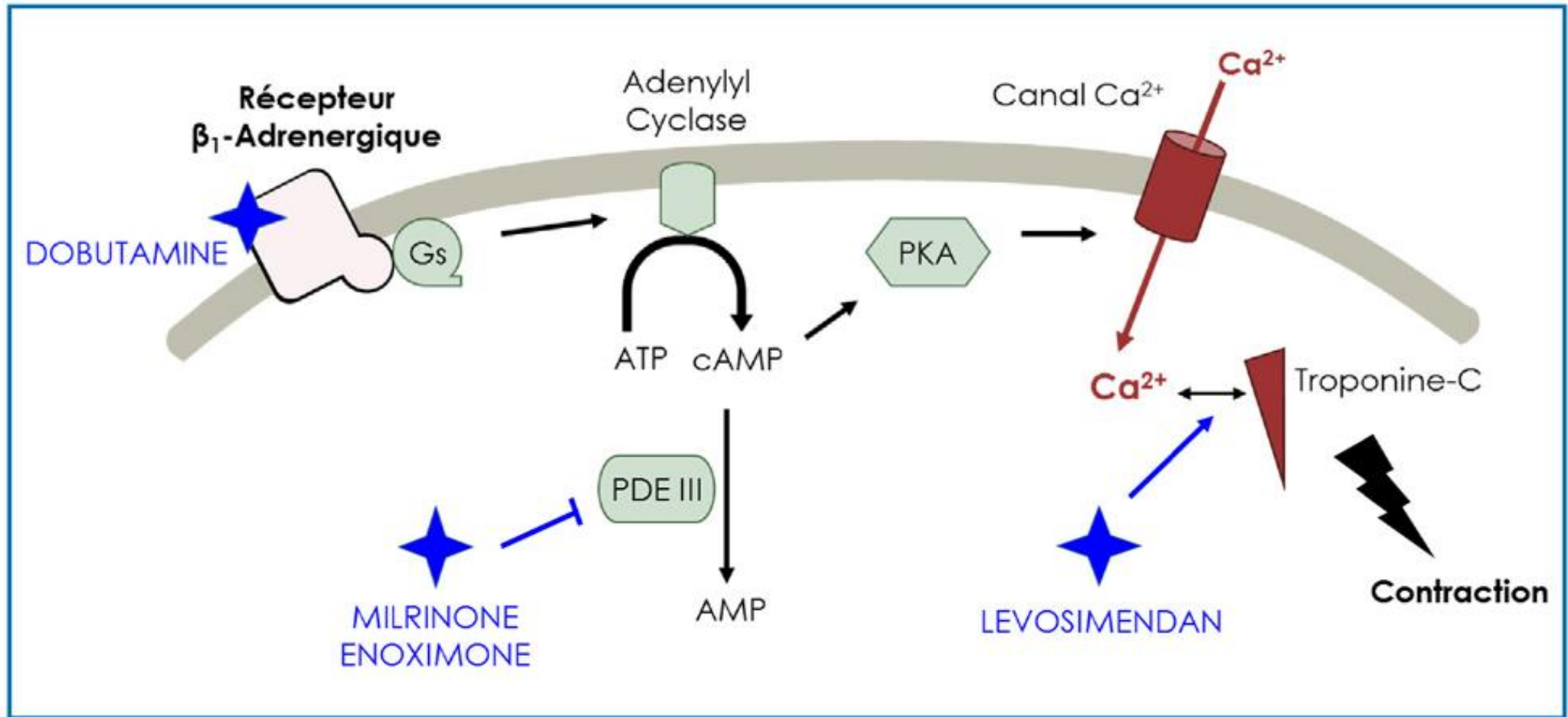
PRÉCHARGE ET POST CHARGE CARDIAQUE LORS DU CC



INOPRESSEURS

INODILATEURS

LES MÉCANISMES D'ACTION DES INODILATEURS



Cardiogenic shock management

A. Etiologic therapy



Coronary artery revascularization, valvular disease management, arrhythmia and conduction disorders management

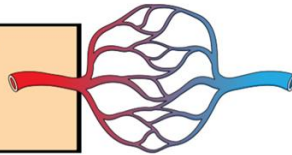
B. Optimizing Hemodynamic

1- Improve Tissue perfusion

If Increase venous pressure and/or pulmonary congestion
Diuretics loop, Renal replacement therapy

If low blood pressure
Vasopressor:
Norepinephrine

Treated other causes of vasoplegia (sepsis,...)



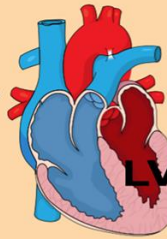
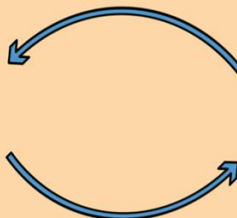
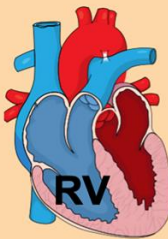
2- Improve Pump function

If Decrease RV or LV contractility => Inotropes: Dobutamine (Milrinone, Levosimendan)

Manage Heart rate: Reduction of supra- or ventricular arrhythmia/ Improves HR if conduction disorders: Isoprenaline

If RV filling inadequate
Volume expansion
Decrease extra wall pressure

If Increase RV afterload
Improvement of LV function
Decrease Intrathoracic pressure



If LV filling inadequate
Optimize intravascular volume/ Decrease transpulmonary pressure

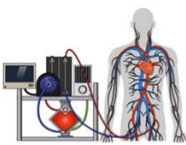
If Increase LV afterload
P... v... reduce

Inotrope +

C. Manage other organ dysfunction



Oxygenation
Non- or invasive Mechanical Ventilation
Reduce metabolic needs: sedation, curarization
Acidosis and /or overload control: Renal replacement therapy



If refractory cardiogenic shock, consider acute mechanical circulatory support

vasopresseur

The **NEW ENGLAND**
JOURNAL *of* **MEDICINE**

ESTABLISHED IN 1812

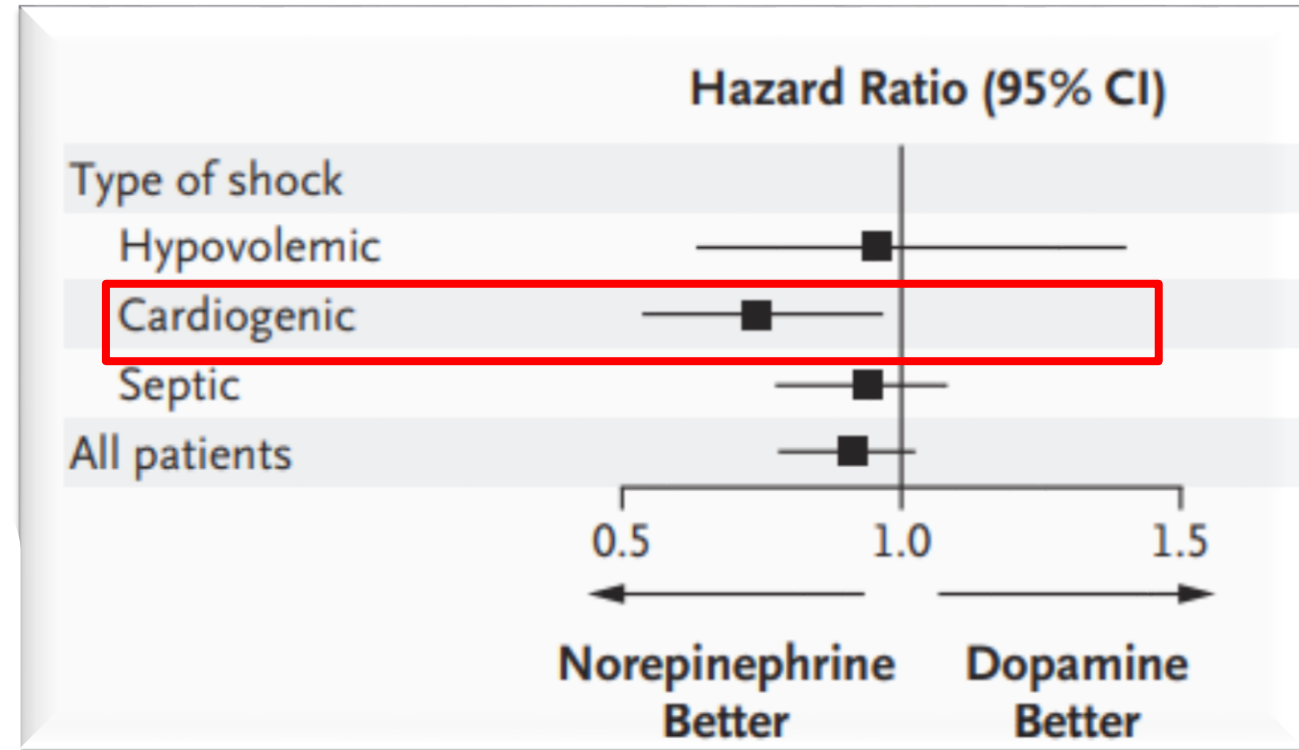
MARCH 4, 2010

VOL. 362 NO. 9

Comparison of Dopamine and Norepinephrine
in the Treatment of Shock

Daniel De Backer, M.D., Ph.D., Patrick Biston, M.D., Jacques Devriendt, M.D., Christian Madl, M.D.,
Didier Chochrad, M.D., Cesar Aldecoa, M.D., Alexandre Brasseur, M.D., Pierre Defrance, M.D.,
Philippe Gottignies, M.D., and Jean-Louis Vincent, M.D., Ph.D., for the SOAP II Investigators*

- Étude multicentrique, randomisée
- 1679 patients en EDC
- Critère de jugement principal: mortalité à j28



Comparison of norepinephrine-dobutamine to epinephrine for hemodynamics, lactate metabolism, and organ function variables in cardiogenic shock. A prospective, **randomized pilot study***

Bruno Levy, MD, PhD; Pierre Perez, MD; Jessica Perny, MD; Carine Thivilier, MD; Alain Gerard, MD

- **Période: 26 mois**
- **Exclusion : IDM/recours à assistance circulatoire**

Pré-inclusion



Pre-inclusion management including Swan-Ganz and tonometer insertion .



