

CHOÁNG TIM SAU NMCT NHỮNG CẬP NHẬT MỚI

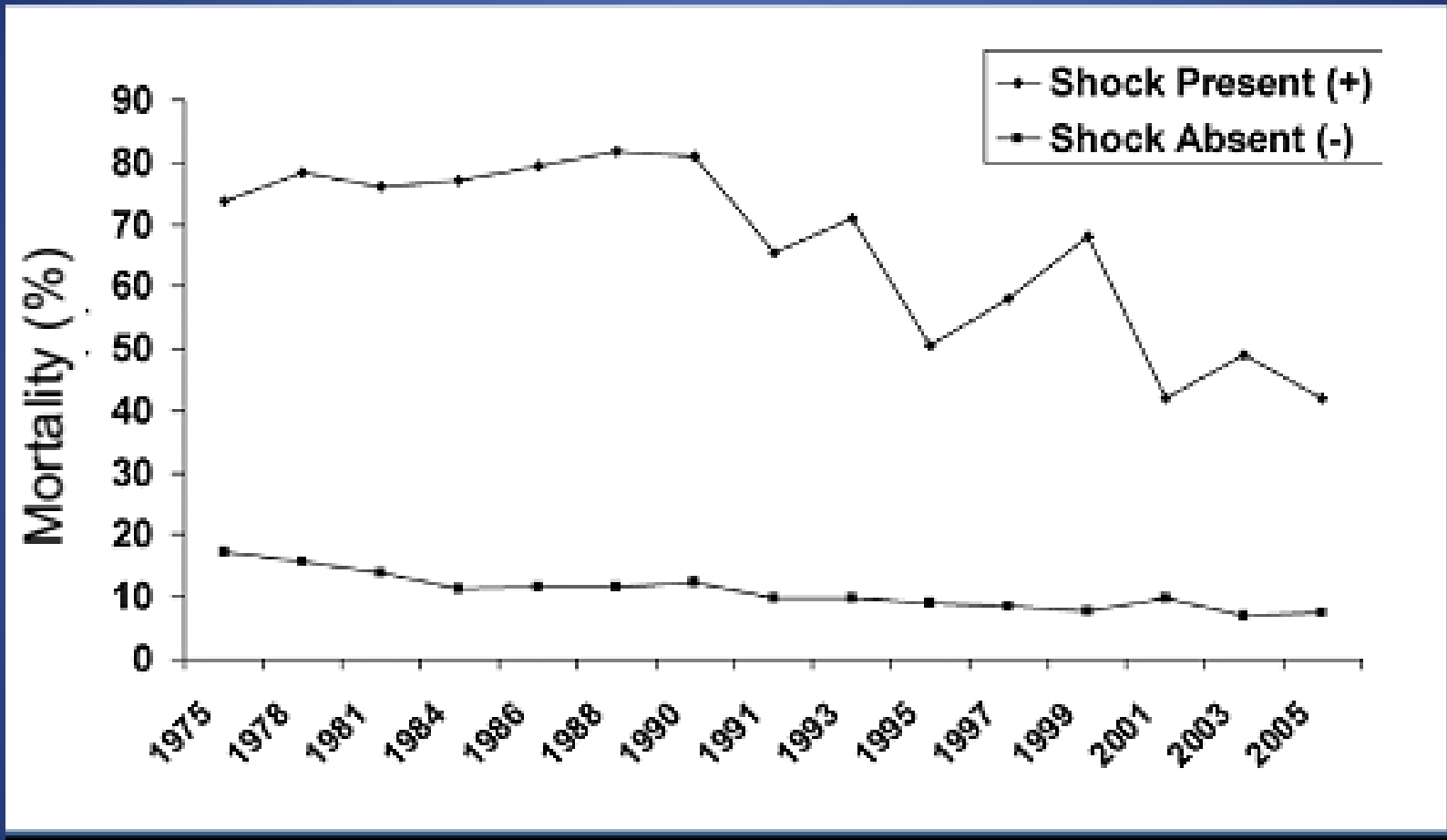
THS.BS NGUYỄN HOÀNG HẢI
PGS.TS HOÀNG QUỐC HÒA
BV NHÂN DÂN GIA ĐỊNH

ĐẶT VẤN ĐỀ

Choáng tim sau nhồi máu cơ tim cấp:

- Tần suất 6-10%
- STEMI > NSTEMI
- Xảy ra trong những giờ đầu (6 giờ 50%, 24 giờ 75%)
- Tử vong 40-50%

ĐẶT VẤN ĐỀ



Tỷ lệ tử vong NMCT có choáng tim và không choáng tim trong 30 năm 1975-2005

ĐẶT VẤN ĐỀ

❖ Điều trị choáng tim có điểm nào thay đổi?

1. Sử dụng thuốc vận mạch
2. Vai trò của hỗ trợ tuần hoàn bằng biện pháp cơ học

CHẨN ĐOÁN

Table 1. Cardiogenic shock criteria

Hemodynamic criteria

Systolic blood pressure (SBP) of less than 90 mm Hg for greater than 30 minutes

SBP drop of greater than 30 mm Hg below basal for greater than 30 minutes in patients with hypertension

