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Un œil critique sur l'assistance circulatoire

Romain GALLET

Cardiologie Interventionnelle

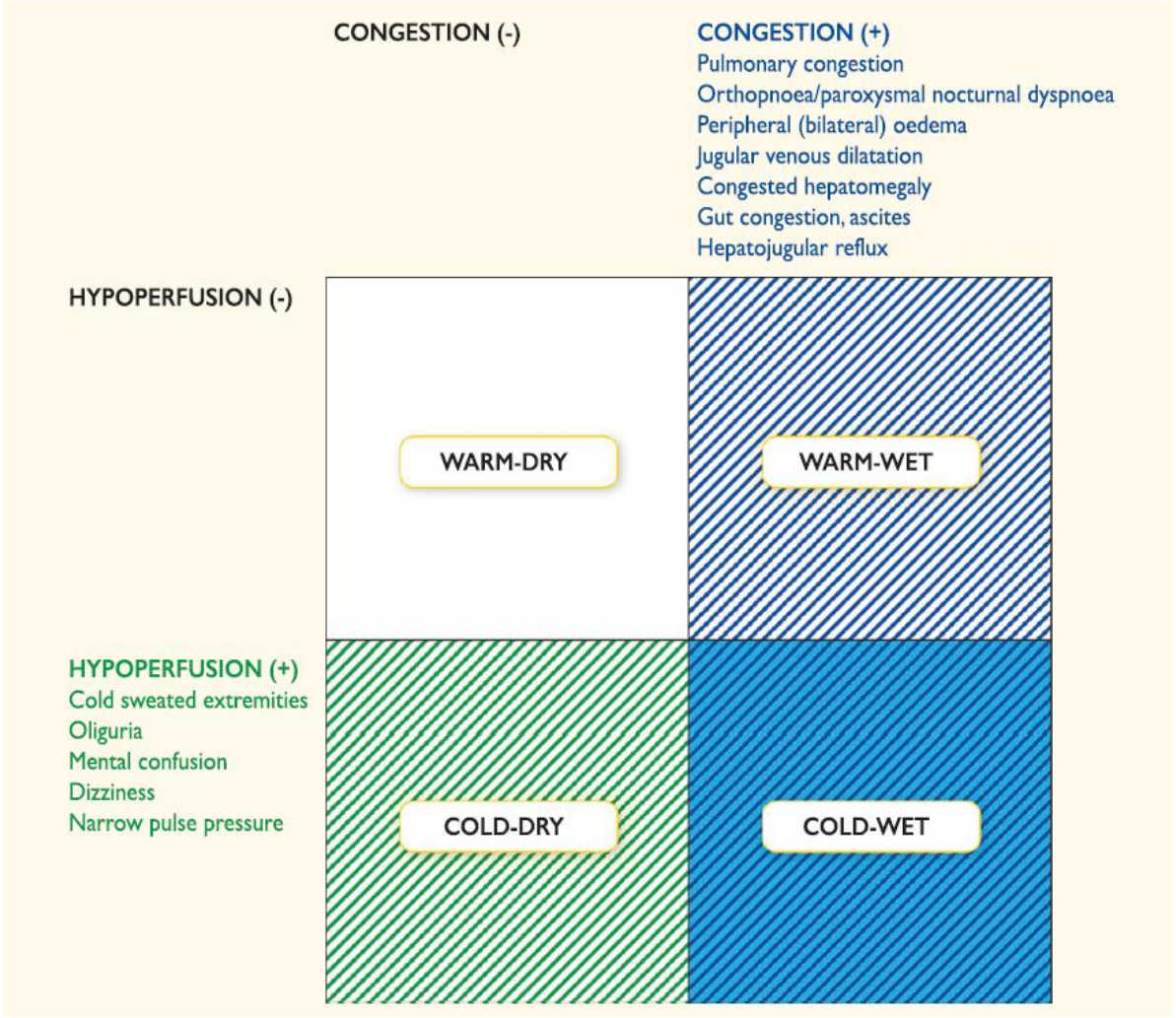
CHU Henri Mondor, Créteil

DÉCLARATION DE LIENS D'INTÉRÊT AVEC LA PRÉSENTATION

Intervenant : Romain GALLET, Créteil

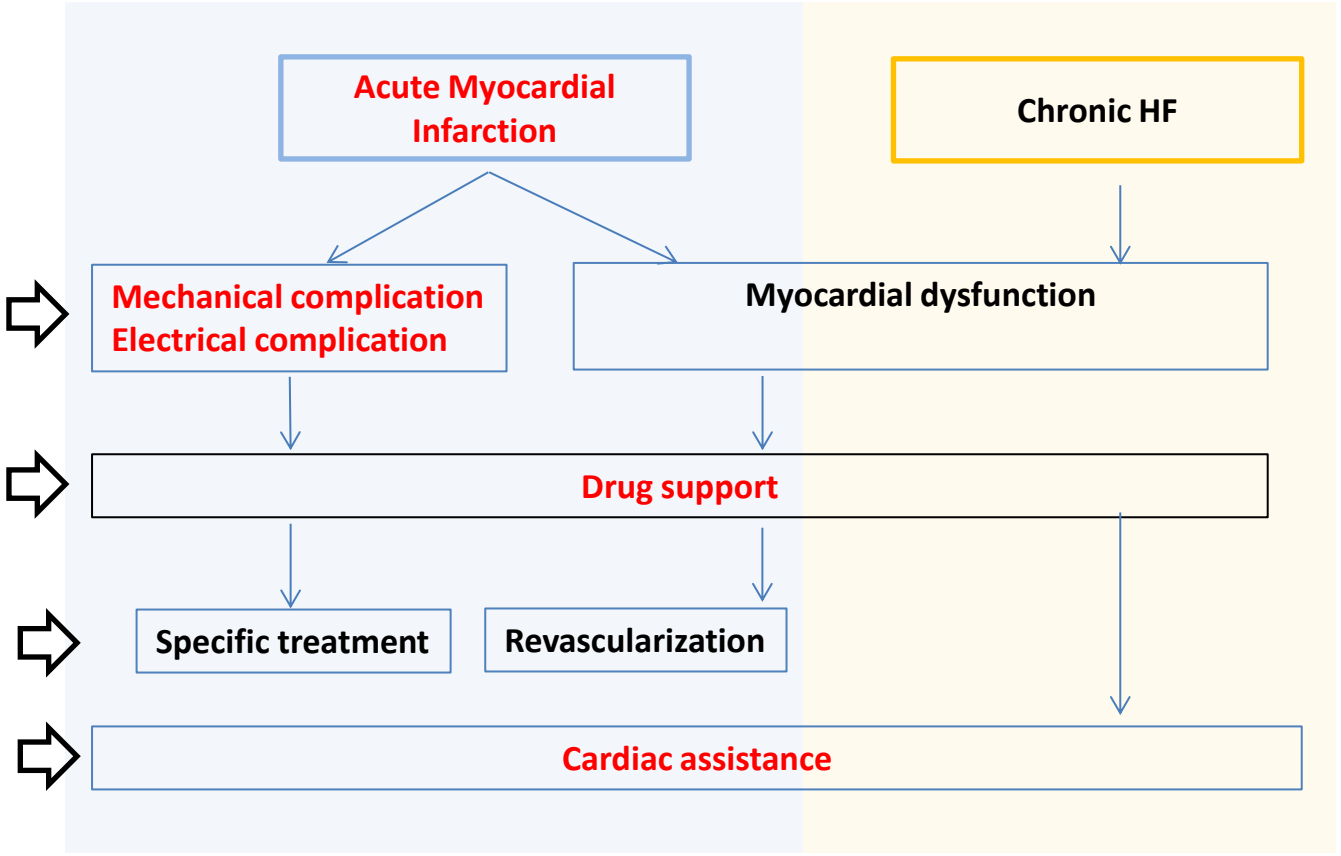
☑ Je n'ai pas de lien d'intérêt à déclarer

Choc cardiogénique: définition



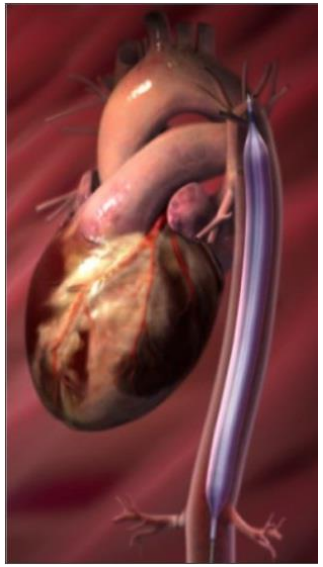
- Hypoperfusion périphérique
- Liée à une baisse du débit cardiaque
- D'origine cardiogénique