Dopamine-Dobutamine



Persistence of shock $\Rightarrow$ study inclusion

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- 
- 30 patients
 - (15 Adré/15 NAD)

H0-H1

Switch dopamine for norepinephrine or epinephrine
Dobutamine : stop in the epinephrine group and keep unchanged in the norepinephrine group.



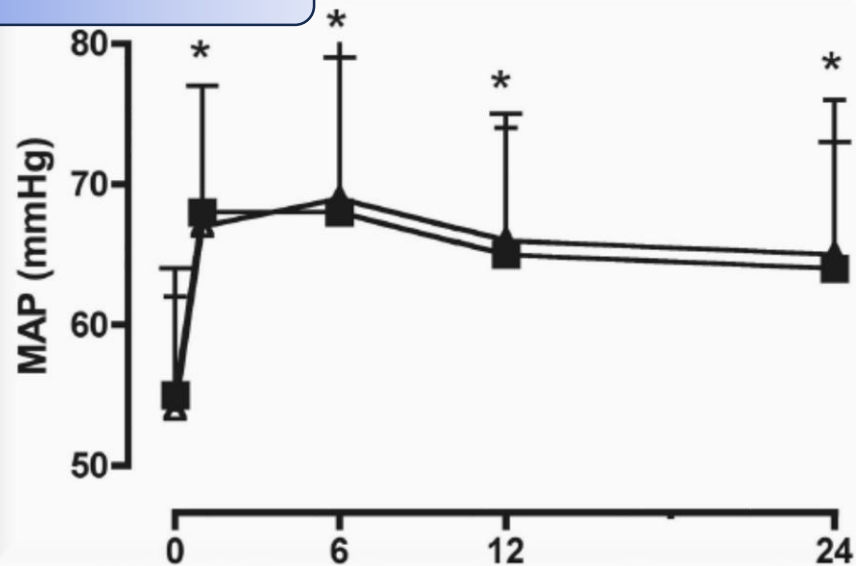
After H1

Drugs adjustment according to MAP and CI.
Tapering of the study drug if the target mean arterial pressure had been maintained for 8 hours.
At each time, consideration for mechanical assistance device.

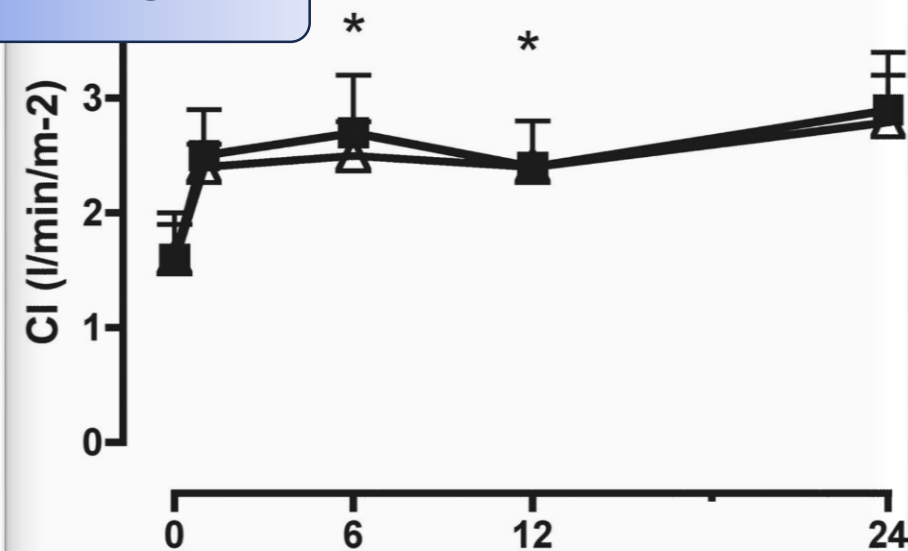


D28 mortality

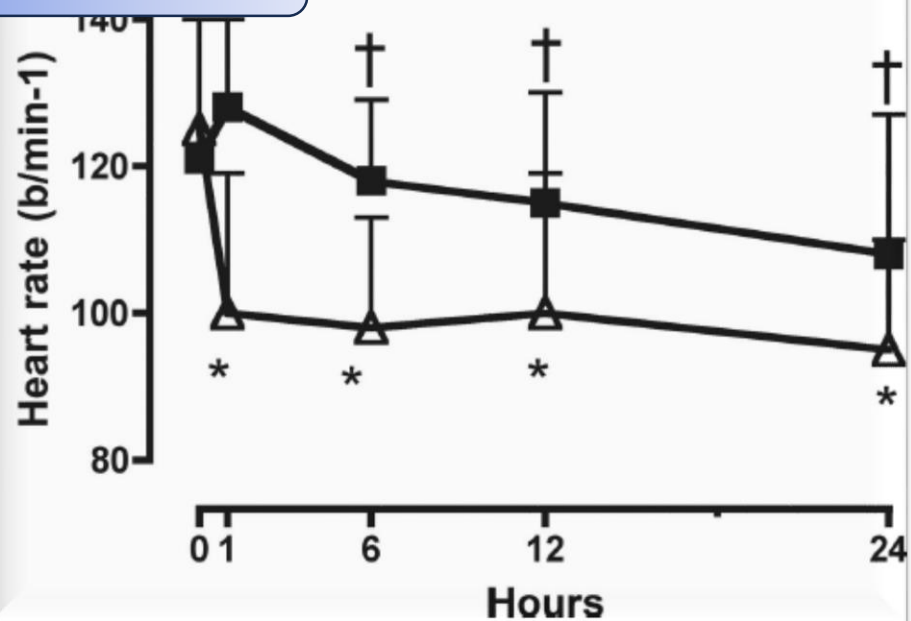
PAM



IC



FC



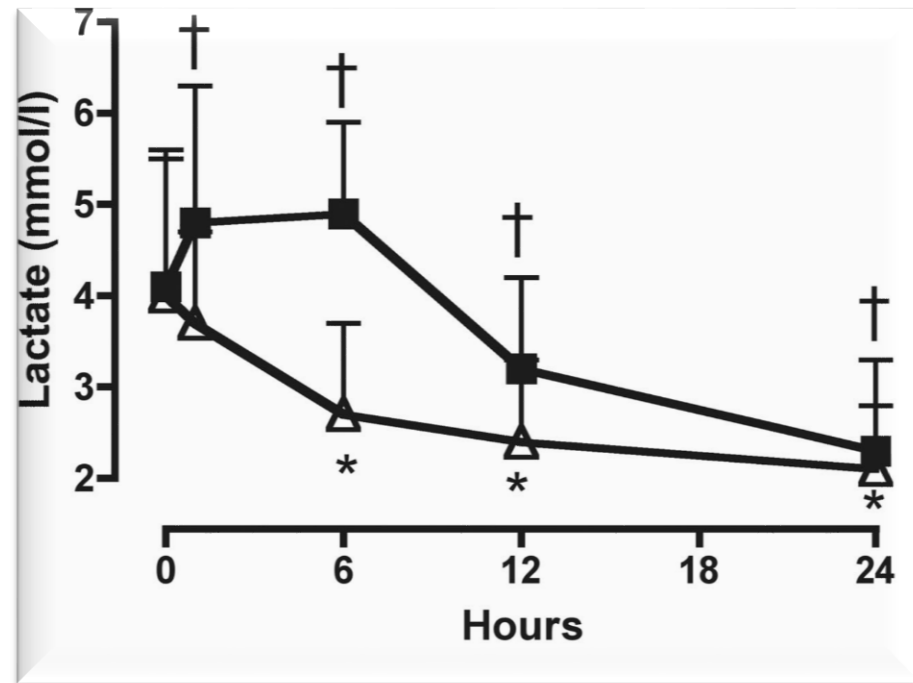
Augmentation significative de la PAM
et DC (2 groupes)

Augmentation significative de la FC
dans le groupe Adrénaline

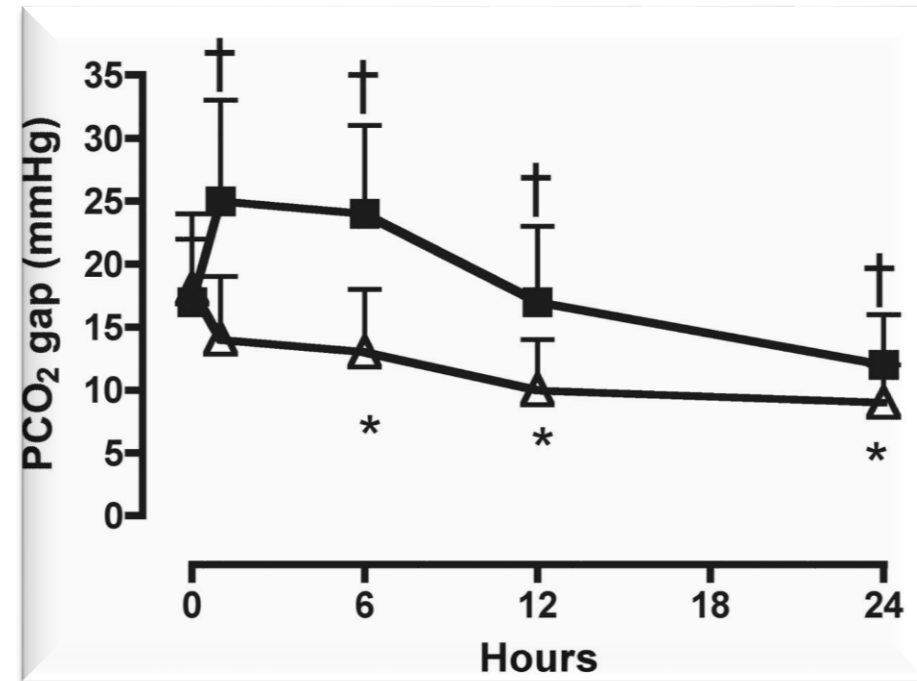
Augmentation significative de la FC
dans le groupe Adrénaline