Use of vasopressors and inotropes to keep SBP greater than 90 mm Hg

Cardiac index of less than 2.2 L/min per m²

Pulmonary artery occlusion pressure of greater than 15 mm Hg

Signs of tissue hypoperfusion

Pale, cool, and clammy peripheries

Prolonged capillary refill times

Altered mental status/confusion

Oliguria

Pulmonary congestion

Tachycardia

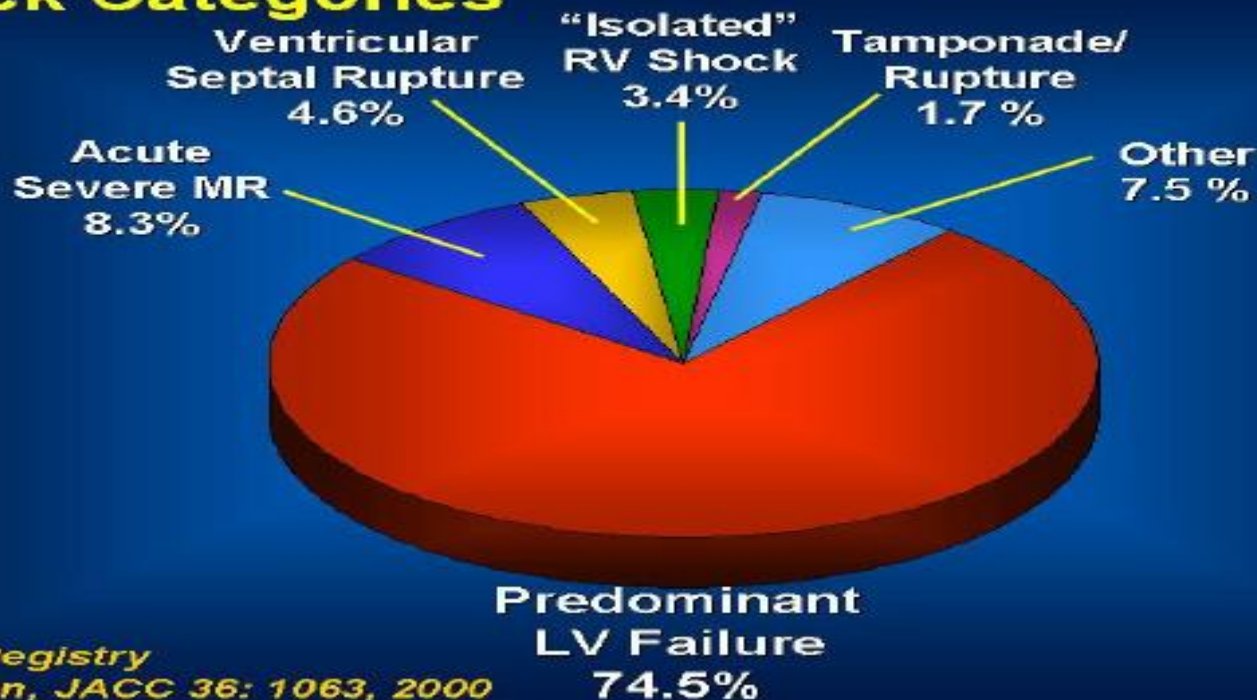
Elevated lactate

Mixed venous saturation of less than 65%

NGUYÊN NHÂN

- Do rối loạn chức năng thất trái (nguyên nhân thường gặp nhất, gặp NMCT ST chênh lên nhiều hơn ST không chênh).
- Biến chứng cơ học :
 - vỡ thành tim,
 - thông liên thất,
 - rối loạn chức năng hoặc đứt cơ nhú.

Shock Categories



Shock Registry
Hochman, JACC 36: 1063, 2000

ĐIỀU TRỊ

Điều trị hiệu quả choáng tim

- Nhận biết sớm các dấu hiệu choáng
- Điều trị tối ưu

NHẬN BIẾT SỚM DẤU HIỆU CHOÁNG

❖ Các yếu tố nguy cơ cho shock tim:

- Tuổi > 70
- Huyết áp tâm thu < 120 mmHg
- Nhịp nhanh xoang > 110 l/p hoặc nhịp tim < 60 l/p.
- Thời gian từ khi khởi phát triệu chứng STEMI kéo dài

ĐIỀU TRỊ

- Thở Oxy hoặc thông khí cơ học (tùy theo khí máu động mạch).
- **Tái tưới máu mạch vành** (PCI, CABG, tiêu sợi huyết).
- Thuốc vận mạch
- Chăm sóc khác: Đường huyết < 180 mg/dl. GIK không hiệu quả. Truyền HC Hb < 7 g/dl, Hct $< 25\%$

Jung, C., Lauten, A., Ferrari, M. (2010), "Microcirculation in cardiogenic shock: from scientific bystander to therapy target". *Crit Care*, 14(5), 193.

Karl Werdan and Martin Rub et al (2012), "Cardiogenic shock due to myocardial infarction: diagnosis, monitoring and treatment". *A German-Austrian S3 Guideline. Dtsch Arztebl Int*, 109(19), 343-351.

THUỐC VẬN MẠCH

Thuốc co mạch:

- Norepinephrine
- Dopamin
- Epinephrine
- Phenylephrine
- Vasopressin

Thuốc tăng co bóp cơ tim:

- Dobutamin
- Milrinone
- Levosimendan

Nguyên tắc điều trị thuốc vận mạch: Khi bù đủ dịch mà không hồi phục được huyết áp và tưới máu mô thì khởi đầu điều trị thuốc vận mạch.

Thuốc vận mạch

	Dose	Cardiac		Peripheral Vasculature		
		Heart Rate	Contractility	Vasoconstriction	Vasodilation	Dopaminergic
Norepinephrine	2-40 $\mu\text{g}/\text{min}$	+	++	++++	0	0
Dopamine	1-4 $\mu\text{g}/\text{kg}/\text{min}$	+	+	0	+	++++
	4-20 $\mu\text{g}/\text{kg}/\text{min}$	++	++-+++	++-+++	0	++
Epinephrine	1-20 $\mu\text{g}/\text{min}$	++++	++++	++++	+++	0
Phenylephrine	20-200 $\mu\text{g}/\text{min}$	0	0	+++	0	0
Vasopressin	0.01-0.03 U/min	0	0	++++	0	0
Dobutamine	2-20 $\mu\text{g}/\text{kg}/\text{min}$	++	+++-++++	0	++	0
Milrinone	0.375-0.75 $\mu\text{g}/\text{kg}/\text{min}$	+	+++	0	++	0
Levosimendan	0.05-0.2 $\mu\text{g}/\text{kg}/\text{min}$	+	+++	0	++	0

ACC/AHA Guidelines for STEMI 2004: *Treatment of Hypotension*

Low Output – Cardiogenic Shock

Check Blood Pressure

Systolic BP
> 100 mm Hg

NTG
10-20 mcg
/min IV

Systolic BP
70-100 mm Hg
NO signs/sx
of shock

Dobutamine
2-20 mcg/kg
/min IV

Systolic BP
70-100 mm Hg
Signs/sx
of shock

Dopamine
5-15 mcg/kg
/min IV

Systolic BP
< 70 mm Hg
Signs/sx
of shock

Norepinephrine
0.5-30 mcg
/min IV

Tuy nhiên các hướng dẫn ACC-
AHA-ESC đang gặp thách
thức lớn?

The NEW ENGLAND JOURNAL *of* MEDICINE

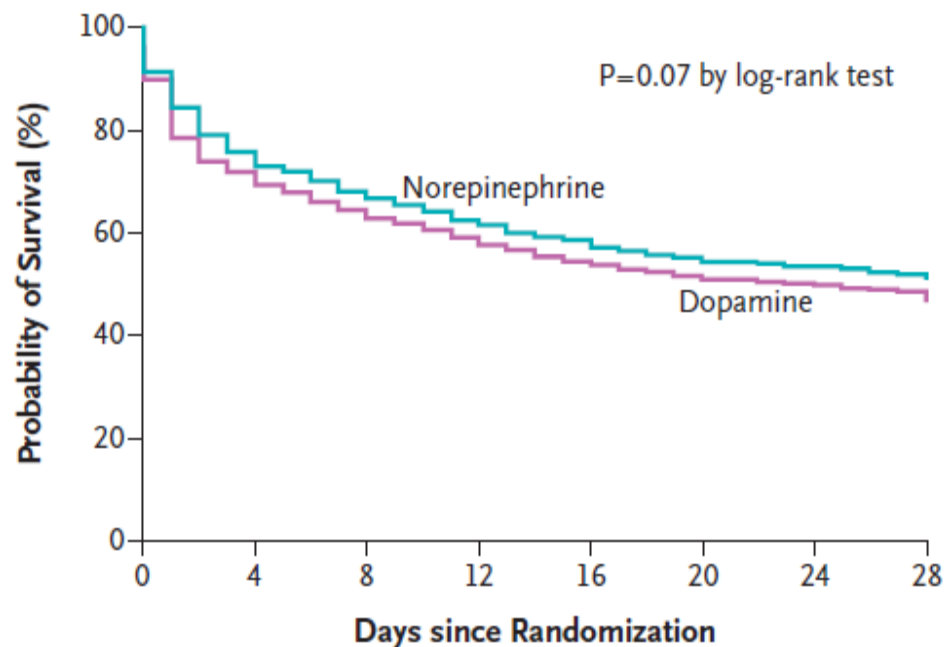
ESTABLISHED IN 1812

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*



No. at Risk

Norepinephrine	821	617	553	504	467	432	412	394
Dopamine	858	611	546	494	452	426	407	386

Figure 2. Kaplan–Meier Curves for 28-Day Survival in the Intention-to-Treat Population.