Choc cardiogénique



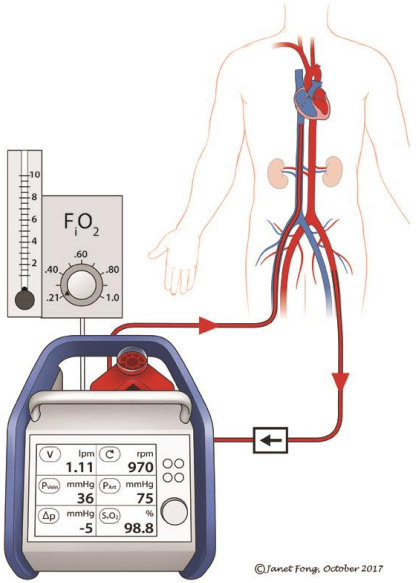
Assistance d’urgence

CPIA

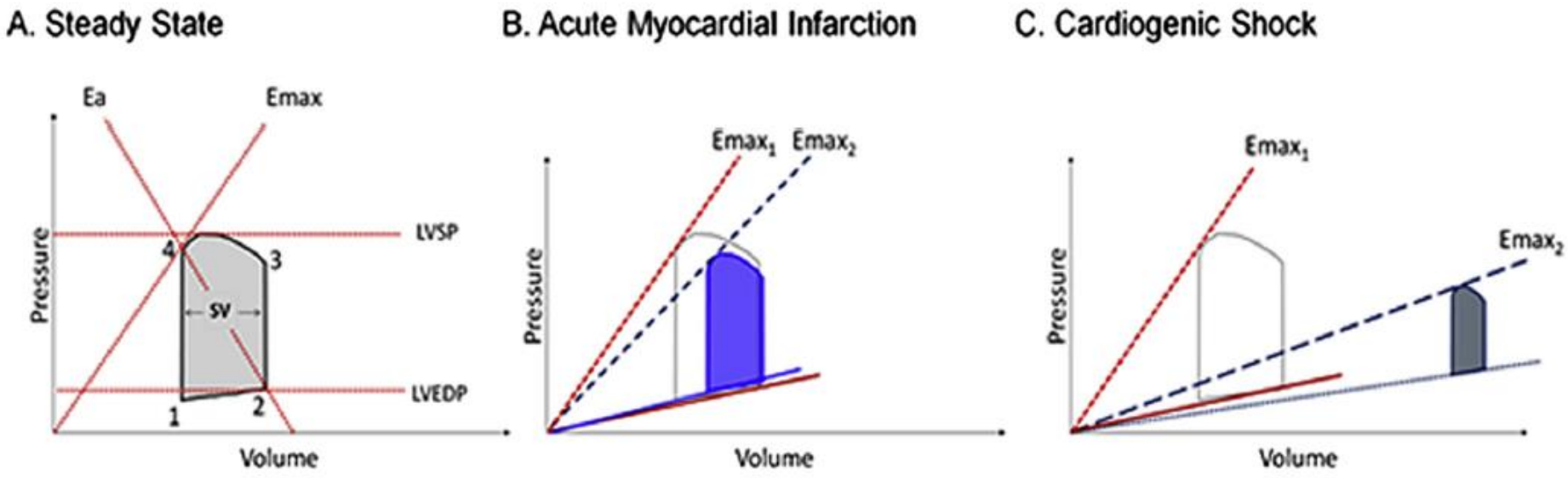


Impella

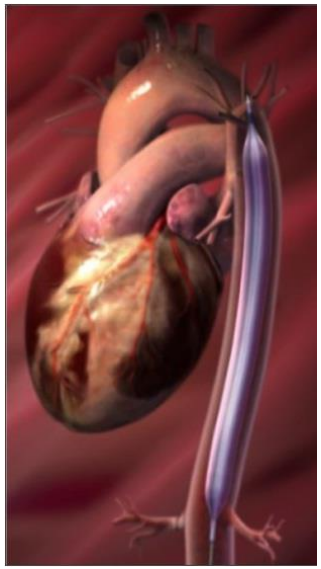
ECMO

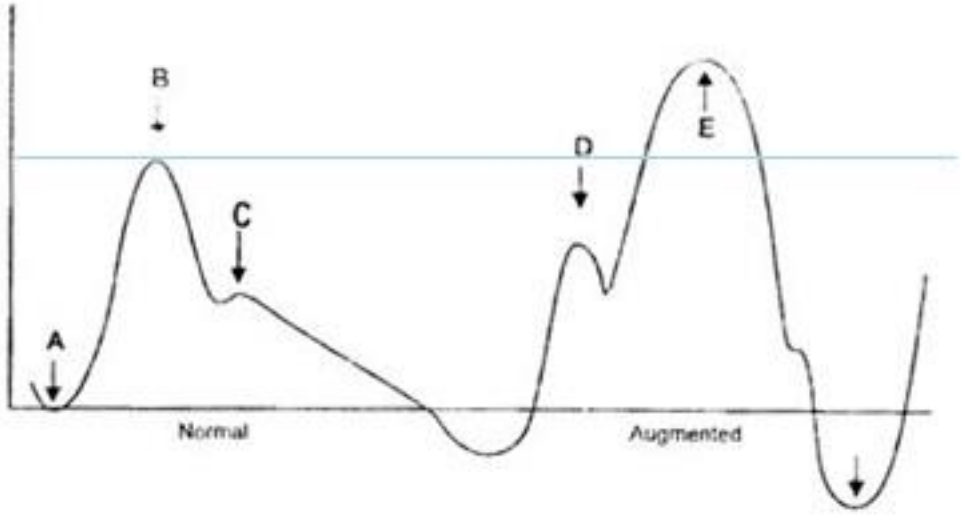


Hémodynamique



Ballon de Contre-Pulsion Intra-Aortique





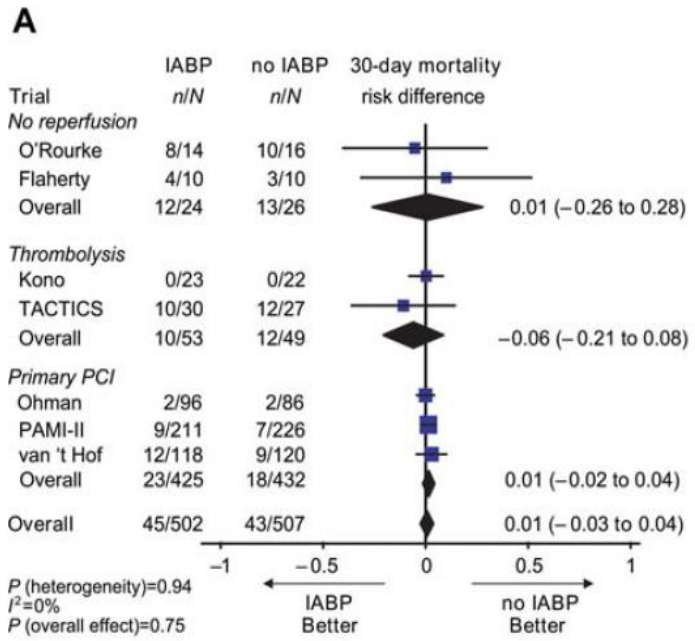
« To improve diastolic blood pressure, coronary perfusion and reduce afterload
To decrease myocardial oxygen consumption and increase cardiac output »

Scheidt S, *N Engl J Med* 1973

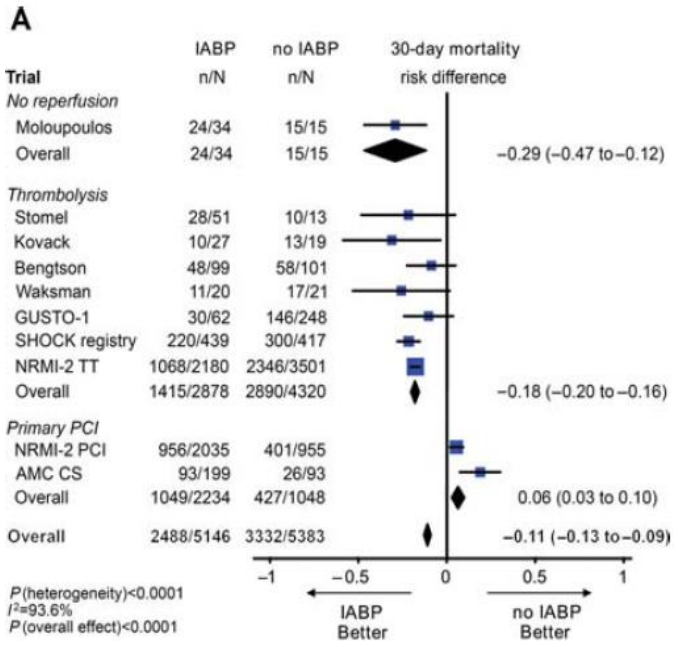
CPIA

A systematic review and meta-analysis of intra-aortic balloon pump therapy in ST-elevation myocardial infarction: should we change the guidelines?

STEMI



STEMI WITH CARDIOGENIC SHOCK



In STEMI with CS, IABP has no benefit when reperfusion by PCI is performed and benefit is limited overall => need for randomized specific study