Crit Care Med 2011 Vol. 39, No. 3

Lactate



PCO₂ gap



To conclude, we compared epinephrine and norepinephrine-dobutamine in cardiogenic shock without acute coronary syndrome and found that in terms of global hemodynamic effects, epinephrine is as effective as norepinephrine-dobutamine. Nevertheless, epinephrine is associated with a transient lactic acidosis, elevated HR, likely more arrhythmia, and inadequacy of gastric mucosa perfusion. Thus, the combination norepinephrine-dobutamine appears to be a more reliable and safe strategy in this particular setting.

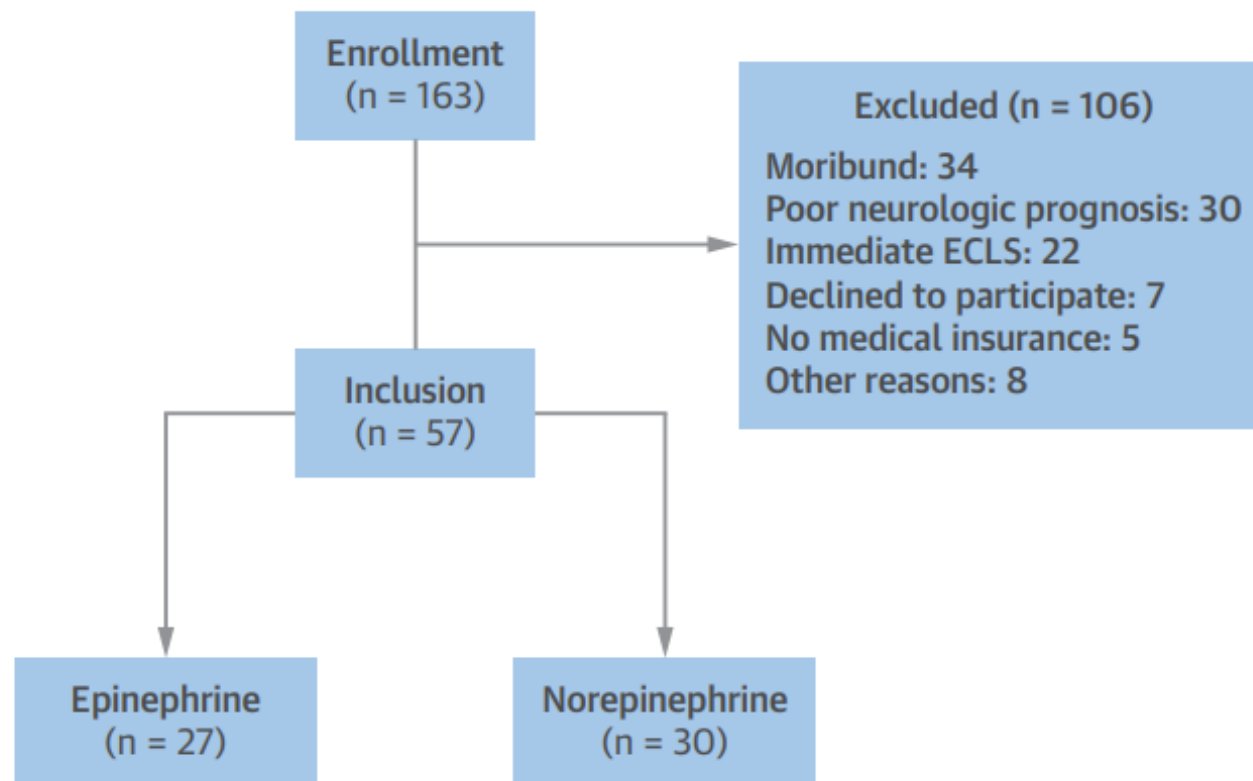
Epinephrine Versus Norepinephrine for Cardiogenic Shock After Acute Myocardial Infarction



Bruno Levy, MD, PhD,^a Raphael Clere-Jehl, MD,^b Annick Legras, MD,^c Tristan Morichau-Beauchant, MD,^d Marc Leone, MD, PhD,^e Ganster Frederique, MD,^f Jean-Pierre Quenot, MD, PhD,^g Antoine Kimmoun, MD, PhD,^a Alain Cariou, MD, PhD,^d Johan Lassus, MD, PhD,^h Veli-Pekka Harjola, MD, PhD,^h Ferhat Meziani, MD, PhD,^b Guillaume Louis, MD,ⁱ Patrick Rossignol, MD, PhD,^j Kevin Duarte, PhD,^j Nicolas Girerd, MD, PhD,^j Alexandre Mebazaa, MD, PhD,^k Philippe Vignon, MD, PhD^l

OPTIMA study:
Étude multicentrique
randomisée

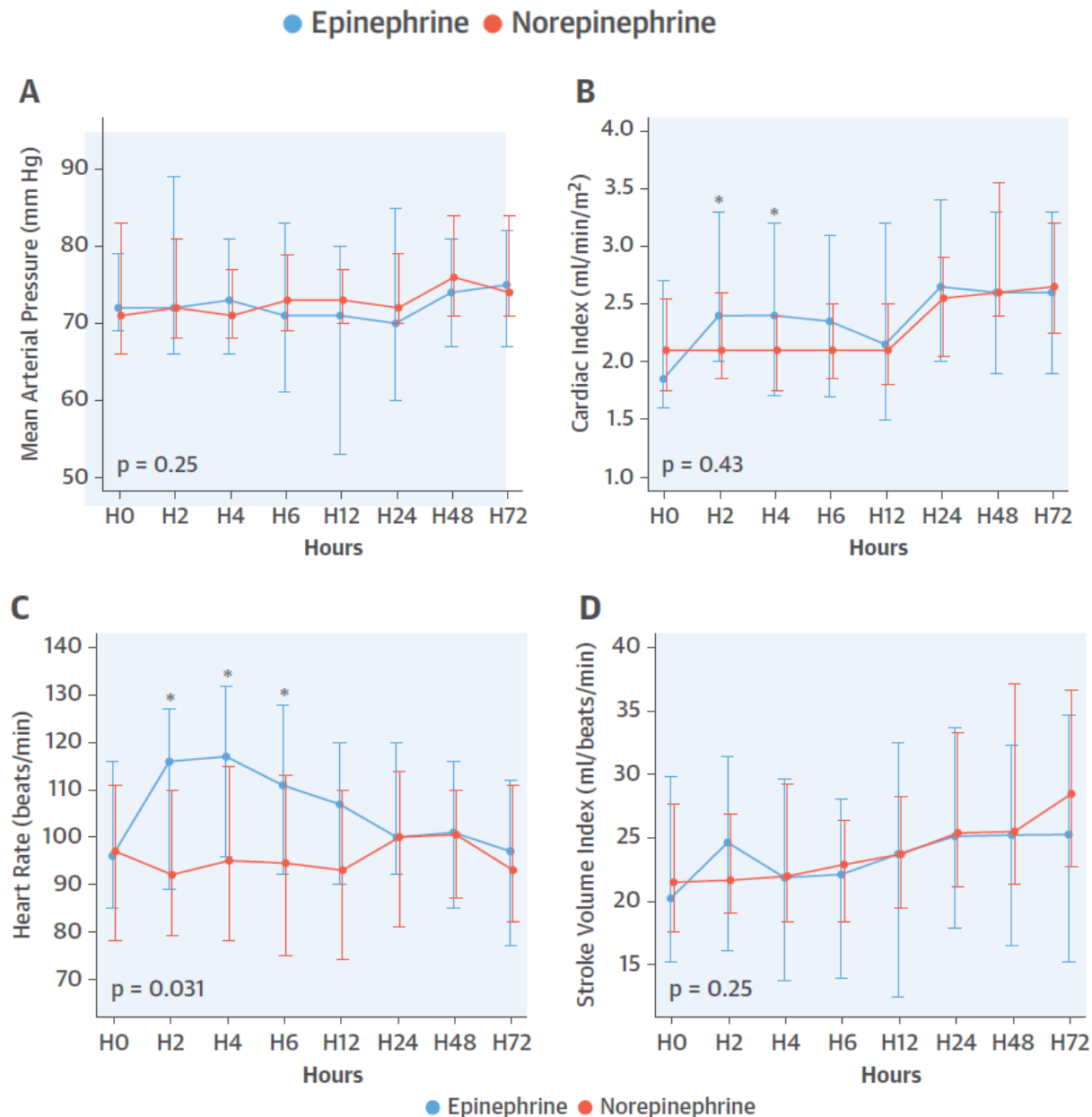
FIGURE 1 Study Flow Diagram



Epinephrine Versus Norepinephrine for Cardiogenic Shock After Acute Myocardial Infarction