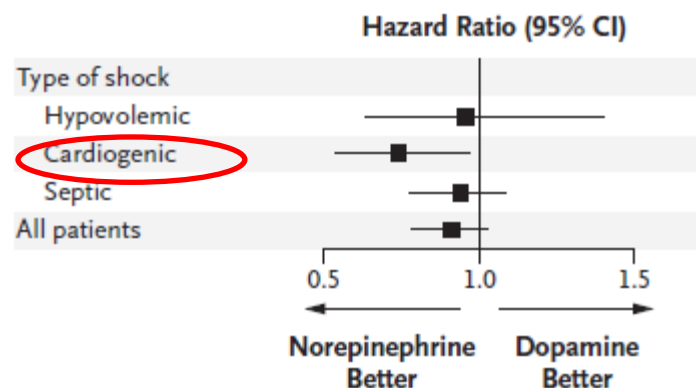


Figure 3. Forest Plot for Predefined Subgroup Analysis According to Type of Shock.

A total of 1044 patients were in septic shock (542 in the dopamine group and 502 in the norepinephrine group), 280 were in cardiogenic shock (135 in the dopamine group and 145 in the norepinephrine group), and 263 were in hypovolemic shock (138 in the dopamine group and 125 in the norepinephrine group). The P value for interaction was 0.87.

Nghiên cứu thực hiện trên 1679 bệnh nhân sốc:

- Không khác biệt tử vong sau 28 ngày
- Nhóm choáng tim (280 bệnh nhân): tỷ lệ tử vong và rối loạn nhịp tăng nhóm sử dụng **Dopamine** so với **Norepinephrine**.

Các hạn chế nghiên cứu:

- Dịch truyền 1000ml tinh thể và 500ml dịch keo: thấp.
- Tương đương tác dụng Dopamine 20 $\mu\text{g/kg/phút}$ với Norepinephrine 0,19 $\mu\text{g/kg/phút}$ chưa được chứng minh
- Nhóm sử dụng Dopamin có tổng liều Norepinephrine cao hơn $\rightarrow$ bệnh nền có nặng hơn không?

Sakr Y and Reinhart K (2006), "Does Dopamine administration in shock influence outcome? Results of the Sepsis Occurrence in Acutely ill Patients (SOAP) Study". *Crit Care Med*, 34, 589-597

ESC 2012

Treatment of cardiogenic shock (Killip class IV)

Oxygen/mechanical respiratory support is indicated according to blood gasses.	I	C
Urgent echocardiography/Doppler must be performed to detect mechanical complications, assess systolic function and loading conditions.	I	C
High-risk patients must be transferred early to tertiary centres.	I	C
Emergency revascularization with either PCI or CABG in suitable patients must be considered.	I	B
Fibrinolysis should be considered if revascularization is unavailable.	IIa	C
Intra-aortic balloon pumping may be considered.	IIb	B
LV assist devices may be considered for circulatory support in patients in refractory shock.	IIb	C
Haemodynamic assessment with balloon floating catheter may be considered.	IIb	B
Inotropic/vasopressor agents should be considered:	IIa	C
• Dopamine		
• Dobutamine	IIa	C
• Norepinephrine (preferred over dopamine when blood pressure is low).	IIb	B

Giải thích sinh lý bệnh

- ❖ Dopamine là tiền chất của Norepinephrine trong hệ thần kinh giao cảm.
- Bệnh nhân **choáng**: đáp ứng với Dopamin kém do **Norepinephrine nội sinh cạn kiệt**. Tác nhân trực tiếp như epinephrine và norepinephrine có hiệu quả.

KHUYẾN CÁO SỬ DỤNG THUỐC VẬN MẠCH TRONG ĐIỀU TRỊ CHOÁNG TIM CỦA ESC 2012

- Khi huyết áp thấp: Norepinephrine là chọn lựa hàng đầu (gây co mạch và ít gây nhịp nhanh), tăng liều cho đến khi huyết áp động mạch đạt 80mmHg.
- Sau đó truyền tĩnh mạch Dobutamine tác động beta tăng co bóp cơ tim.

Ph. Gabriel Steg, Stefan K. James, Dan Atar, Luigi P. Badano, Carina Blo
"mstrom-Lundqvist (2012), "ESC Guidelines for the management of acute
myocardial infarction in patients presenting with ST-segment elevation".
European Heart Journal, 33, 2569-2619.

DỤNG CỤ CƠ HỌC HỖ TRỢ TUẦN HOÀN

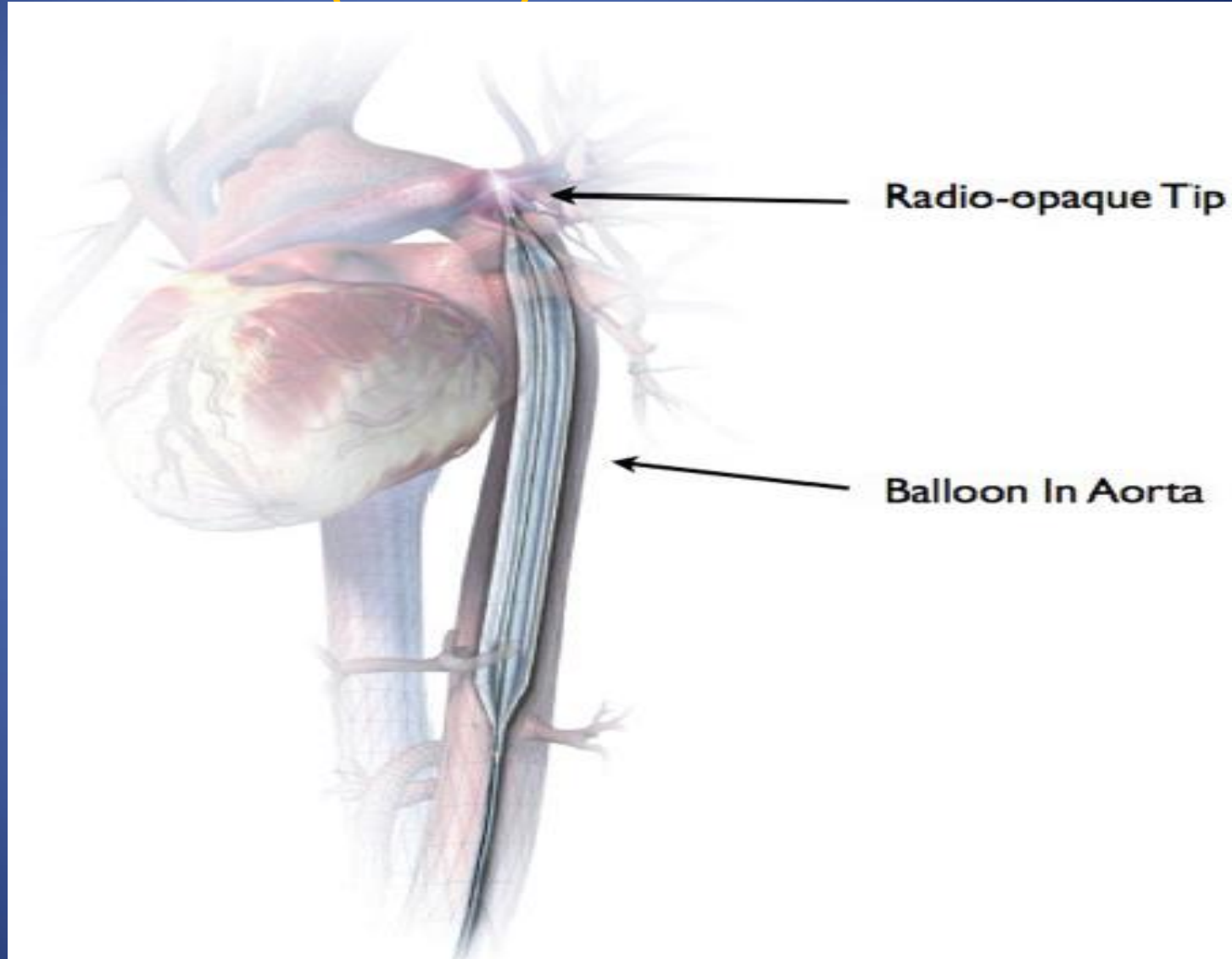
- Thuốc vận mạch làm tăng nhu cầu tiêu thụ oxy cơ tim → tăng thiếu máu cục bộ cơ tim.
- Sử dụng các dụng cụ cơ học hỗ trợ tuần hoàn ngay khi dùng thuốc tăng co bóp cơ tim có thể cải thiện tình trạng choáng tim như thế nào?