Sjauw et al. Eur Heart J 2008

Etude IABP SCOCK II

- 595 patients en choc cardiogénique post-IDM
- CPIA vs. Pas de CPIA

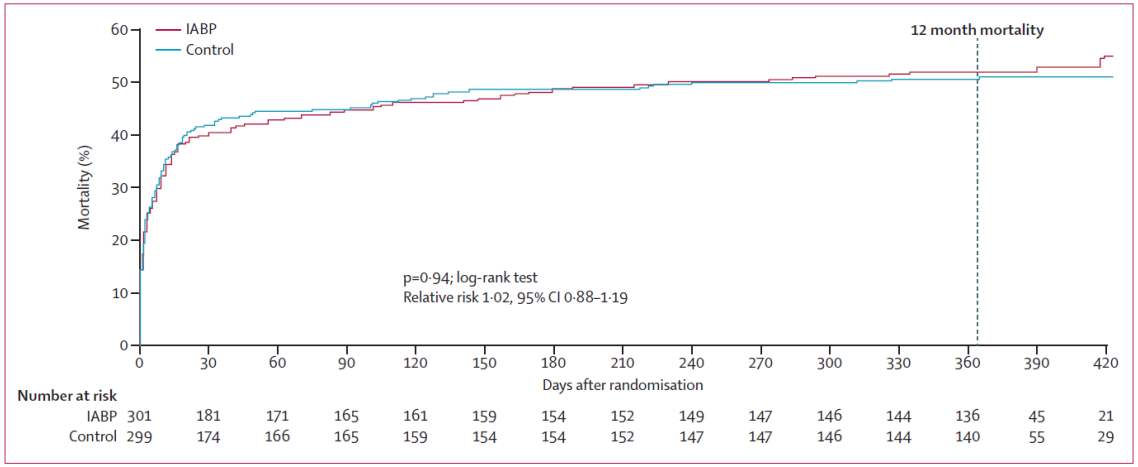
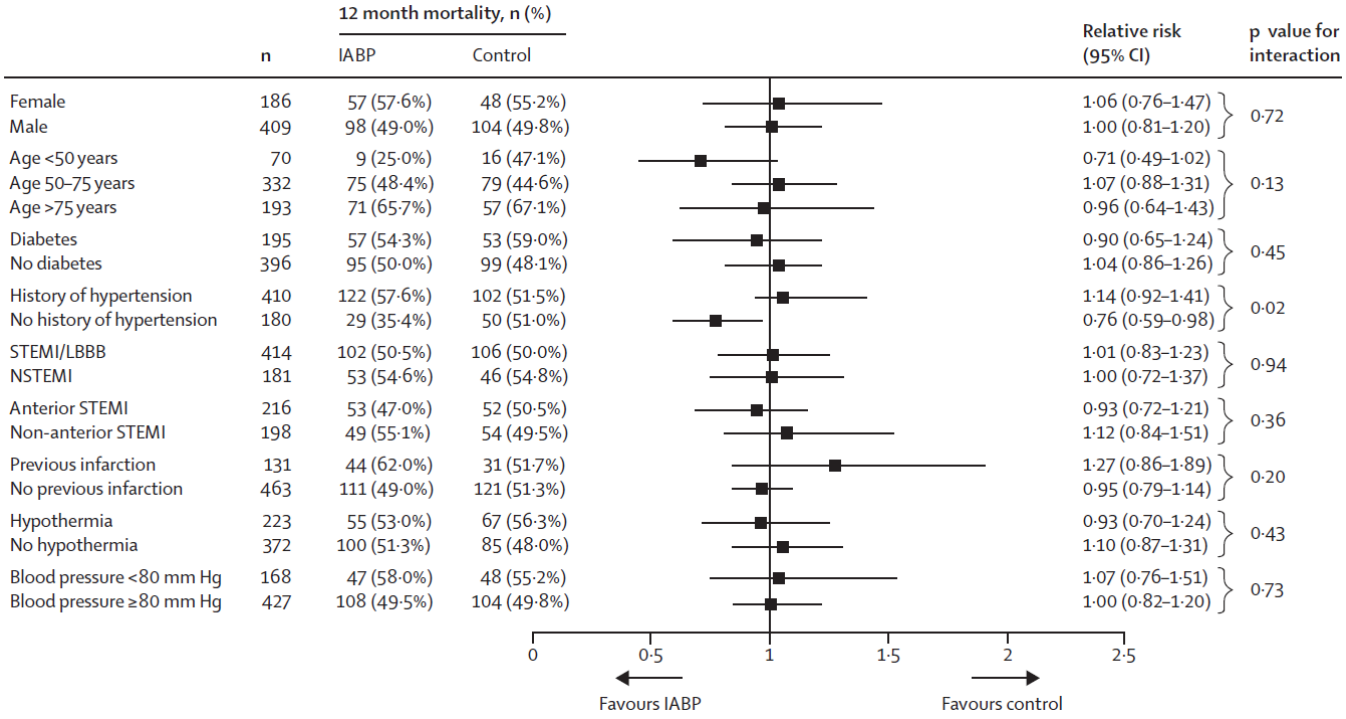


Table 1: Clinical outcomes at 12 months	IABP (n=299)	Control (n=296)	Relative risk (95% CI)	p value
All-cause mortality	155/299 (52%)	152/296 (51%)	1·01 (0·86–1·18)	0·91
Cardiac mortality	150/299 (50%)	148/296 (50%)	1·00 (0·85–1·18)	0·97
Non-cardiac mortality	5/299 (2%)	4/296 (1%)	1·23 (0·34–4·56)	1·00
Events in 1-year survivors				
Reinfarction	13/144 (9%)	5/144 (3%)	2·60 (0·95–7·10)	0·05
Stroke	3/144 (2%)	2/144 (1%)	1·50 (0·25–8·84)	1·00
Recurrent revascularisation	29/144 (20%)	32/144 (22%)	0·91 (0·58–1·41)	0·77
Repeat PCI	22/144 (15%)	25/144 (17%)	0·88 (0·52–1·49)	0·63
Additional CABG	7/144 (5%)	7/144 (5%)	1·00 (0·36–2·78)	1·00
ICD implantation	14/144 (10%)	14/144 (10%)	1·00 (0·49–2·02)	1·00