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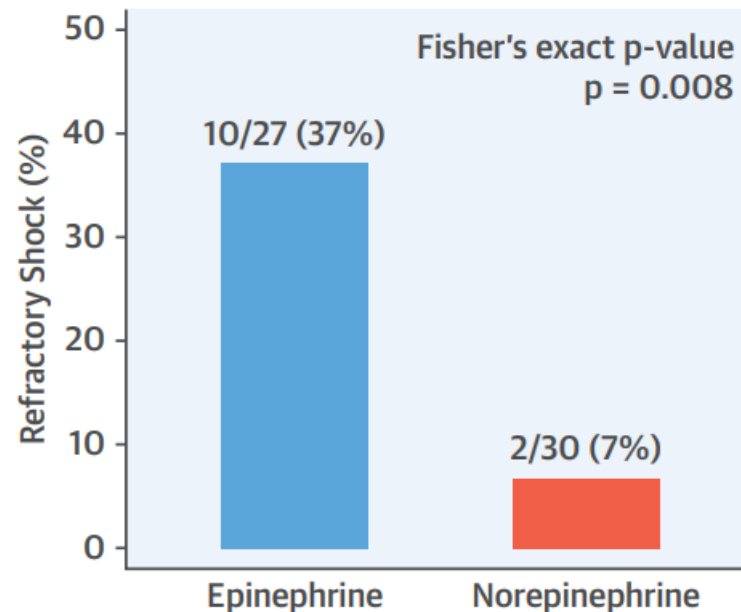
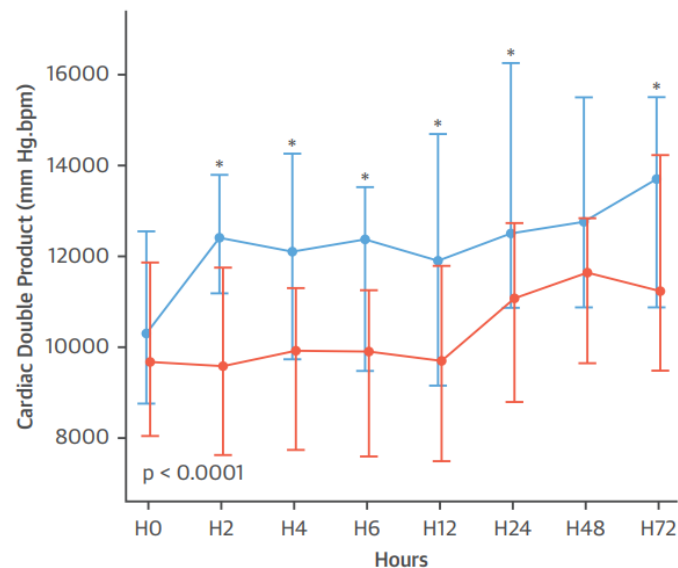
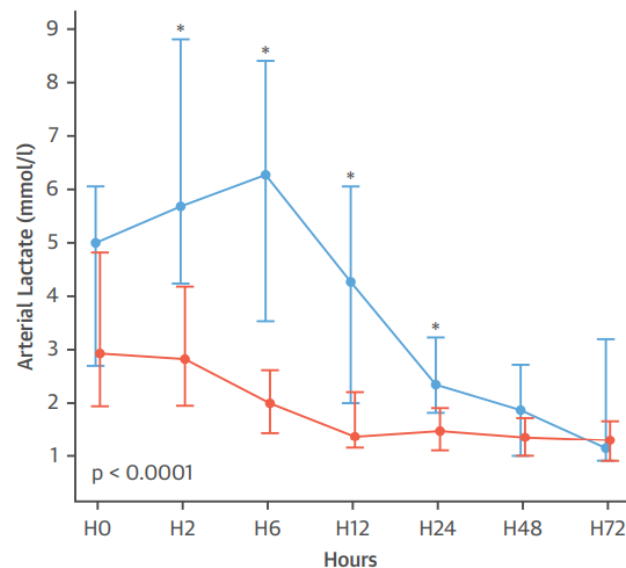


Epinephrine Versus Norepinephrine for Cardiogenic Shock After Acute Myocardial Infarction



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● Epinephrine ● Norepinephrine



SYSTEMATIC REVIEW

Epinephrine and short-term survival in cardiogenic shock: an individual data meta-analysis of 2583 patients



Valentine Léopold¹, Etienne Gayat¹, Romain Pirracchio², Jindrich Spinar³, Jiri Parenica³, Tuukka Tarvasmäki^{4,5}, Johan Lassus⁴, Veli-Pekka Harjola⁴, Sébastien Champion⁶, Faiez Zannad⁷, Serafina Valente⁸, Philip Urban⁹, Horng-Ruey Chua^{10,11,12,13,14}, Rinaldo Bellomo^{10,11,12,13}, Batric Popovic¹⁵, Dagmar M. Ouweneel¹⁶, José P. S. Henriques¹⁶, Gregor Simonis^{17,18}, Bruno Lévy¹⁹, Antoine Kimmoun¹⁹, Philippe Gaudard²⁰, Mir Babar Basir²¹, Andrej Markota²², Christoph Adler²³, Hannes Reuter²³, Alexandre Mebazaa^{1,24*} and Tahar Chouihed^{1,7,25,26}

16 études
2583 patients

- Critères d'inclusion:
 1. Choc cardiogénique population médicale
 2. Au moins 15 % des patients sont traités par adrénaline seule ou en association

Table 1 Sample size, inclusion criteria, outcome and main patients' characteristics in all the studies included

Observational studies	Inclusion period	Cause of cardiogenic shock	Single/multi-center	Number of patients (n)	Epinephrine-treated patients n (%)	Death n (%)	Mortality endpoint	ECLS (n)
Adler, 2012 [16]	2007–2008	Out of hospital cardiac arrest	Single	40	10 (25)	11 (28)	Day 30	No
Adler, unpublished		All-cause	Single	47	9 (19)	10 (21)	Day 30	No

Adrénaline prescrire: 37 %

(17-76 %)

Mortalité : 49 %

(21-69 %)

Randomized controlled trial—epinephrine versus norepinephrine								
OPTIMA CC, 2018 [11]	2011–2016	Acute coronary syndrome	Multi	57	27 (47)	21 (37)	Day 30	Yes (3)
Total				2583	947 (37)	1273 (49)		

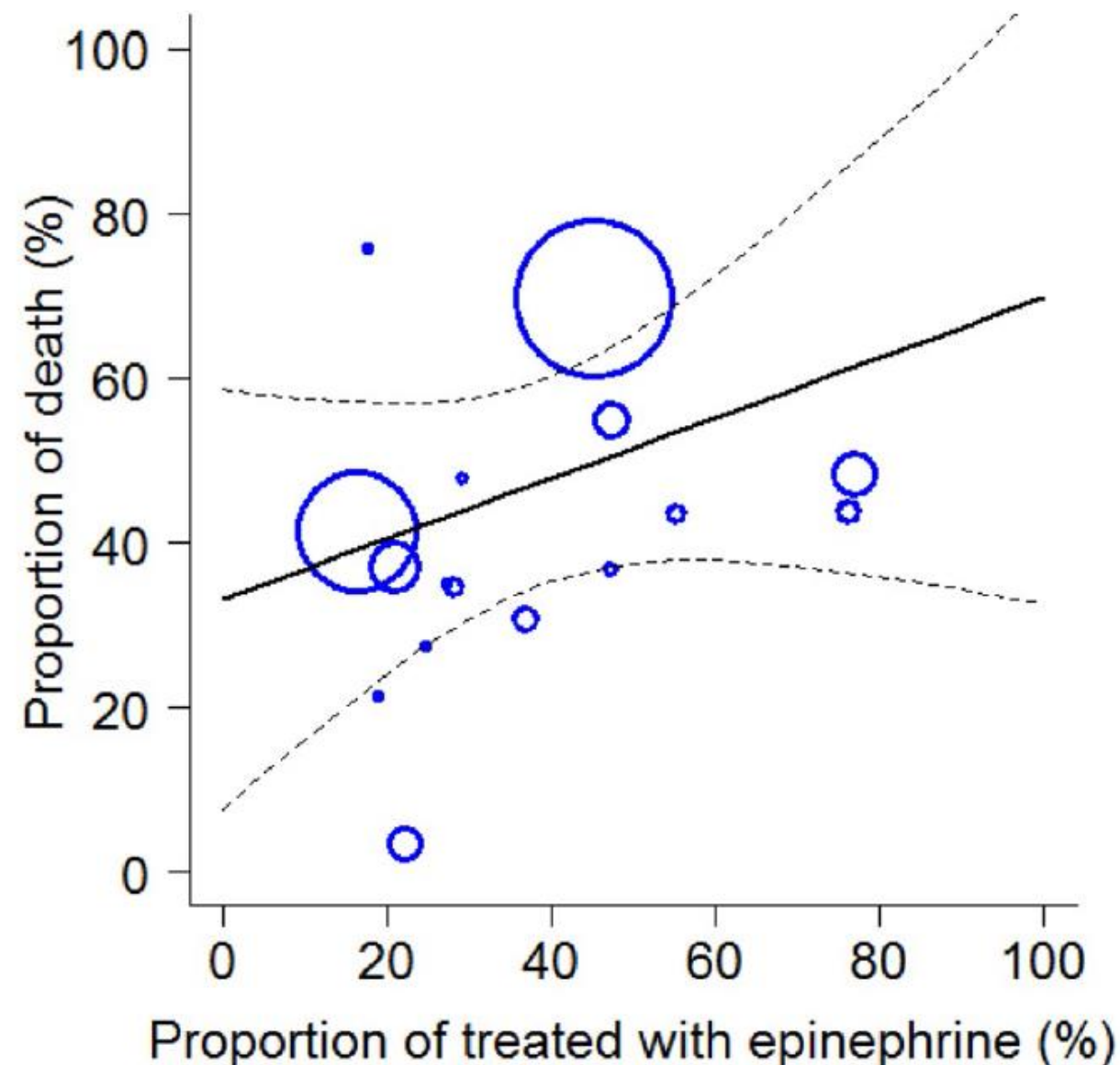
ECLS extracorporeal life support (combining extracorporeal membrane oxygenation (ECMO) and left ventricular assist devices (LVAD))