DỤNG CỤ CƠ HỌC HỖ TRỢ ĐIỀU TRỊ CHOÁNG TIM

- Qua da:
 - IABP
 - Tandem Heart
 - Impella
- Phẫu thuật:
 - Tuần hoàn ngoài cơ thể
 - ECMO
 - VADs

BÓNG ĐỐI XUNG ĐỘNG MẠCH CHỦ (IABP)

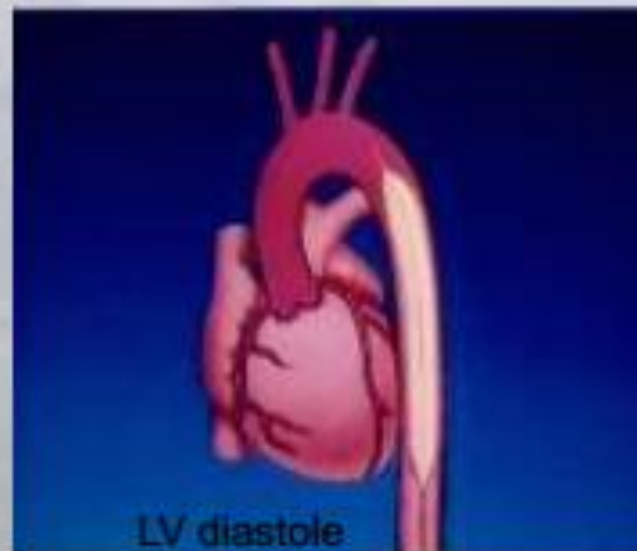
- Năm 1968: áp dụng trên người
- Năm 1980: cải tiến → đặt xuyên qua da



Intra-Aortic Balloon Pump

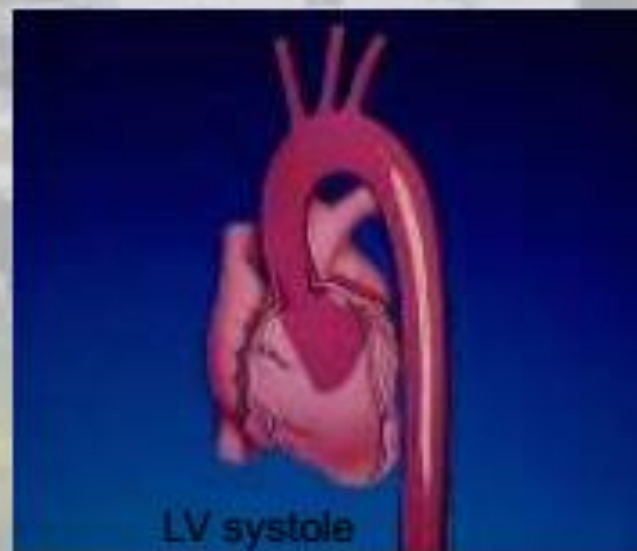
Advantages:

- Mature technology, easy to use
- Increases coronary perfusion
- Improves cardiac performance by reducing afterload.



Disadvantages:

- Does not affect contractility- benefit in advanced disease?
- Requires a minimum of cardiac function
- Requires a stable rhythm



CÁC NGHIÊN CỨU VAI TRÒ IABP

Table 2. Mortality evidence supporting intra-aortic balloon pump use in cardiogenic shock complicating an acute myocardial infarction

Study	Patients	IABP ^a	No IABP ^a	P value
Pre-thrombolysis				
O'Rourke et al. [22] (1981)	30	50%	43%	0.09
Flaherty et al. [23] (1985)	20	52%	53%	-
Thrombolysis era				
Kovack et al. [25] (1997)	335	93%	37%	0.0002
GUSTO-I [26] (1997)	310	47% ^b	60% ^b	0.06
SHOCK [27] (2000)	856	47%	63%	0.007
NRMI-2 [28] (2001)	12,054 ^c	49%	67%	-
Reperfusion by PCI				
NRMI-2 [28] (2001)	7,881 ^c	47%	42%	-

^aIn-hospital mortality expressed as a percentage. ^bThirty-day mortality. ^cTotal number of patients in the study, including those with no reperfusion therapy, was 23,180. GUSTO-I, Global Utilization of Streptokinase and Tissue Plasminogen Activator for Occluded Coronary Arteries; IABP, intra-aortic balloon pump; NRMI-2, National Registry of Myocardial Infarction 2; PCI, percutaneous coronary intervention; SHOCK, Should We Emergently Revascularize Occluded Coronary Arteries for Cardiogenic Shock.

CÁC NGHIÊN CỨU VAI TRÒ IABP

- Nghiên cứu IABP-Shock I.
- Phân tích gộp từ 9 nghiên cứu đoàn hệ với 10529 bệnh nhân năm 2009
- 6 nghiên cứu ngẫu nhiên trên 190 bệnh nhân choáng tim sau NMCT từ dữ liệu Cochrane 2011.