Thiele H et al. Lancet 2013

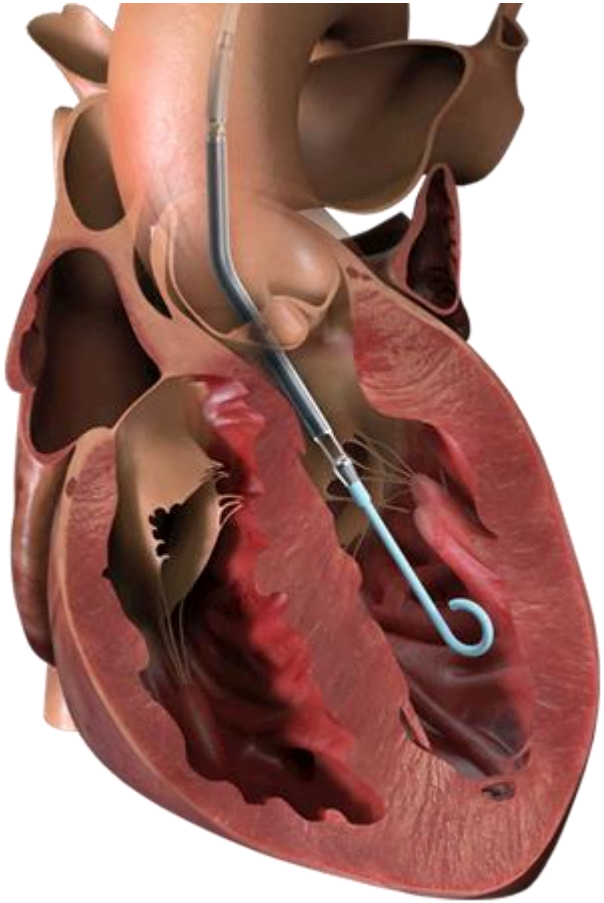
IABP SHOCK II

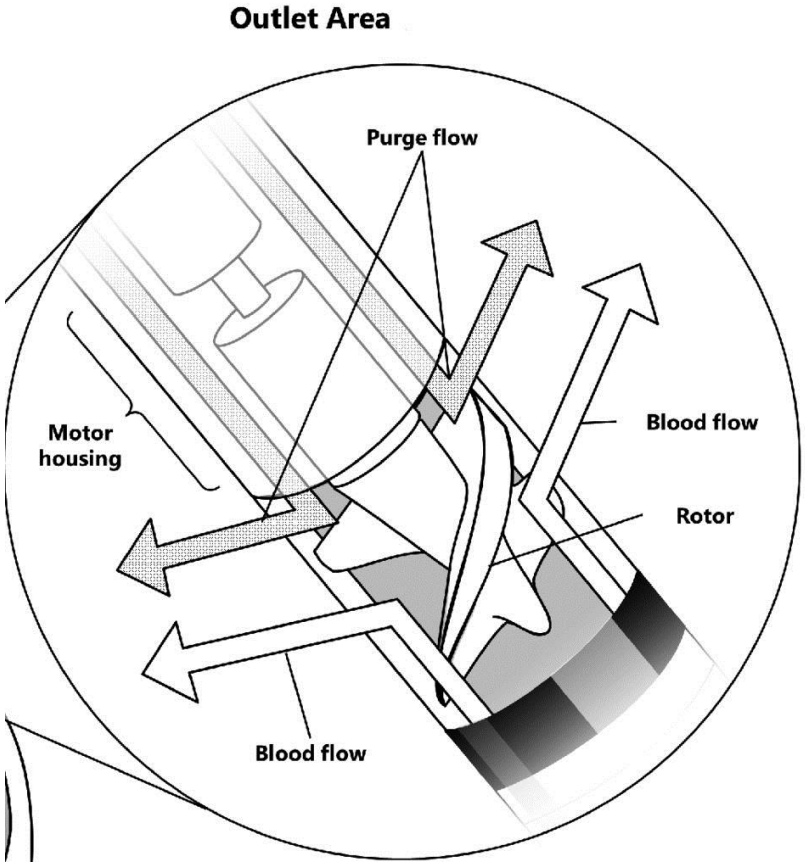


→ reco. Classe III

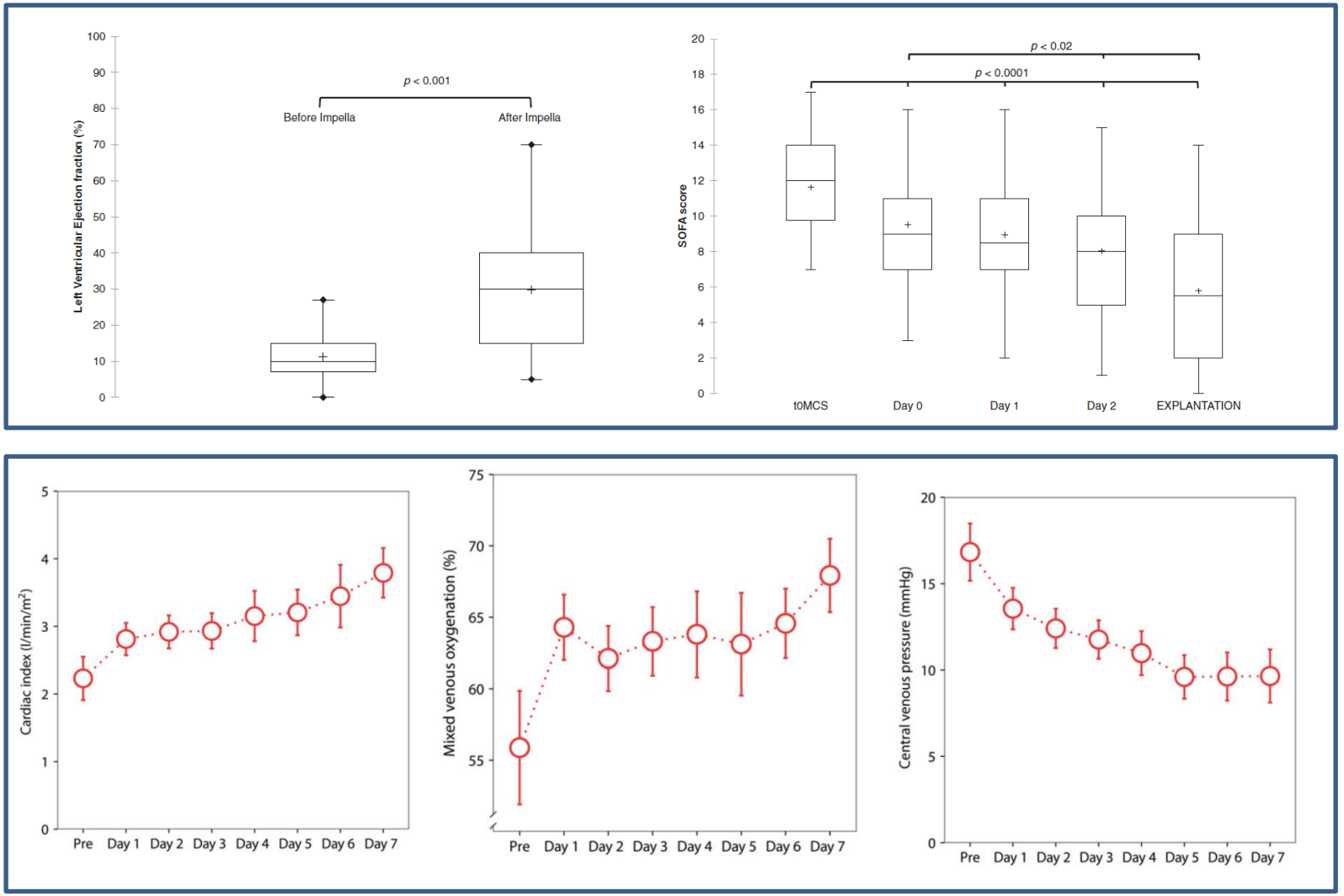
Thiele H et al. Lancet 2013

Impella




Outlet Area
Purge flow
Motor housing
Blood flow
Rotor
Blood flow

Impact hémodynamique



Gaudard et al. Critical Care 2015 et Schiller et al. Interactive CardioVascular and Thoracic Surgery 2016

Management and outcome of patients supported with Impella 5.0 for refractory cardiogenic shock

Event	Total (n = 40)
Death during Impella 5.0 support, n (%)	12 (30)
Impella 5.0 weaning, n (%)	18 (45)
Sustained cardiac recovery[a] at ICU discharge, n (%)	16 (40)
Bridge to LVAD, n (%)	9 (23)
Bridge to heart transplantation, n (%)	3 (8)
Total MV duration, days [IQR]	15 [7–26]
Need for RRT in ICU, n (%)	17 (43)
ICU length of stay, days [IQR]	20 [8–32]
Mortality at day 28, n (%)	14 (35)
Post-AMI, n (%)	9 (53 %)
Dilated cardiomyopathy, n (%)	3 (25 %)
Postcardiotomy, n (%)	1 (14 %)
Others, n (%)	1 (25 %)
Mortality at ICU discharge, n (%)	17 (43)
Mortality at month 6, n (%)	20 (50)

	Bef		irs	48 hours
Alive, number (%)	40		%)	37 (93 %)
MAP, mmHg	65		-88][a]	80 [75–86][a]
Impella flow, L/min	-		–4.2]	3.9 [3.3–4.2][b]
ECMO flow, L/min	4.1		–4.1][b]	3.2 [2.5–3.9][b]
PaO2/FiO2 ratio	204		37–327]	244 [172–335]
ScvO2*, %	62		-80]	70 [69–73]
Blood lactate (mmol/L)	3.8		–2.8][a,b]	1.5 [1.0–2.1][a,b]
SOFA score	12		–11.0][a,b]	8.0 [5.0–10.0][a,b]
Vasoactive-inotropic score	51		56][a,b]	9 [0–32][a,b]
Inotrope score	10		a,b	0 [0–0.4][a,b]
Cardiothoracic ratio	0.58		.50–0.60][a]	0.54 [0.49–0.59][a]
NT-proBNP (ng/L)	373		799–5689][a]	1780 [745–3931][a]

Gaudard et al. Critical Care 2015

Management and outcome of patients supported with Impella 5.0 for refractory cardiogenic shock

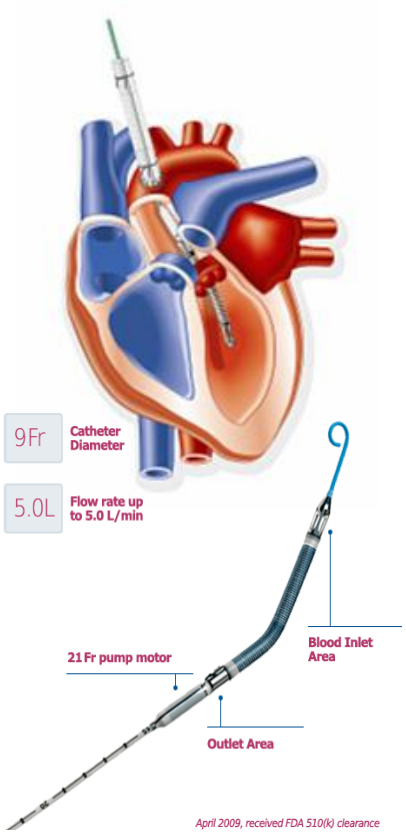
N=40 choc cardiogénique dont 17 en post IDM

Table 3 Incidences of complications or adverse events during Impella 5.0 support

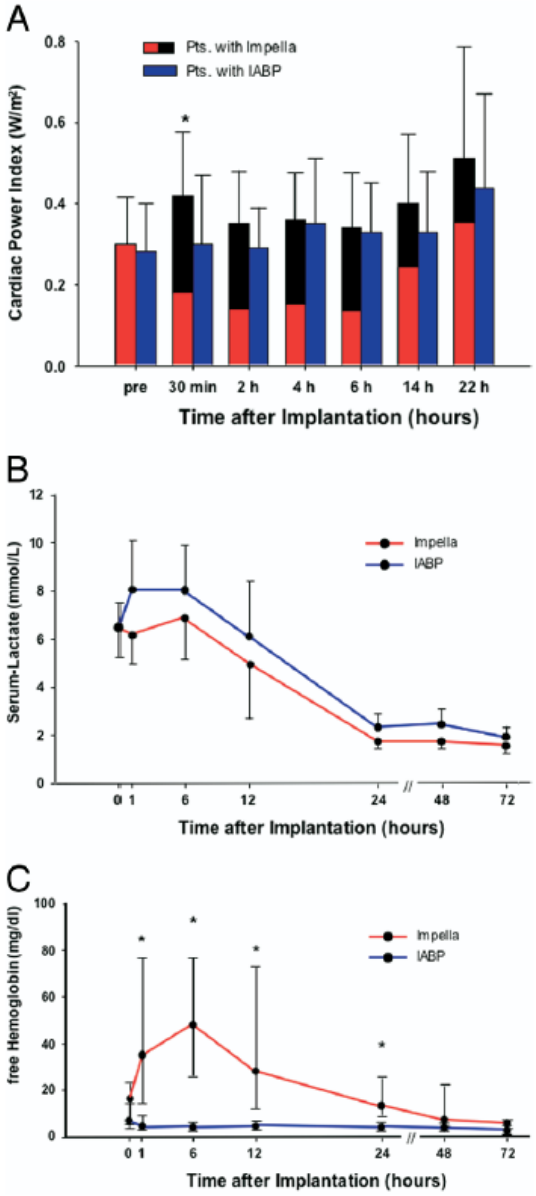
Type of complication	Values
Major device malfunction, n (%)	4 (10)
Minor device malfunction, n (%)	3 (8)
Device displacement (intra-aortic or intraventricular moving), n (%)	8 (20)
Including successful bedside repositioning, n	6
Bleeding requiring transfusion during surgical implantation, n (%)	7 (18)
Bleeding requiring surgery after implantation, n (%)	0 (0)
RBC transfusion on MCS, units [IQR]	4 [1.5–8]
RBC transfusion by day on MCS, units [IQR]	0.4 [0.1–1.2]
Upper or lower limb ischemia on implantation site, n (%)	1 (3)
Thromboembolic events, n (%)	1 (3)
Major hemolysis, n (%)	1 (3 %)
Suspected or minor hemolysis, n (%)	3 (8 %)
Ventricular arrhythmia, n (%)	3 (8)
Device-related infection, n (%)	7 (18)
Surgical site infection, n (%)	4 (10)
Infected thrombus on the head of the pump, n (%)	3 (8)
Bloodstream infection during MCS, n (%)	5 (13)

Gaudard et al. Critical Care 2015

Impella LP2.5 vs. IABP in Cardiogenic SHOCK (ISAR-SHOCK)