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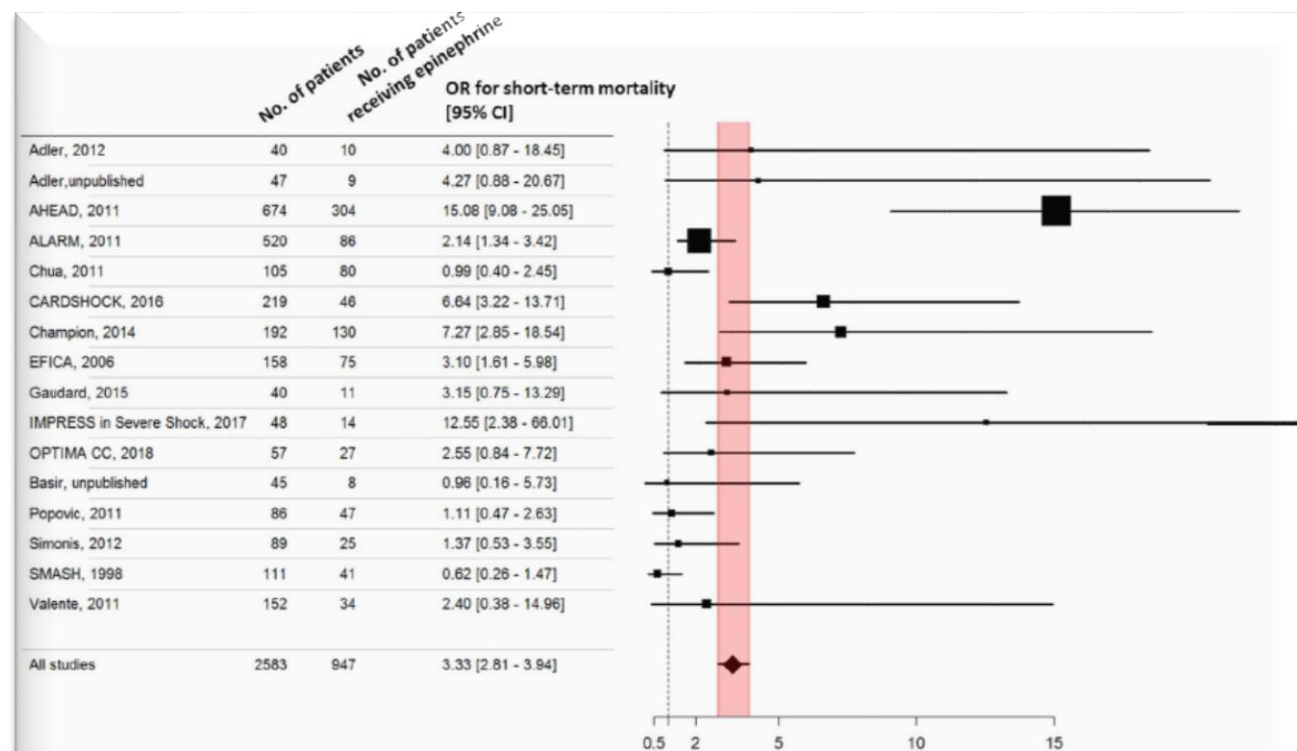


Fig. 3 Forest plot of the meta-analysis of short-term mortality

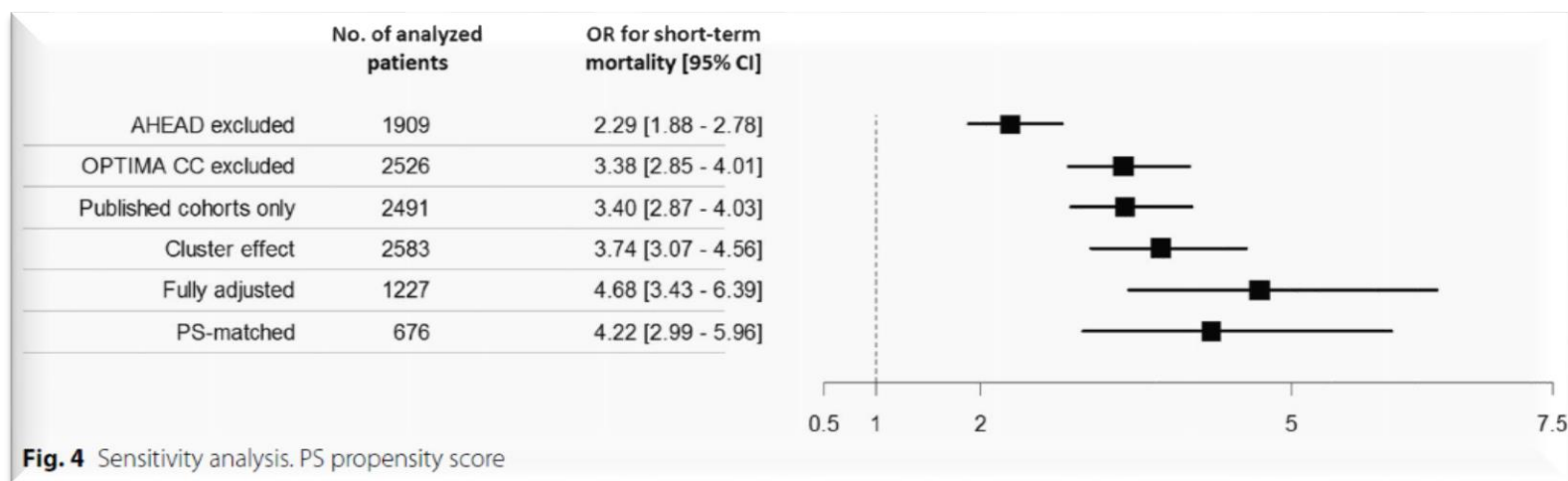


Fig. 4 Sensitivity analysis. PS propensity score

REVIEW

Open Access



Experts' recommendations for the management of adult patients with cardiogenic shock

Circulation

AHA/ACC/HFSA CLINICAL PRACTICE GUIDELINE

2022 AHA/ACC/HFSA Guideline for the Management of Heart Failure: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines

ESC GUIDELINES

2021 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure

Developed by the Task Force for the diagnosis and treatment of acute and chronic heart failure of the European Society of Cardiology (ESC)

With the special contribution of the Heart Failure Association (HFA) of the ESC

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Experts' recommendations for the management of adult patients with cardiogenic shock



- **Noradrénaline** en première intention +++
(*strong agreement*).
avec Objectif de PAM > 65 mmHg.
- **Adrénaline** remplacerait [NAD + Dobutamine]
(*weak agreement*) (arythmie/ lactates)

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Experts' recommendations for the management of adult patients with cardiogenic shock

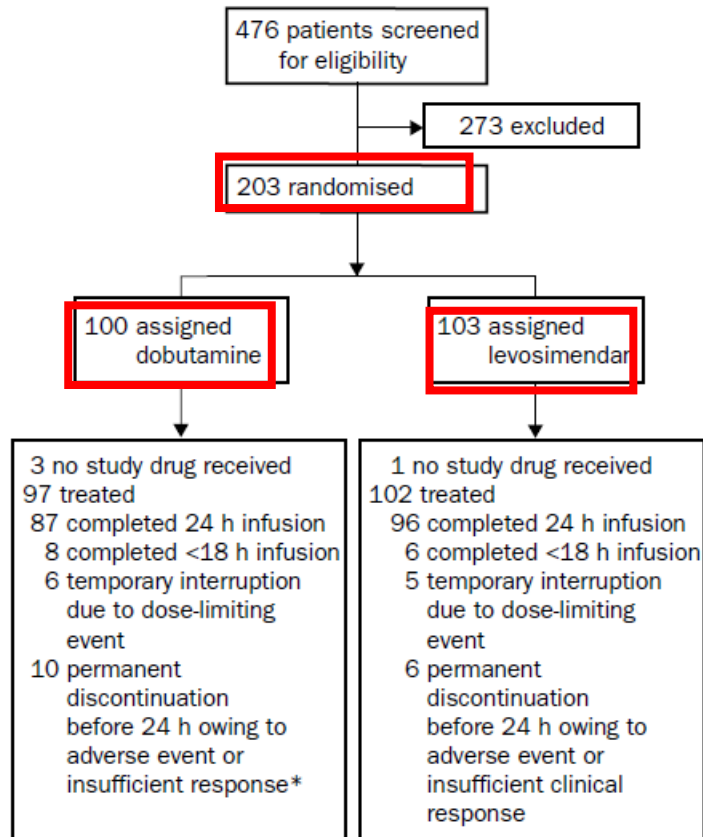
•**Dobutamine** should be used to treat low cardiac output in cardiogenic shock (*strong agreement*).

Dobutamine must be used at the lowest possible dose, starting at **2 µg/kg/min**. Its titration is based on cardiac index and SvO₂.