→ **Không thấy lợi ích của IABP.**

→ Chờ kết quả nghiên cứu IABP-SHOCK II công bố năm 2012

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Intraaortic Balloon Support for Myocardial Infarction with Cardiogenic Shock

Holger Thiele, M.D., Uwe Zeymer, M.D., Franz-Josef Neumann, M.D., Mirosław Ferenc, M.D.,
Hans-Georg Olbrich, M.D., Jörg Hausleiter, M.D., Gert Richardt, M.D., Marcus Hennersdorf, M.D., Klaus Empen, M.D.,
Georg Fuernau, M.D., Steffen Desch, M.D., Ingo Eitel, M.D., Rainer Hambrecht, M.D., Jörg Fuhrmann, M.D.,
Michael Böhm, M.D., Henning Ebel, M.D., Steffen Schneider, Ph.D., Gerhard Schuler, M.D., and Karl Werdan, M.D.,
for the IABP-SHOCK II Trial Investigators*

Tiêu chí chính: tử vong

Tiêu chí phụ:

thời gian ổn định huyết động,
thời gian nằm ICU,
nồng độ lactat,
thời gian và liều dùng
catecholamine,
chức năng thận

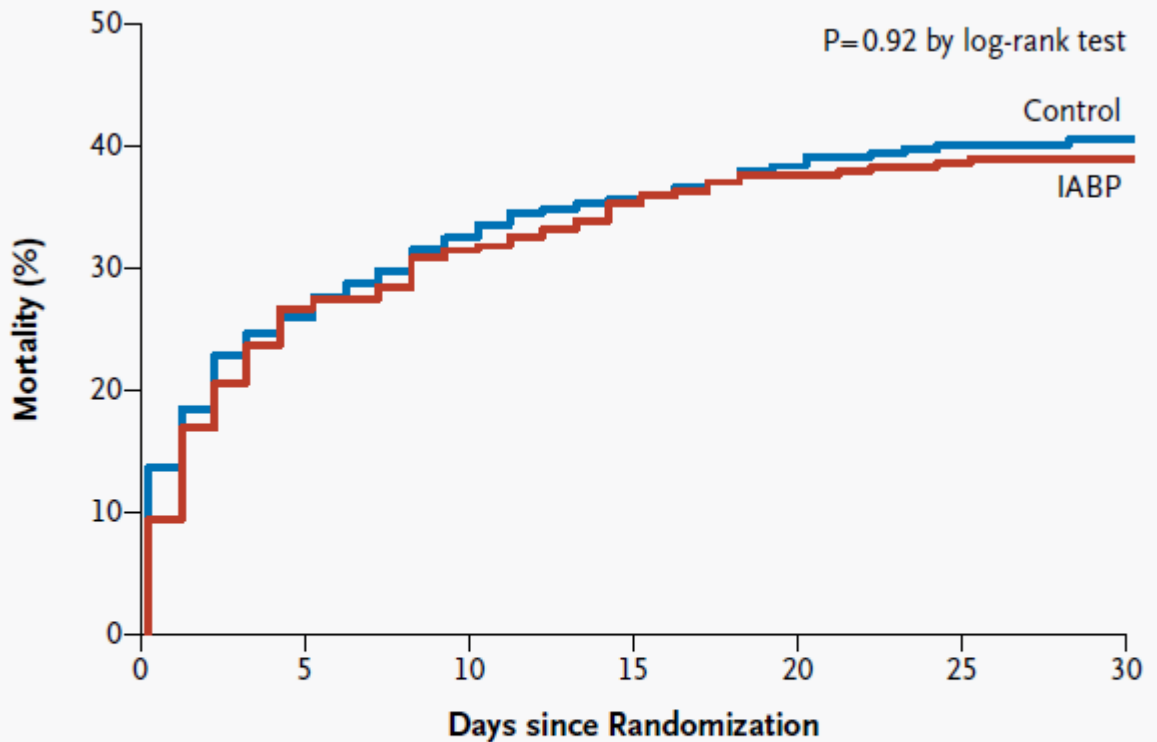


Figure 1. Time-to-Event Curves for the Primary End Point.

Time-to-event curves are shown through 30 days after randomization for the primary end point of all-cause mortality. Event rates represent Kaplan-Meier estimates.

KHUYẾN CÁO ESC 2012

Treatment of cardiogenic shock (Killip class IV)

Oxygen/mechanical respiratory support is indicated according to blood gasses.	I	C
Urgent echocardiography/Doppler must be performed to detect mechanical complications, assess systolic function and loading conditions.	I	C
High-risk patients must be transferred early to tertiary centres.	I	C
Emergency revascularization with either PCI or CABG in suitable patients must be considered.	I	B
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Intra-aortic balloon pumping may be considered.	IIb	B
LV assist devices may be considered for circulatory support in patients in refractory shock.	IIb	C
Haemodynamic assessment with balloon floating catheter may be considered.	IIb	B
Inotropic/vasopressor agents should be considered:	IIa	C
• Dopamine		
• Dobutamine	IIa	C
• Norepinephrine (preferred over dopamine when blood pressure is low).	IIb	B

2013 ACCF/AHA Guideline for the Management of ST-Elevation Myocardial Infarction

A Report of the American College of Cardiology Foundation/
American Heart Association Task Force on Practice Guidelines

9.1. Cardiogenic Shock

9.1.1. Treatment of Cardiogenic Shock: Recommendations

CLASS I

1. Emergency revascularization with either PCI or CABG is recommended in suitable patients with cardiogenic shock due to pump failure after STEMI irrespective of the time delay from MI onset (212,379,452). (*Level of Evidence: B*)
2. In the absence of contraindications, fibrinolytic therapy should be administered to patients with STEMI and cardiogenic shock who are unsuitable candidates for either PCI or CABG (81,453,454). (*Level of Evidence: B*)

CLASS IIa

1. The use of intra-aortic balloon pump (IABP) counterpulsation can be useful for patients with cardiogenic shock after STEMI who do not quickly stabilize with pharmacological therapy (455–459). (*Level of Evidence: B*)

CLASS IIb

1. Alternative LV assist devices for circulatory support may be considered in patients with refractory cardiogenic shock. (*Level of Evidence: C*)

Guidelines

IABP in STEMI complicated by cardiogenic shock

American Heart
Association



Class 1B → IIa B



Class IC → IIb B

Antman et al. Circulation 2004; 110: 82-292
O'Gara et al. Circulation 2013; 127: 425-435.
Van de Werf et al. Eur Heart J 2008; 29: 2909-2945
Steg et al. Eur Heart J 2012; 33: 2569-2619

ESC Revascularization Guidelines 2014

IABP in cardiogenic shock



EUROPEAN
SOCIETY OF
CARDIOLOGY®

Class IC → IIb B → III?

Routine use of IABP in patients with cardiogenic shock is not recommended.

III

A

IABP insertion should be considered in patients with haemodynamic instability/cardiogenic shock due to mechanical complications.