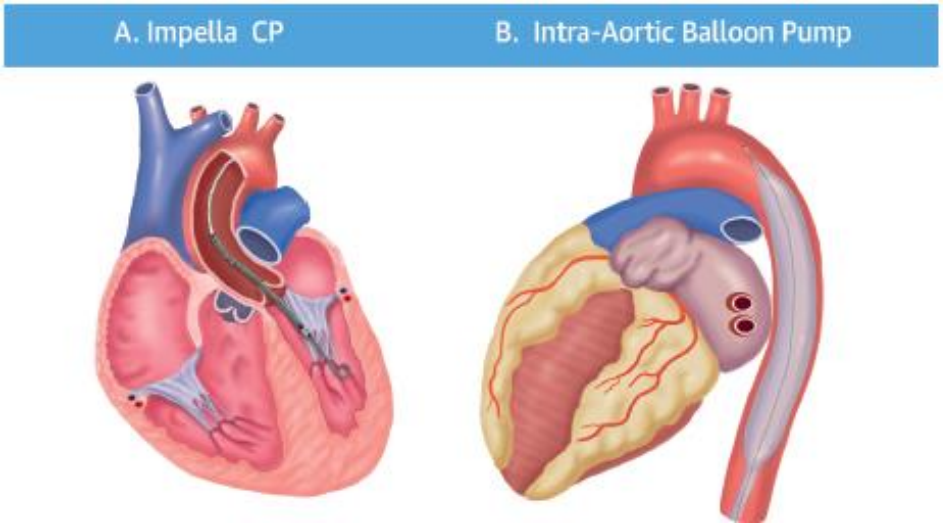


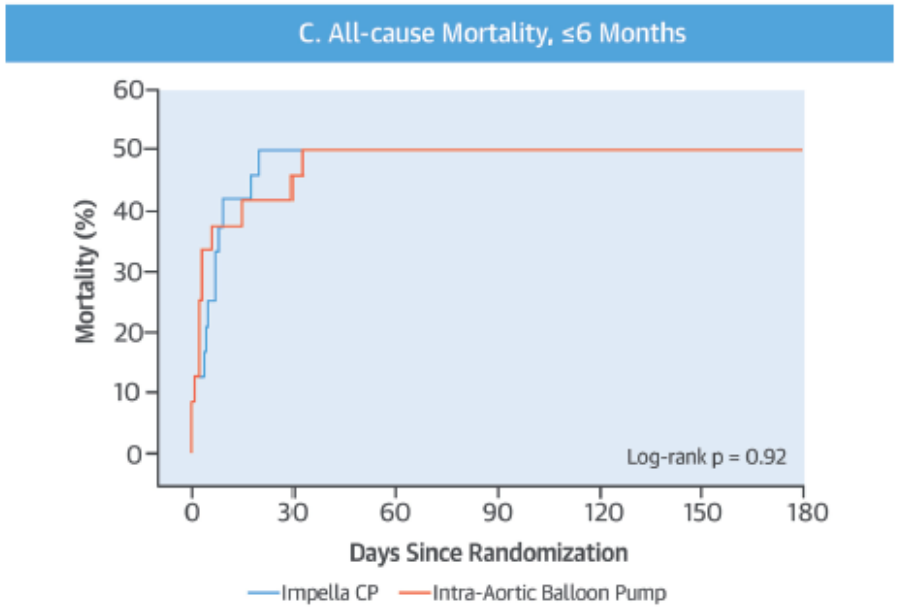
- 26 patient RCT Impella vs IABP
- ↑ Cardiac Index, ↑ MAP (by 10mmHg) vs IABP
- Complications ≤ IABP
- No difference in mortality



Seyfarth, J Am Coll Cardiol 2008

Impella vs. CPIA





- 48 patients RCT Impella CP vs IABP
- No difference in mortality
- Increased hemolysis

Ouweneel, D.M. et al. J Am Coll Cardiol. 2017;69(3):278-87.

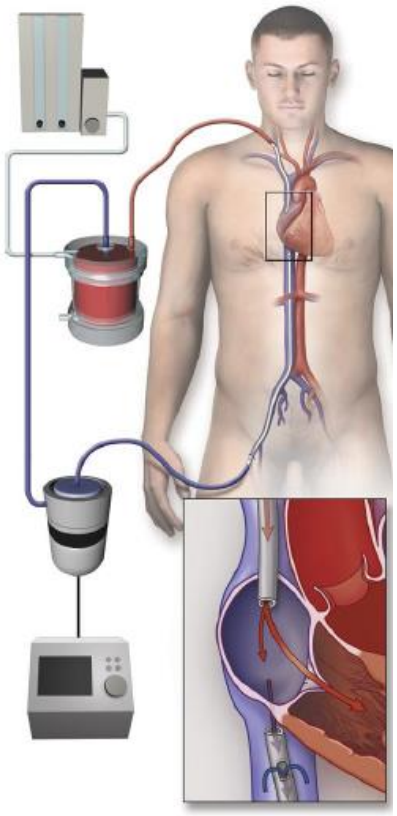
(A and B) Schematic drawings of the heart and aorta showing the 2 mechanical support devices used in the study: (A) Impella CP (Abiomed, Danvers, Massachusetts); (B) the intra-aortic balloon pump (IABP). (C) Time-to-event Kaplan-Meier curves up to 6 months after randomization for all-cause mortality. LV = left ventricular.

Blood products during admission§		
Any blood products during admission	11/24 (46)	8/24 (33)
Packed red blood cells		
Patients treated	11/24 (46)	8/24 (33)
Number of units administered	6 (3-13)	3 (1-5)
Fresh frozen plasma	3/24 (13)	0/24 (0)
Platelets	4/24 (17)	1/24 (4)