Efficacy and safety of intravenous levosimendan compared with dobutamine in severe low-output heart failure (the LIDO study): a randomised double-blind trial

F Follath, J G F Cleland, H Just, J G Y Papp, H Scholz, K Peuhkurinen, V P Harjola, V Mitrovic, M Abdalla, E-P Sandell, L Lehtonen, for the Steering Committee and Investigators of the Levosimendan Infusion versus Dobutamine (LIDO) Study*

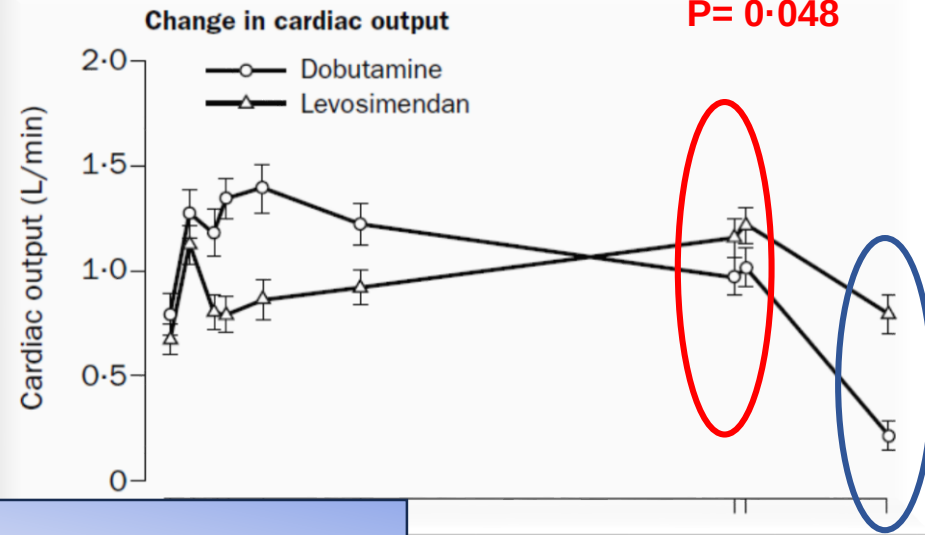
- Essai multicentrique, randomisé, en double aveugle
- 26 centres (11 pays européens)



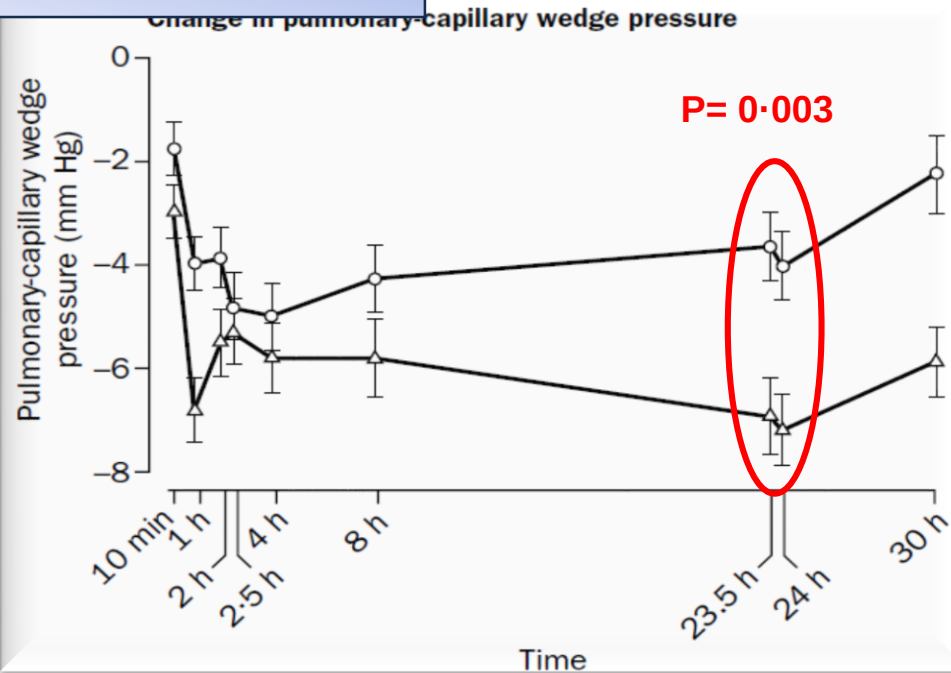
Critère de jugement principale:
 DC augmente : 30 %
 et PAPO diminue de 25 % à H24

Levosimendan 29 pt (28%) vs Dobutamine 15 pts (15%) (hazard ratio 1·9 [95% CI 1·1–3·3]; $p=0\cdot022$)