IIa

C

KẾT LUẬN

- Choáng tim sau NMCT tử vong cao 40-50%
- Thuốc vận mạch ưu tiên Norepinephrine khi huyết áp thấp, khi huyết áp tâm thu đạt 80 mmHg có thể phối hợp thêm Dobutamine.
- Vai trò bóng đối xung động mạch chủ giảm thấp và có thể có hại nếu sử dụng thường quy trong điều trị choáng

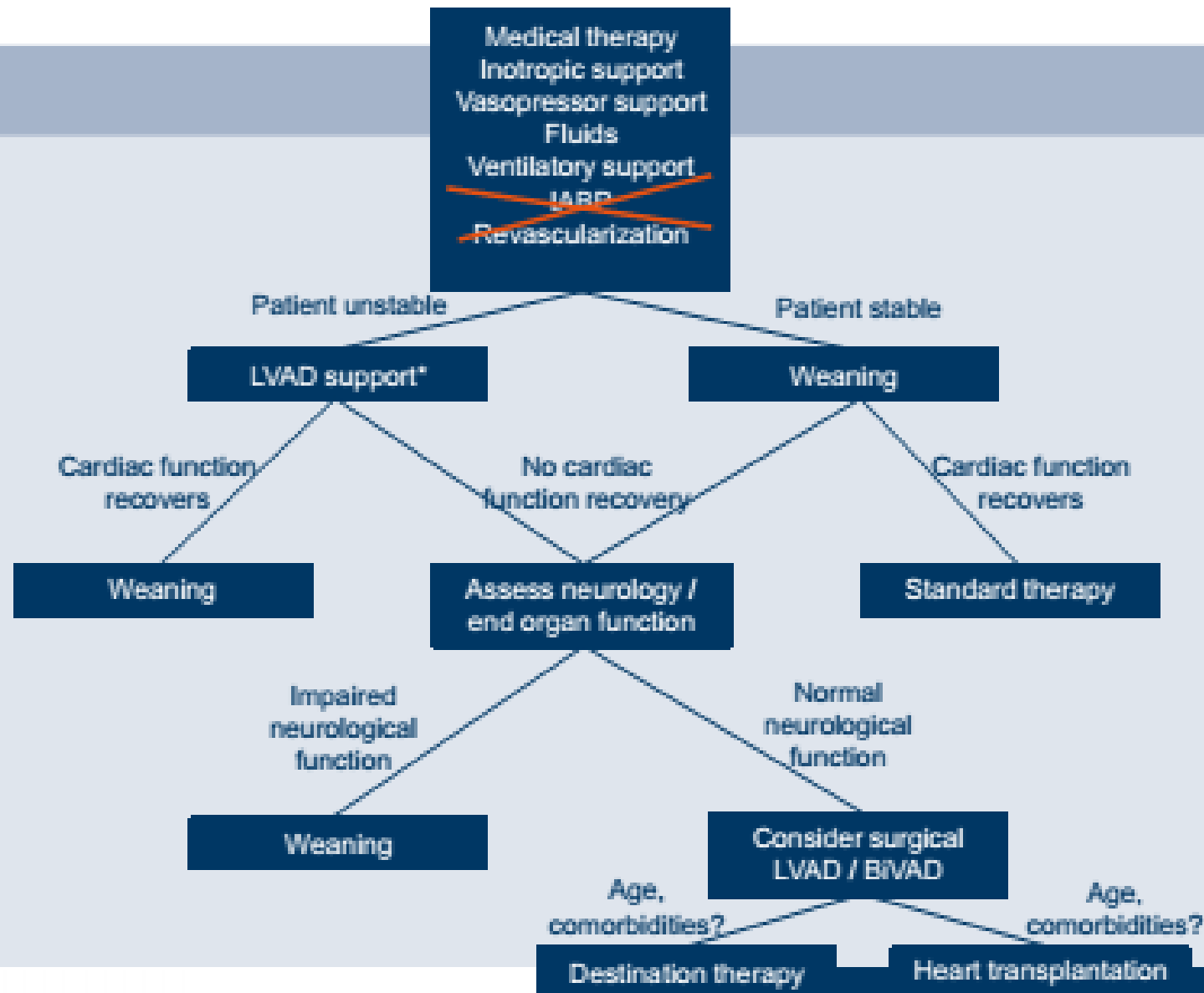
Tài liệu tham khảo

- 1 Christopher M O'Connor and Joseph G Roger (2012), "Evidence for overturning the guidelines in cardiogenic shock". *N Engl J Med*, 367, 1349-1350.
- 2 Holger Thiele and Uwe Zeymer (2012), "Intraaortic Balloon support for myocardial infarction with cardiogenic shock". *N Engl J Med*, 367, 1287-1296.
- 3 Hollenberg, S. M. (2011), "Vasoactive drugs in circulatory shock". *Am J Respir Crit Care Med*, 183(7), 847-855.
- 4 Jerrold H Levy (2010), "Treating shock- Old Drugs, New Ideas". *N Engl J Med*, 362(9), 841-843.
- 5 Jung, C., Lauten, A., Ferrari, M. (2010), "Microcirculation in cardiogenic shock: from scientific bystander to therapy target". *Crit Care*, 14(5), 193.
- 6 Karl Werdan and Martin Rub et al (2012), "Cardiogenic shock due to myocardial infarction: diagnosis, monitoring and treatment". *A German-Austrian S3 Guideline. Dtsch Arztebl Int*, 109(19), 343-351.
- 7 Sakr Y and Reinhart K (2006), "Does Dopamine administration in shock influence outcome? Results of the Sepsis Occurrence in Acutely ill Patients (SOAP) Study". *Crit Care Med*, 34, 589-597.



XIN CHÂN THÀNH CẢM ƠN

Treatment Algorithm



MỘT SỐ ĐIỂM CHÚ Ý KHI ĐIỀU TRỊ THUỐC VẬN MẠCH

- Nguyên tắc điều trị thuốc vận mạch: Khi bù đủ dịch mà không hồi phục được huyết áp và tưới máu mô thì khởi đầu điều trị thuốc vận mạch.
- Huyết áp là mục tiêu điều trị vận mạch, tuy nhiên giữ HA ở mức nào còn là câu hỏi bởi vì:
 - Hiện tượng tự điều hòa huyết áp khác nhau với từng bệnh nhân.
 - Mục tiêu nâng huyết áp trong **sốc nhiễm trùng**: MAP 60-65 mmHg.
- Trong **sốc tim**, huyết áp thấp có thể làm thiếu máu cơ tim nhiều hơn nữa do giảm lưu lượng mạch vành, thuốc vận mạch có thể dùng để duy trì lưu lượng vành.

IABP SHOCK-2 Trial: Why Did IABP Not Work ?