ECMO

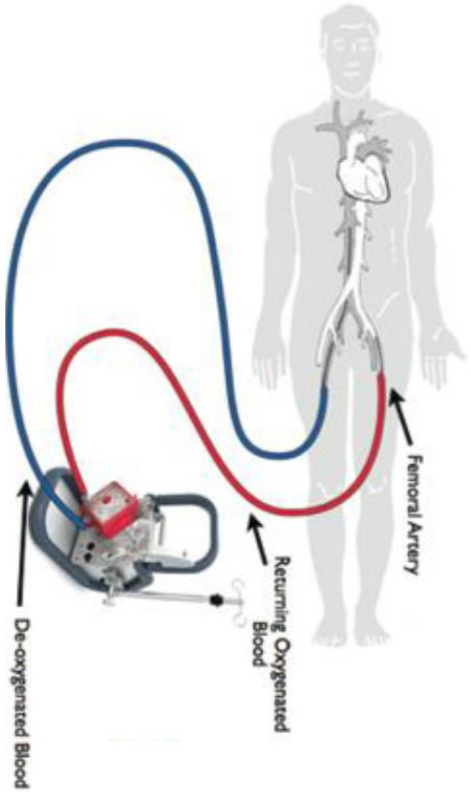
ECMO V-V

fonction oxymétrique pure

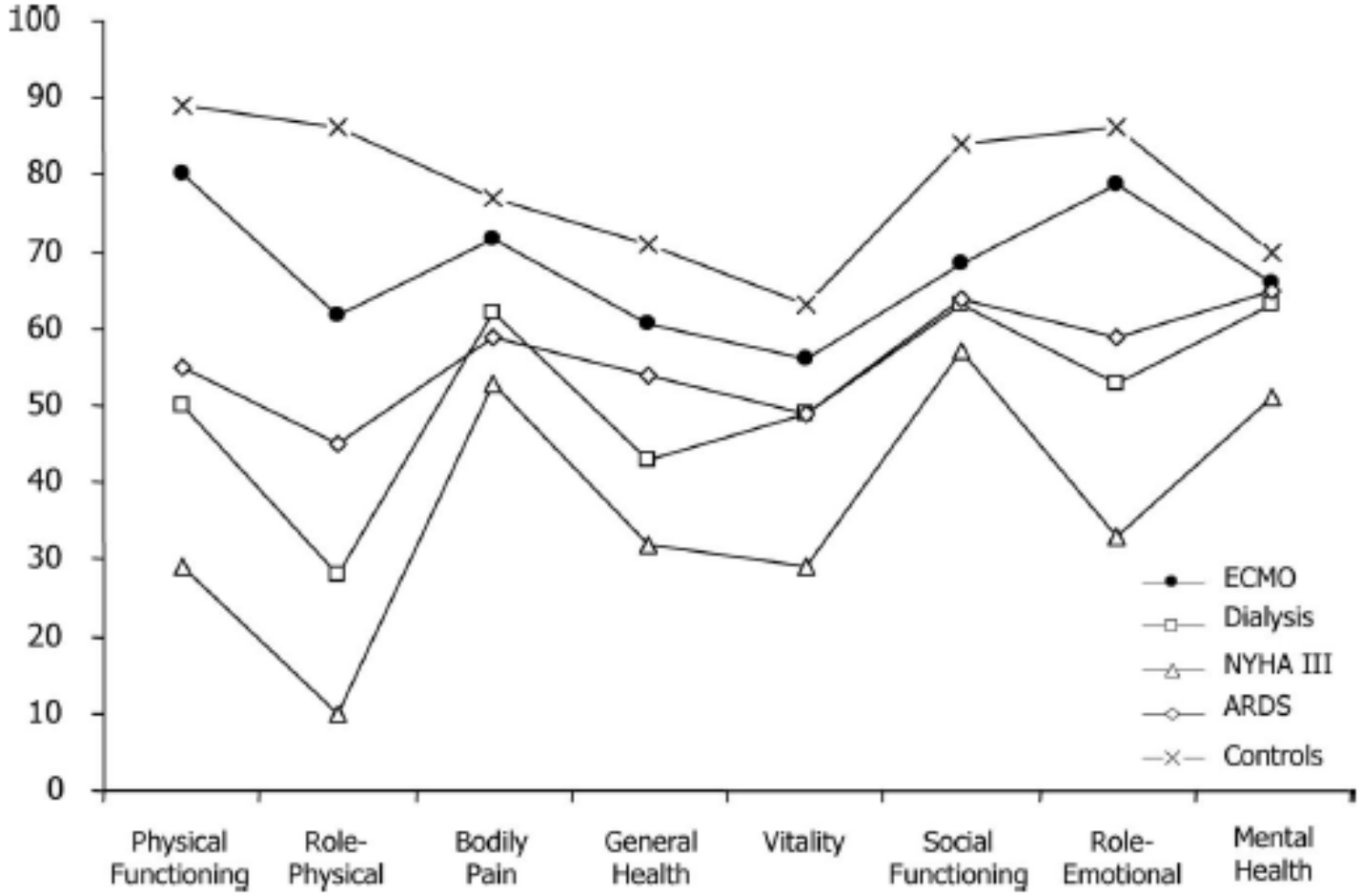


ECMO V-A

fonction pompe et oxymétrique

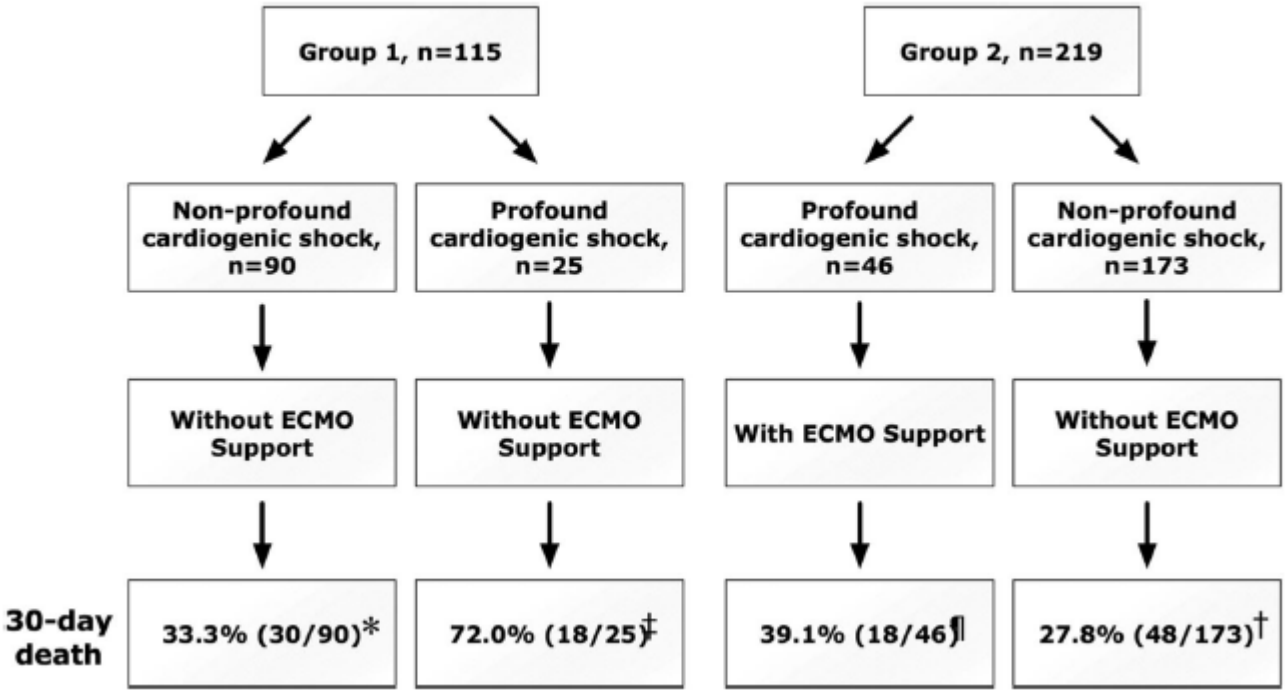


ECMO



Combes et al, CCM 2008

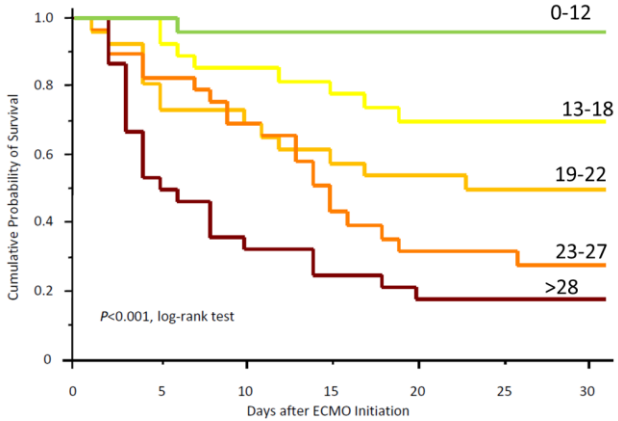
ECMO



Sheu et al. Crit Care Med 2010

Pour qui?

The ENCOURAGE mortality risk score and analysis of long-term outcomes after VA-ECMO for acute myocardial infarction with cardiogenic shock



Parameter	β Coefficient	OR (95 % CI)	*P* value	ENCOURAGE component score
Age >60 years	0.966	2.63 (1.01–6.85)	0.048	5
Female	1.470	4.35 (1.29–14.72)	0.018	7
Body mass index >25 kg/m^2	1.131	3.10 (1.21–7.92)	0.018	6
Glasgow coma score <6	1.128	3.09 (1.19–8.05)	0.021	6
Creatinemia >150 µmol/L	0.957	2.60 (1.05–6.49)	0.040	5
Serum lactate				
<2 mmol/L	0	1		0
2–8 mmol/L	1.551	4.71 (1.31–17.01)	0.020	8
>8 mmol/L	2.165	8.71 (1.76–43.10)	0.004	11
Prothrombin activity <50 %	1.029	2.80 (1.01–7.77)	0.049	5

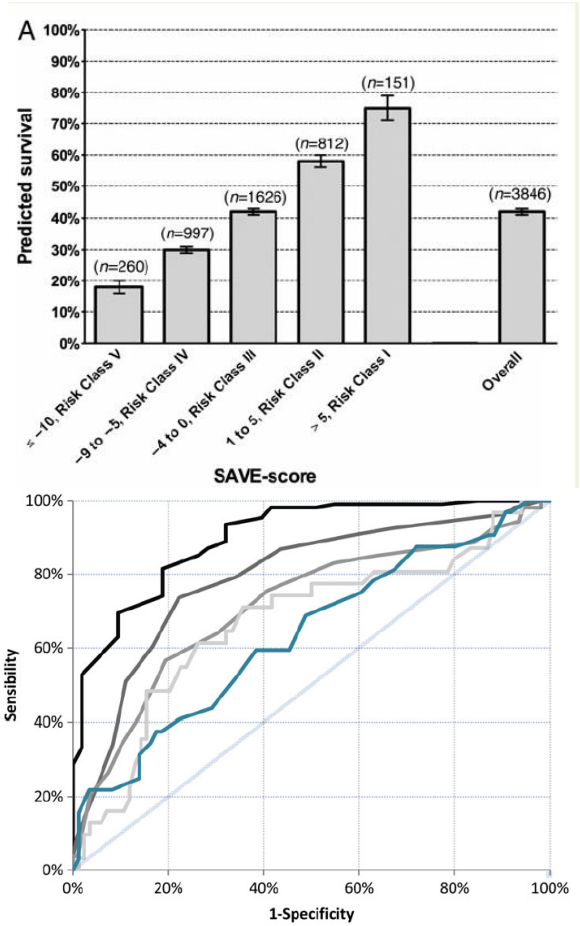
Muller et al. Intensive Care Med 2016

Pour qui?

Table 4 The survival after veno-arterial-extracorporeal membrane oxygenation-score

Parameter	Score	
Acute cardiogenic shock diagnosis group (select one or more)		
Myocarditis	3	
Refractory VT/VF	2	
Post heart or lung transplantation	3	
Congenital heart disease	−3	
Other diagnoses leading to cardiogenic shock requiring VA-ECMO	0	
Age (years)		
18–38	7	
39–52	4	
53–62	3	
≥63	0	
Weight (kg)		
≤65	1	
65–89	2	
≥90	0	
Acute pre-ECMO organ failures (select one or more if required)		
Liver failure[a]	−3	
Central nervous system dysfunction[b]	−3	
Renal failure[c]	−3	
Chronic renal failure[d]	−6	
Duration of intubation prior to initiation of ECMO (h)		
≤10	0	
11–29	−2	
≥30	−4	
Peak inspiratory pressure ≤20 cmH_2O	3	
Pre-ECMO cardiac arrest	−2	
Diastolic blood pressure before ECMO ≥40 mmHg[e]	3	
Pulse pressure before ECMO ≤20 mmHg[e]	−2	
HCO_3 before ECMO ≤15 mmol/L[e]	−3	
Constant value to add to all calculations of SAVE-score	−6	
Total score	−35 to 17	
Total SAVE-score	Risk class	Survival (%)
Hospital survival by risk class		
>5	I	75
1–5	II	58
−4 to 0	III	42
−9 to −5	IV	30
≤−10	V	18

www.save-score.com



Schmitdt et al. Europ Heart J 2015

ECMO: comment la poser?

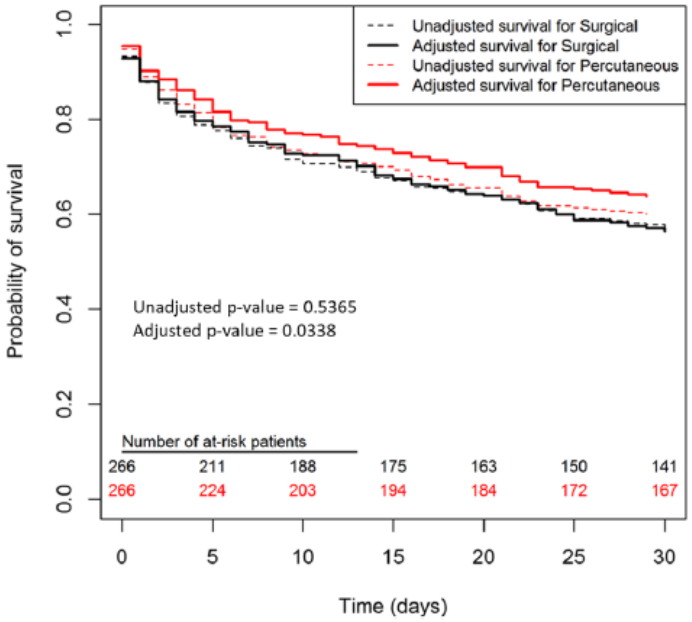
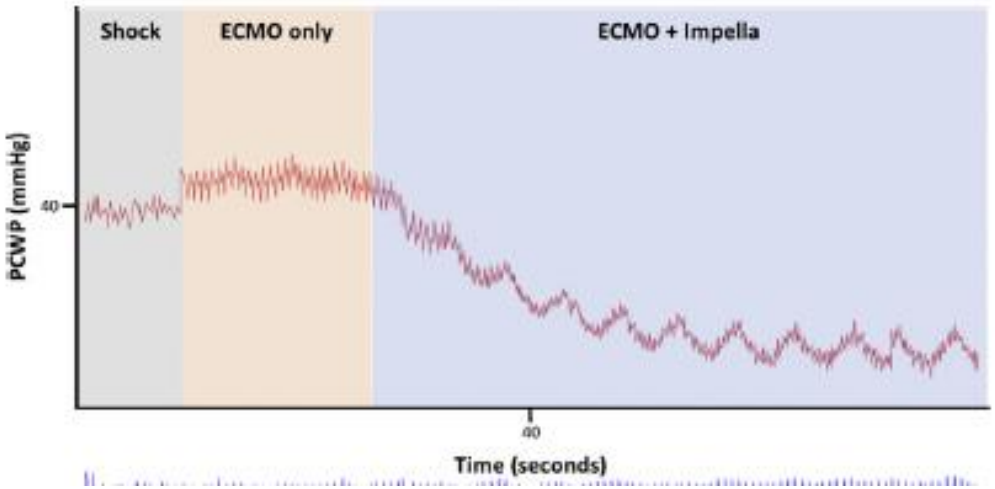


Fig. 1 Kaplan–Meier survival estimates in the unadjusted and propensity matched populations receiving percutaneous or surgical VA-ECMO

	Surgical group $n = 266$ (%)	Percutaneous $n = 266$ (%)	*p* value
30-Day overall survival	150 (56.3)	170 (63.8)	0.034
Cannulation site infection	74 (27.8)	44 (16.5)	0.001
Infection requiring surgical revision[a]	40 (15.0)	14 (5.3)	< 0.001
Vascular complications at cannulation[b]	7 (2.6)	10 (3.8)	0.663
Limb ischemia	33 (12.4)	23 (8.6)	0.347
Cannula relocation or removal	25 (9.4)	15 (5.6)	0.258
Limb fasciotomy	10 (3.8)	6 (2.3)	0.310
Amputation	2 (0.8)	2 (0.8)	1.000
Vascular complications after cannula removal	9 (3.4)	39 (14.7)	< 0.001
Surgical revision for persistent bleeding early after decannulation	4 (1.5)	25 (9.4)	< 0.001
Surgical revision in the days after decannulation[c]	5 (1.9)	14 (5.3)	0.035
Lower limb sensory-motor deficit	6 (2.3)	7 (2.6)	0.779

Danial et al. 2018

Faut-il décharger le VG?