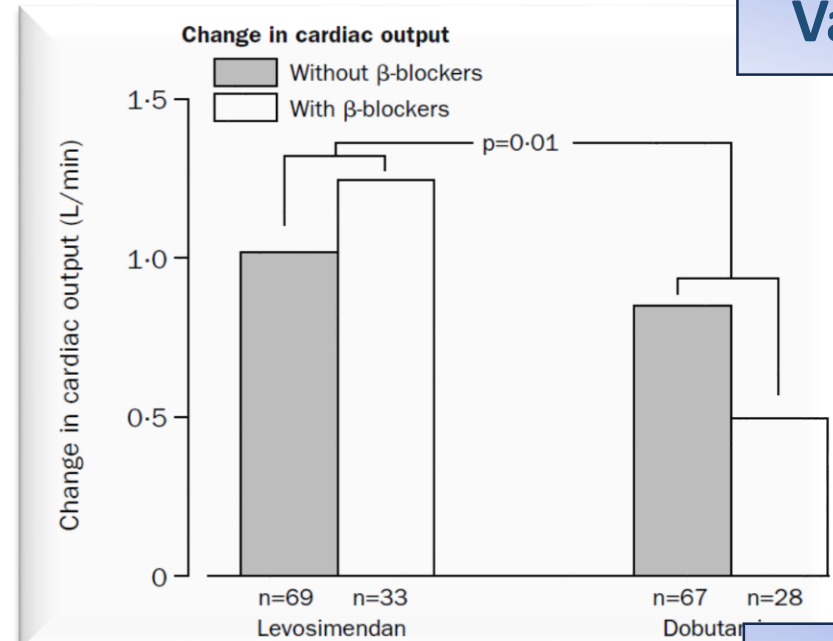
Débit cardiaque



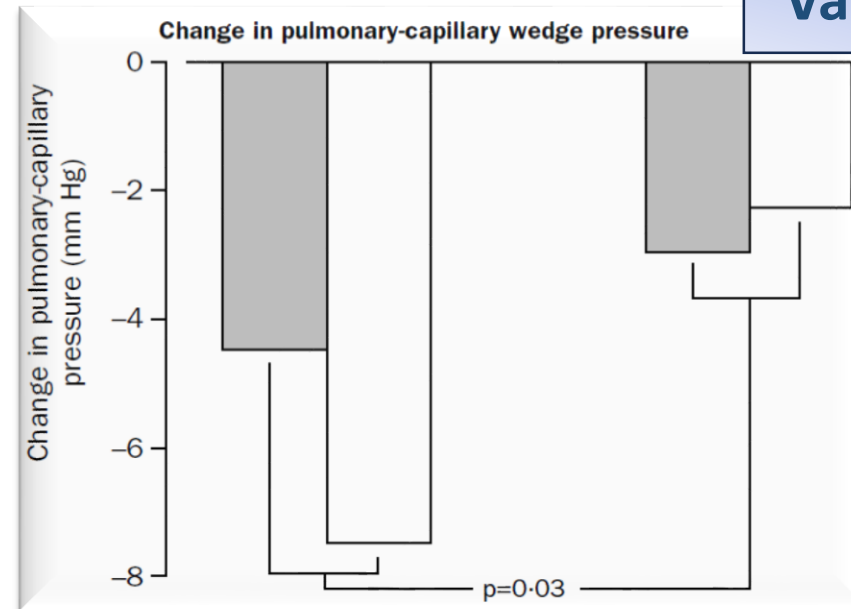
PCP



Variation DC



Variation PCP



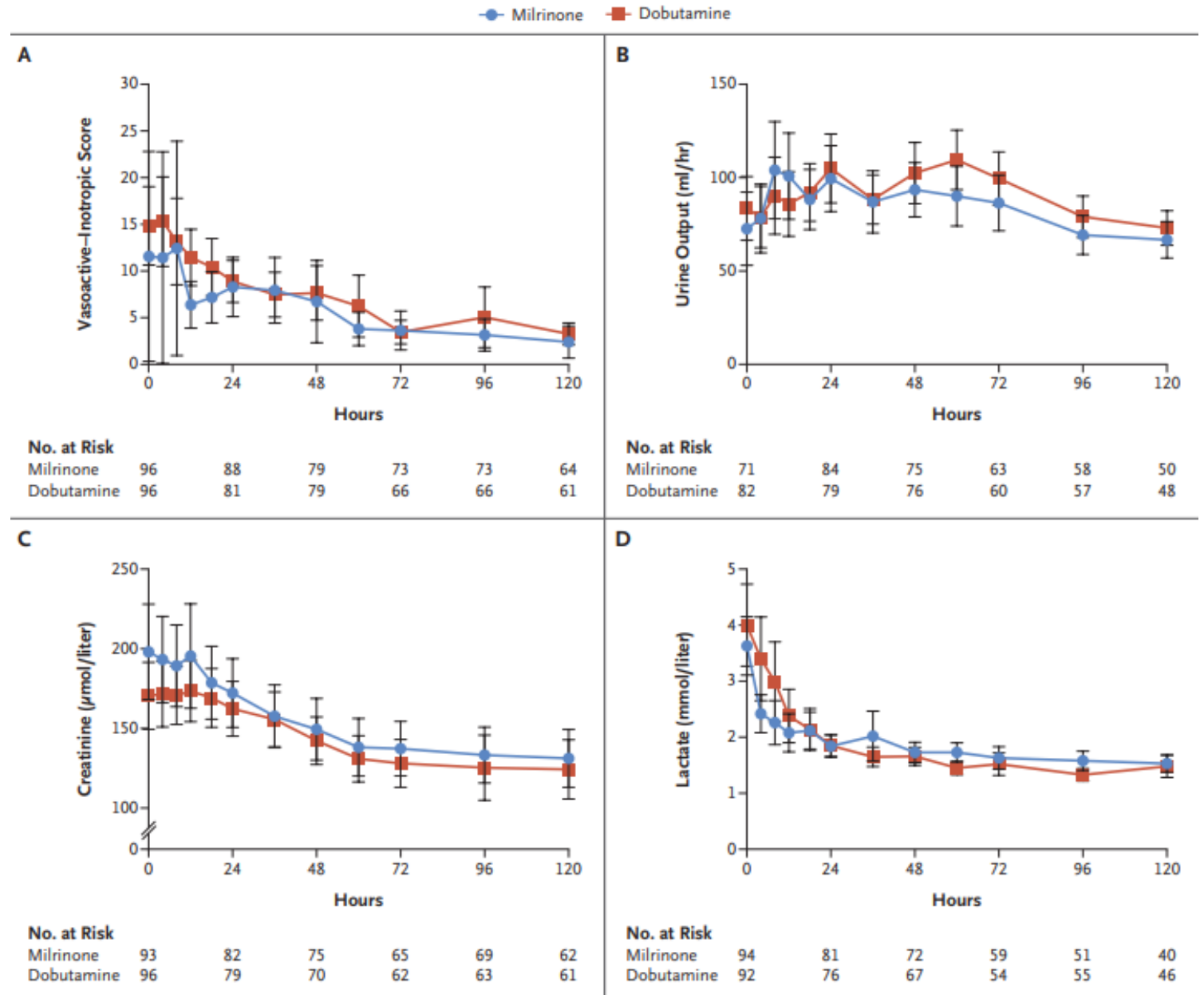
ORIGINAL ARTICLE

Milrinone as Compared with Dobutamine in the Treatment of Cardiogenic Shock

Rebecca Mathew, M.D., Pietro Di Santo, M.D., Richard G. Jung, Ph.D., Jeffrey A. Marbach, M.B., B.S., Jordan Hutson, M.D., Trevor Simard, M.D., F. Daniel Ramirez, M.D., David T. Harnett, M.D., Anas Merdad, M.B., B.S., Aws Almufleh, M.B., B.S., Willy Weng, M.D., Omar Abdel-Razek, M.D., Shannon M. Fernando, M.D., Kwadwo Kyeremanteng, M.D., M.H.A., Jordan Bernick, M.Sc., George A. Wells, Ph.D., Vincent Chan, M.D., Michael Froeschl, M.D., C.M., Marino Labinaz, M.D., Michel R. Le May, M.D., Juan J. Russo, M.D., and Benjamin Hibbert, M.D., Ph.D.

DOREMI trial

Pas de différence
significative



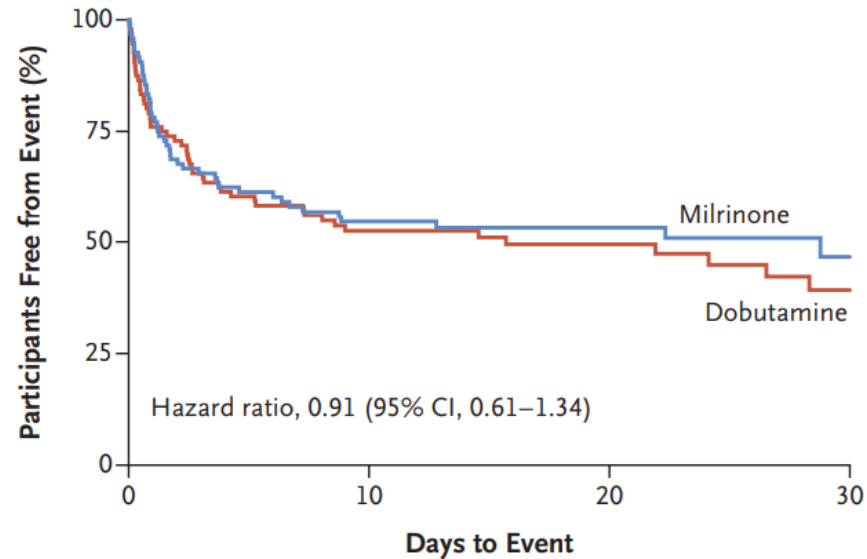
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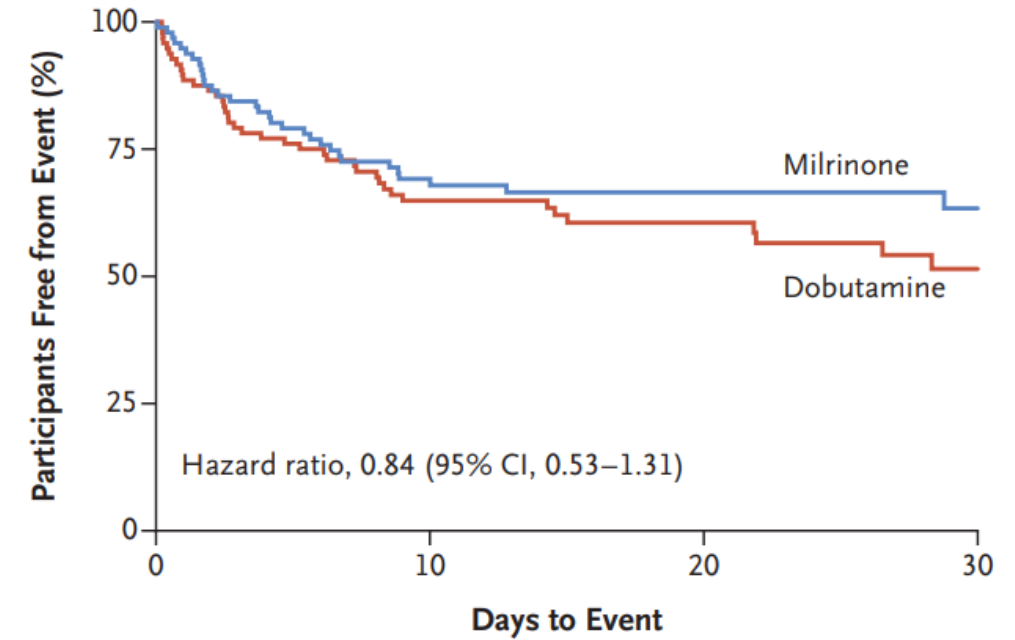
A Primary Composite Outcome



No. at Risk

Milrinone	96	42	26	7
Dobutamine	96	43	25	13

B In-Hospital Death from Any Cause



No. at Risk

Milrinone	96	55	34	15
Dobutamine	96	55	33	19

**Pas de différence
significative**

REVIEW

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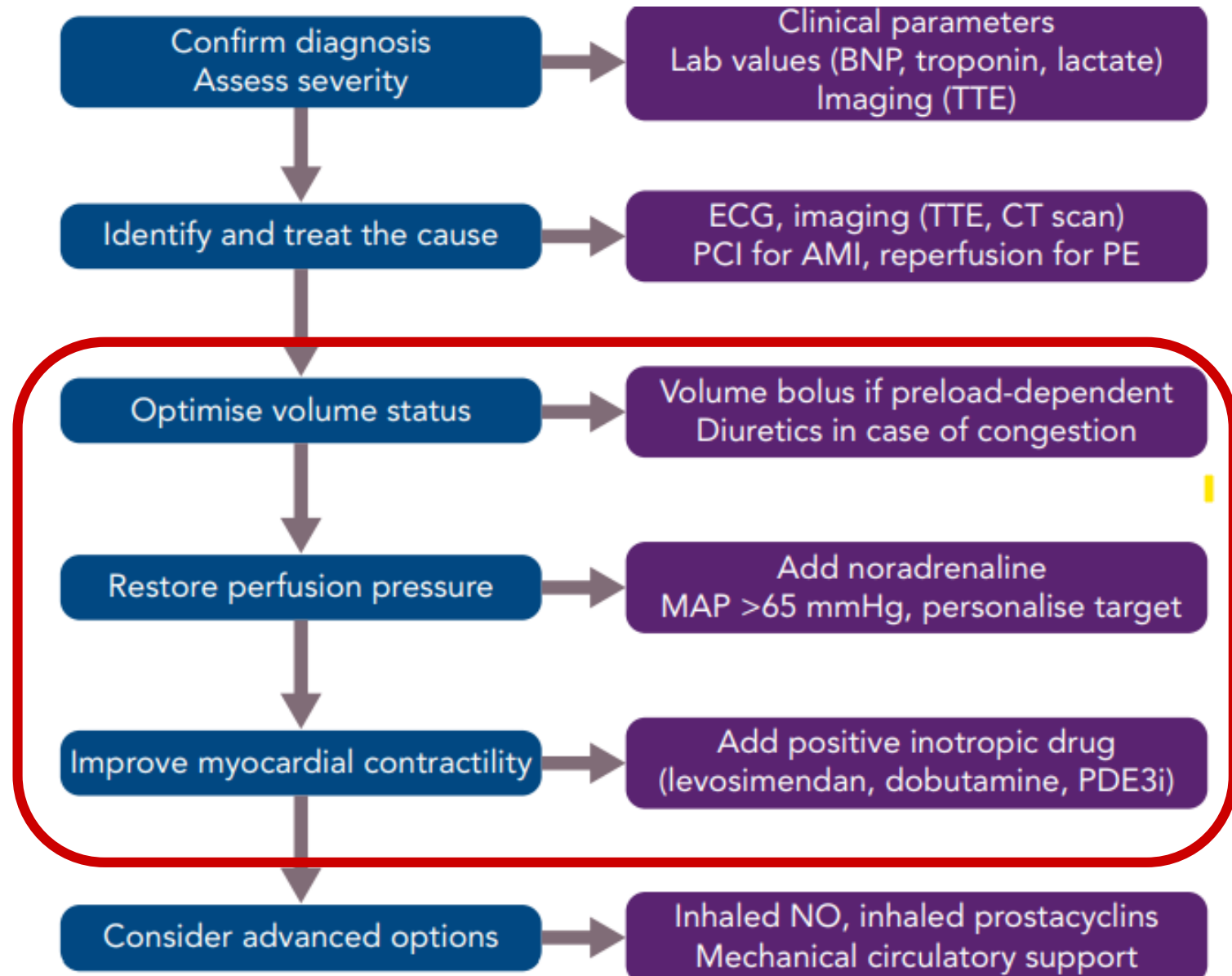
Experts' recommendations for the management of adult patients with cardiogenic shock



- **Dobutamine** should be used to treat low cardiac output in cardiogenic shock (*strong agreement*).