❖ The timing of IABP placement

- ❖ Only 40% had IABP placed before PCI in the trial

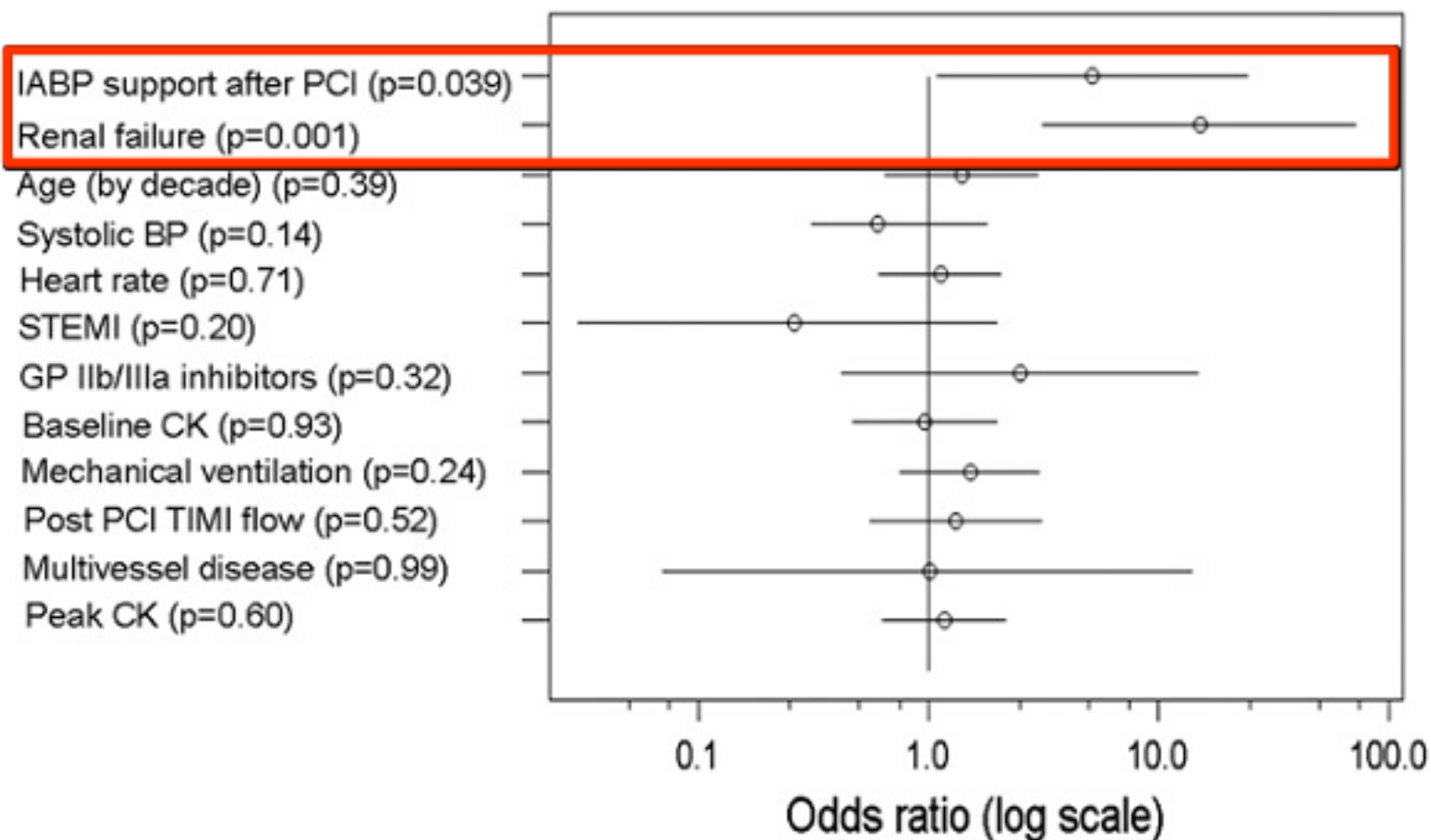
❖ Did the patients have mostly LV failure ?

- ❖ IABP little value in RV failure
- ❖ Low use of Swan-Ganz in the trial – so ?

❖ Inadequate LV support

- ❖ IABP only offers approximately 0.25 – 0.50 L/min added CO
- ❖ Hypoperfusion main predictors of mortality

Patients receiving IABP after PCI have a less favourable outcome in CS



ECMO

VA-ECMO

VV-ECMO

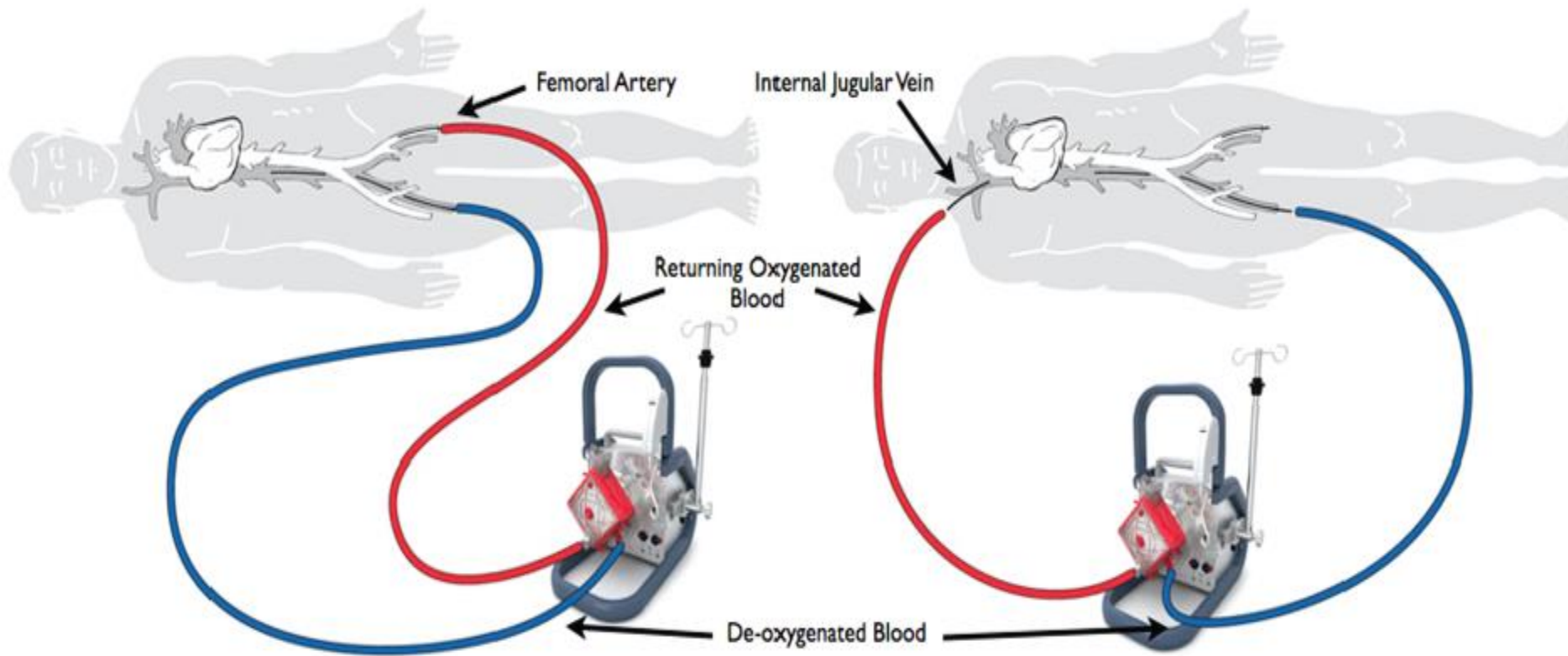
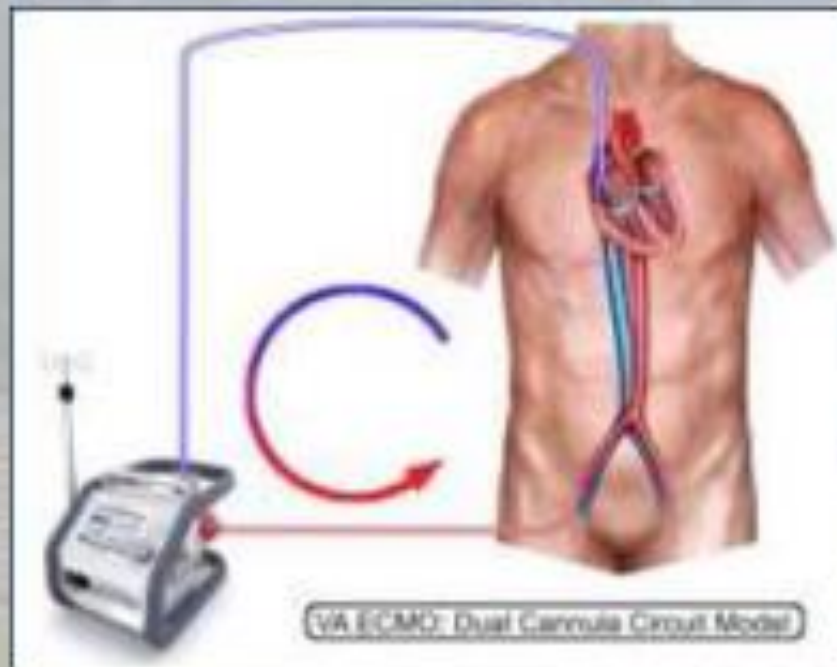


Figure 2. Diagrammatic representation of peripheral veno-venous (VV-ECMO) and peripheral veno-arterial (VA-ECMO) extracorporeal membrane oxygenation. Reprinted with permission from Maquet GmbH & Co. KG (Rastatt, Germany).