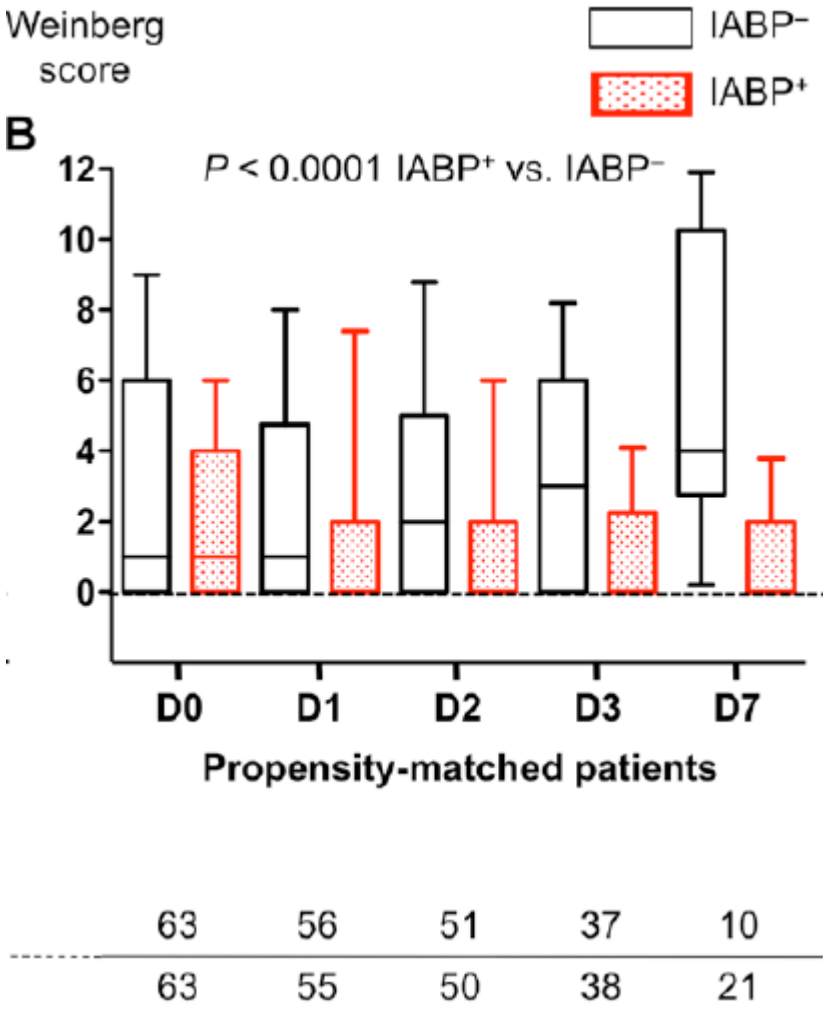
	All Patients (N = 106)
Hypoxic brain damage	17 (19.1)
Intracerebral bleeding	3 (3.4)
Stroke	10 (11.4)
Vascular complication requiring an intervention	36 (34.3)
Abdominal compartment with the need of laparotomy	24 (22.9)
Mesenteric ischemia	10 (9.5)
Bleeding requiring an intervention	26 (24.8)
Hemolysis	48 (47.1)
Sepsis	44 (41.9)
Renal replacement therapy during hospital stay	63 (59.4)

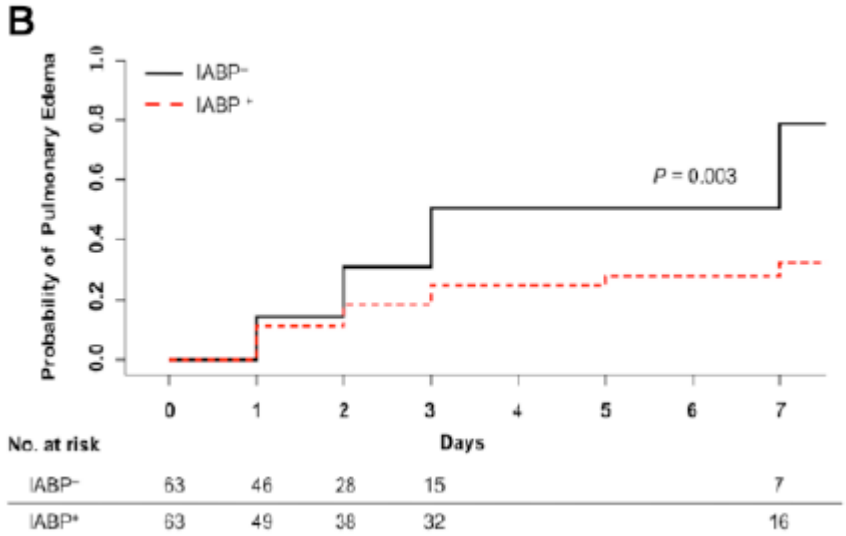
Schrage et al. 2018

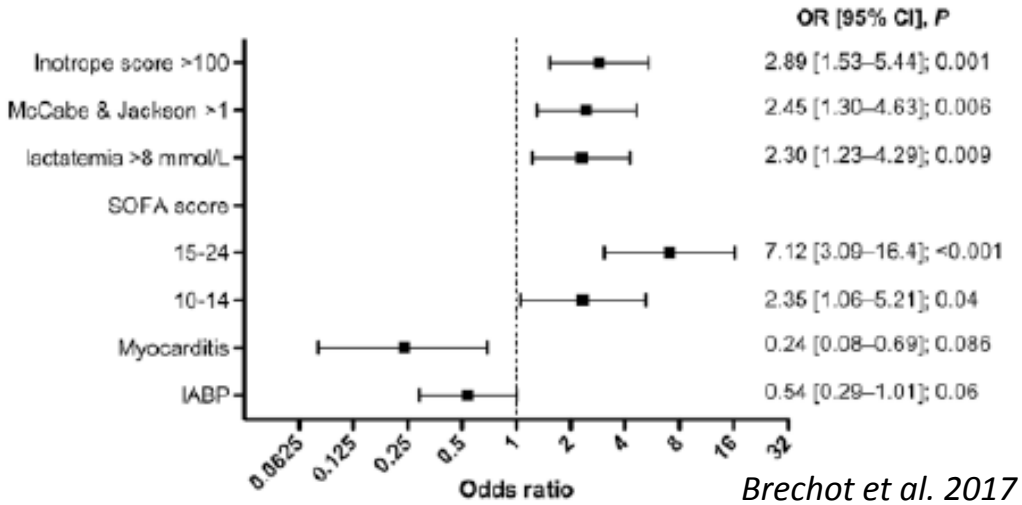
Parameter	Total ($n = 63$)	ECMO + Impella ($n = 21$)	ECMO ($n = 42$)	*P*-value
Hospital mortality, *n* (%)	41 (65)	10 (48)	31 (74)	0.04
Bridge to next therapy or recovery, *n* (%)	28 (44)	13 (62)	15 (36)	0.048
Weaning from MCS, *n* (%)	26 (41)	10 (48)	16 (28)	0.047
Bridge to recovery, *n* (%)	19 (30)	8 (38)	11 (26)	0.3
Bridge to VAD, *n* (%)	8 (13)	4 (19)	4 (9.5)	0.5
Bridge to cardiac transplantation, *n* (%)	0	0	0	
Duration of ECMO, h	120 (36–234)	148 (72–239)	73.5 (29–217)	0.2
Duration of MV, h	93 (29–228)	163 (90–228)	48 (17–265)	0.04
CVVH, *n* (%)	18 (29)	10 (48)	8 (19)	0.02
Haemolysis, *n* (%)	30 (48)	16 (76)	14 (33)	0.004
Major bleeding, *n* (%)	20 (32)	8 (38)	12 (29)	0.6
Minor bleeding, *n* (%)	14 (22)	4 (19)	10 (24)	0.8
LVEF at weaning, %	45.5 (30–55)	52.5 (47–55.5)	37.5 (25–50)	0.13