- **Phosphodiesterase inhibitors** or **levosimendan** should not be used first-line (*strong agreement*).

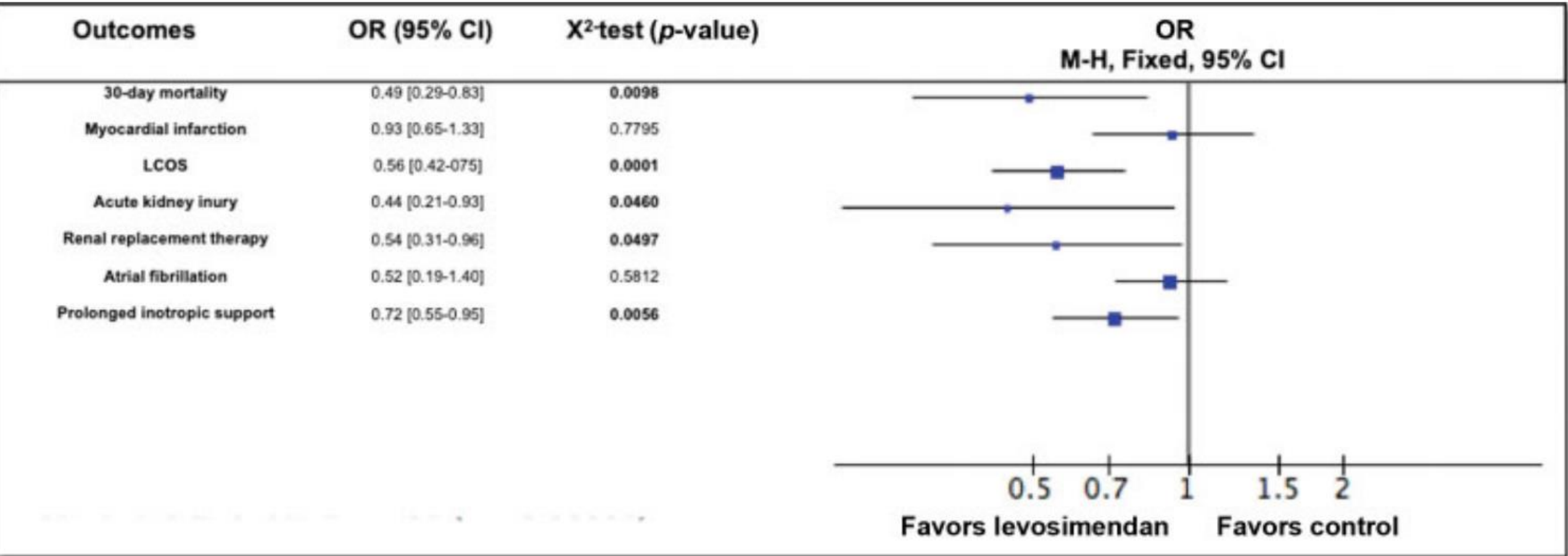
Dysfonction ventriculaire droite



Levosimendan Reduces Mortality and Low Cardiac Output Syndrome in Cardiac Surgery

Carolyn Weber¹ Matthias Esser¹ Kaveh Eghbalzadeh¹ Anton Sabashnikov¹ Ilija Djordjevic¹
Johanna Maier¹ Julia Merkle¹ Yeong-Hoon Choi¹ Navid Madershahian¹ Oliver Liakopoulos¹
Antje Christin Deppe^{1,*} Thorsten C. W. Wahlers^{1,*}

- Méta-analyse
- 27 ERC
- 3198 patients



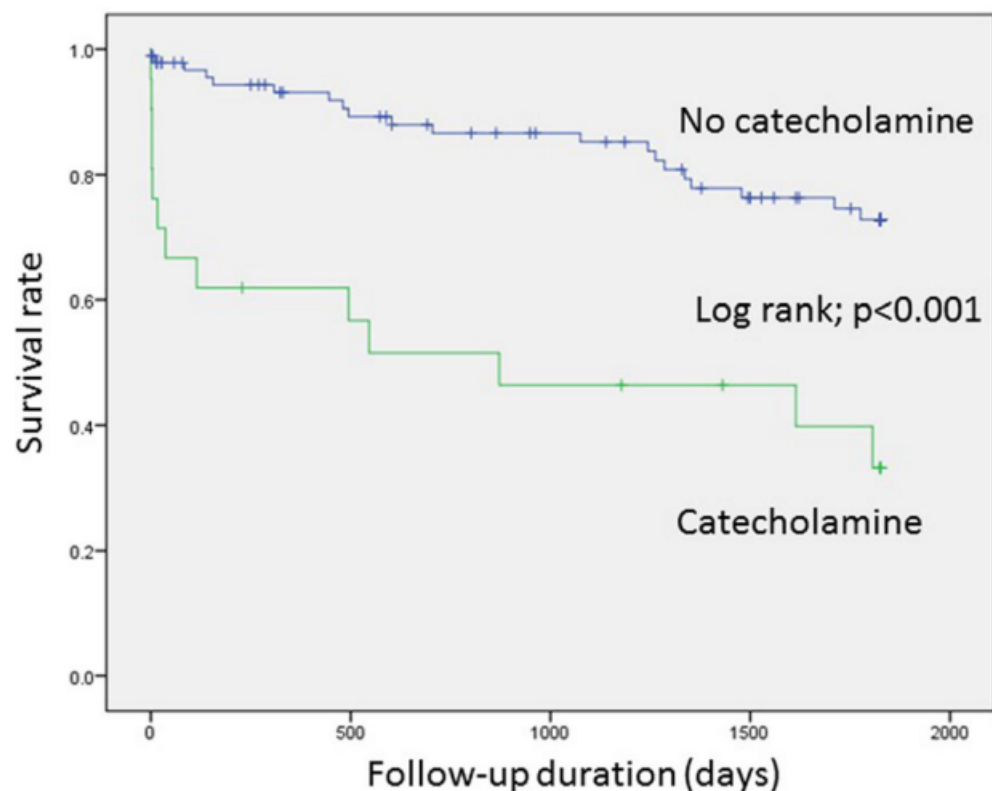
RESEARCH ARTICLE

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Clinical outcomes associated with catecholamine use in patients diagnosed with Takotsubo cardiomyopathy

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- 114 patients
- 2003-2015

	Univariate analysis			Multivariate analysis ^{a)}		
	HR	95% CI	P-value	HR	95% CI	P-value
Male	2.6	1.2–5.7	0.01	1.8	0.8–4.0	0.14
EF ≤ 35%	4.8	2.2–10.4	< 0.01	3.6	1.6–8.1	< 0.01
Emotional stress	0.4	0.1–1.1	0.10			
Inotropic drugs	3.9	1.9–7.9	< 0.01	2.2	1.0–4.8	0.04
Diabetes mellitus Typ II	1.0	0.7–1.4	0.81			
Hypertension	0.9	0.7–1.2	0.64			
Apical ballooning	1.1	0.8–1.4	0.39			
History of cancer	1.7	0.7–4.2	0.21			
Smoking	0.7	0.3–1.6	0.49			



Update of Takotsubo cardiomyopathy: Present experience and outlook for the future

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TTS confirmed diagnosis

Cardiogenic shock

Stage A: monitoring

Stage B: Levosimendan, Ultra-short-acting-
b-blockers (landiolol, esmolol)

Stage C-D:

Ultra-short-acting-b-blockers (if LVOTO);
VA-ECMO (if LV thrombus);
LV/BiV Impella (if shock)

Stage E: VA-ECMO

Heart Failure

Diuretics
ACE inhibitors
or ARBs

?

..., consider ACEi or beta
blockers

Rhythm disorders

Monitoring 3 days
b-blockers (if QT<500 mls), K and Mg
levels (if QT>500 mls)
PP or defibrillator (if persistent
dyscardia or persistent prolongation of
QT interval)
Amiodarone (if fibrillation)

CONCLUSION

- 1- **Noradrénaline** en **1^{ère} intensión** pour restaurer la perfusion des organes (coronaires+++)
- 2- Associer **la dobutamine** si une atteinte de la **contractilité myocardique** avec des signes de **bas débit cardiaque**
- 3- **Titration de la dobutamine** +++

CONCLUSION

4- Le Lévosimendan:

- En cas choc cardiogénique chez des patients sous **bétabloquants**
- En post opératoire **d'une chirurgie cardiaque**
- **Syndrome de Takotsubo**