Pappalardo et al. 2017

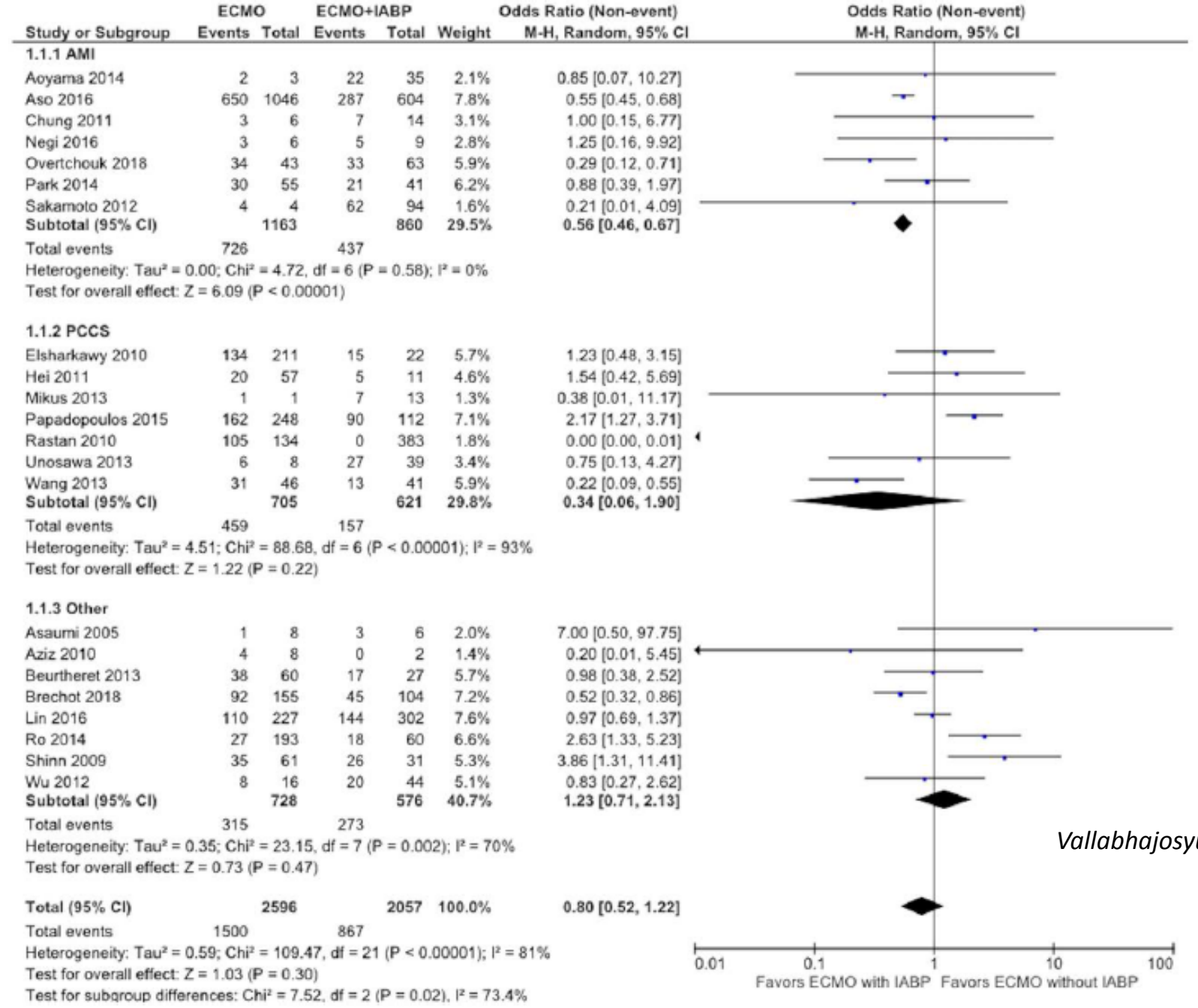
Faut-il décharger le VG?







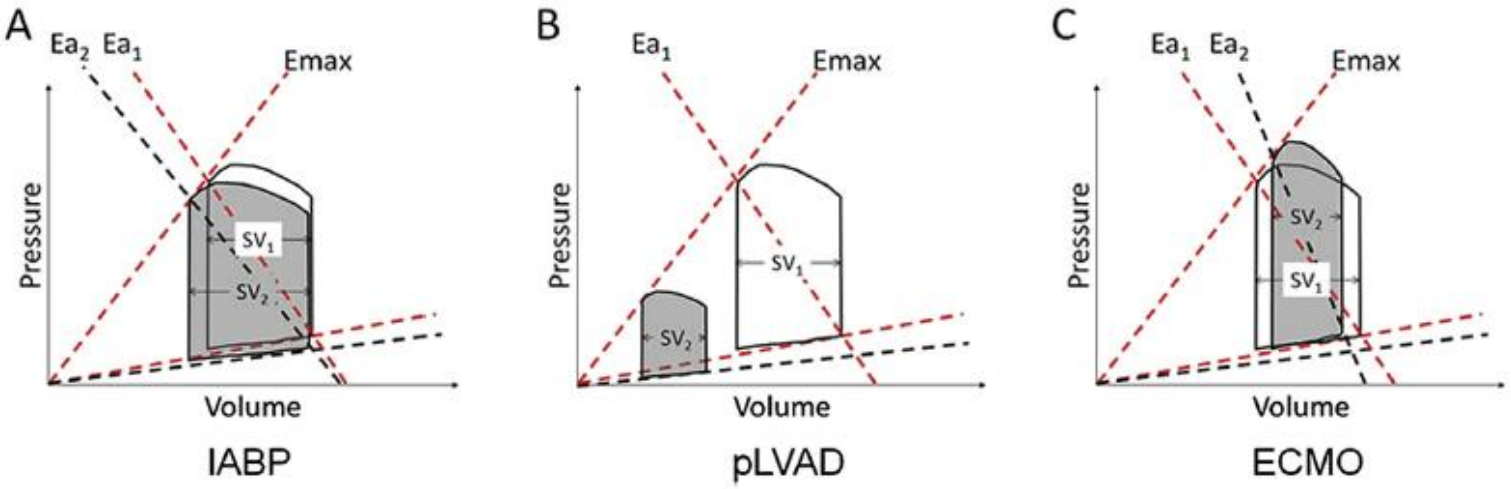
Brechot et al. 2017



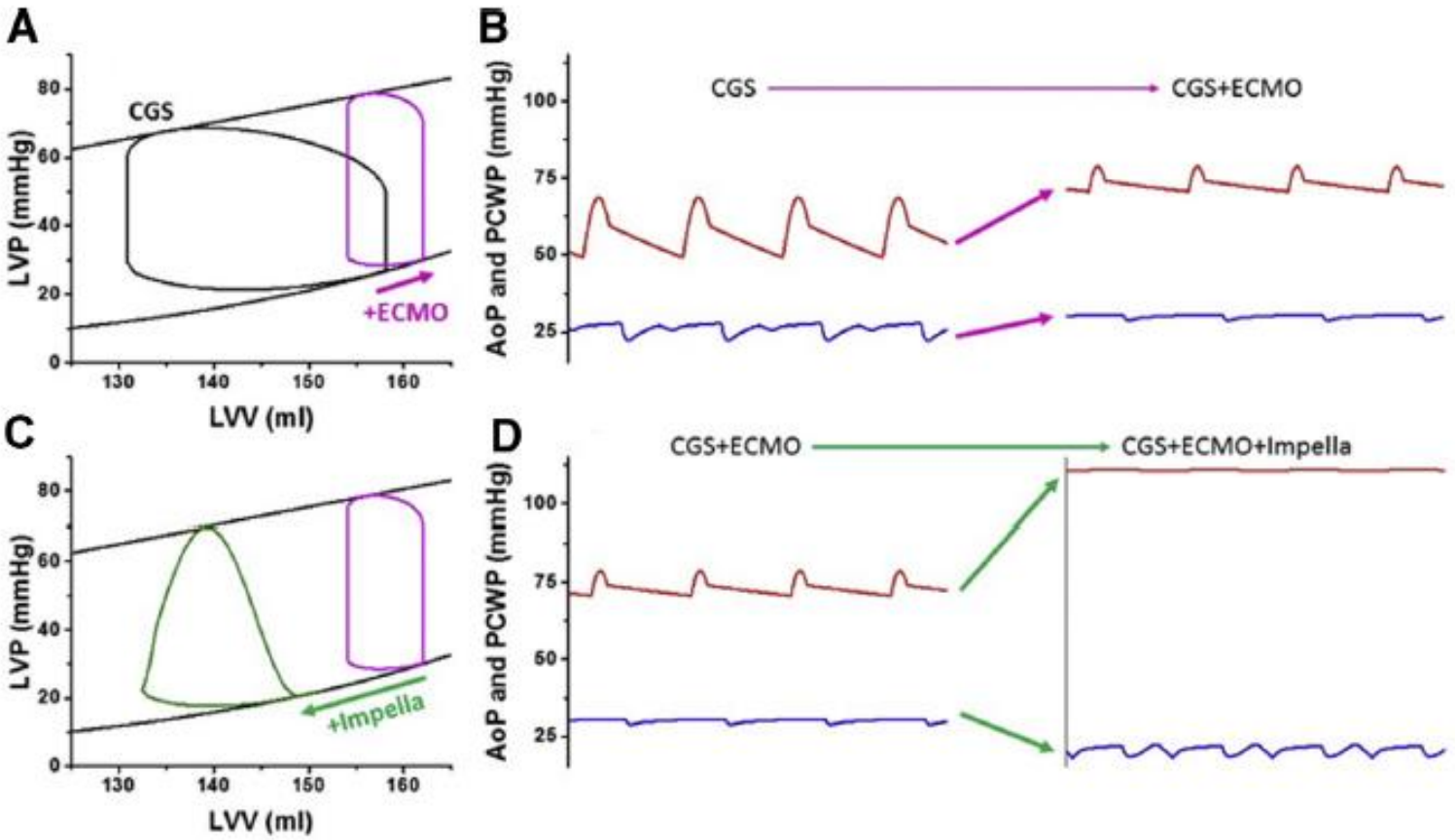
Vallabhajosyula et al. 2018

Au total

	Débit	Post charge VG	MVO2	Facilité mise en place	Facilité gestion	Durée max	Coût /CPIA
CPIA	0-0,5	↓→	↓→	++++	++++	5-10J	
Impella	2,5-5	↓	↓	+++	++	5-10J	+++
ECMO	>5	↑	↑	++	+	15-20J	+



Au total



Schrage et al. 2018

Conclusion

- Assistance à considérer après échec traitement médical
- Ne pas trop attendre
- CPIA: pas de bénéfice
- Impella: pas mieux que CPIA avec plus de complications
- ECMO: potentiel bénéfice
  - Pas trop tard
  - Privilégier per-cutanée
  - Décharge à envisager