Extracorporeal Membrane Oxygenation (ECMO)



Flow: 2.0 L/min

Inflow: Right atrium

Outflow: femoral artery

Pros

- Oxygenation
- Availability
- Easy initiation

Cons

- Limb ischemia
- Anticoagulation/Hemorrhage
- Thromboembolism

Support With ECMO: Lacks Evidence

Poor outcomes with high complication rates in Adult Cardiac Patients even with last generation ECMO



Peripheral Extracorporeal Membrane Oxygenation System as Salvage Treatment of Patients With Refractory Cardiogenic Shock: Preliminary Outcome Evaluation

100% bleeding, high rate of hemolysis, low survival rate in shock

and Frat

Department of Cardiac Surgery and T

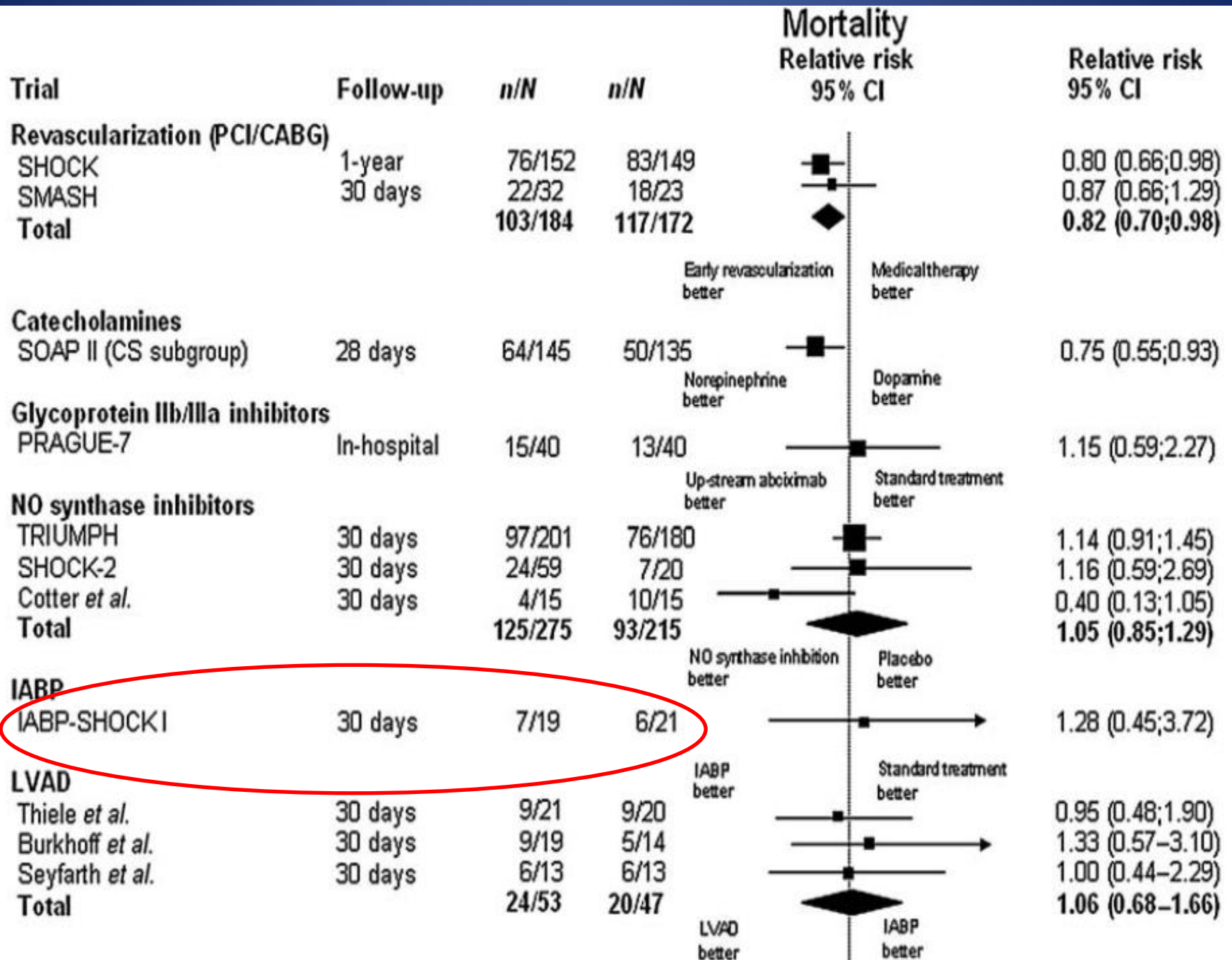
Abstract: The novel Permanent Life Support (PLS) Maquet, Jöstra Medizintechnik AG, Hirrlingen, Germany as peripheral veno-arterial extracorporeal membrane oxygenation (ECCMO) support system has been investigated as treatment for patients with refractory cardiogenic shock (CS). Between January 2007 and July 2011, 73 consecutive adult patients were supported on peripheral P ECMO system at our institution (55 men; a 60.3 ± 11.6 years, range: 23–84 years). Indications for support were failure to wean from cardiopulmonary bypass in the setting of postcardiotomy ($n = 50$), a primary donor graft failure ($n = 8$), post-acute myocardial infarction CS ($n = 12$), and CS on chronic heart failure ($n = 3$). Mean support time was 10.9 ± 7.6 days (range 2–34 days). Overall, 26 (35.6%) patients died on ECMO. Among survivors on ECMO, 44 (60.2%) patients were successfully weaned from support, and three (4.1%) were switched to a mid-long-term ventricular assist device. Thirty-three (45.2%) were successfully discharged. The following variables were significantly different if survivors and nonsurvivors on ECMO were compared: $P < 0.04$, female gender ($P < 0.01$), cardiopulmonary

	Postcardiotomy ($n = 50$)	Donor graft failure ($n = 8$)	Post-AMI ($n = 12$)	Acute on chronic HF ($n = 3$)
ECMO time (days)	10.9 (2–36)	4.9 (3–7)	10.7 (6–24)	9.9 (8–13)
ECMO >6 days	38 (76%)	1 (12.5%)	9 (75%)	3 (100%)
IABP on ECMO	50 (100%)	8 (100%)	12 (100%)	3 (100%)
IABP time (days)	14.9 (2–42)	7.9 (3–12)	13.7 (6–30)	13.7 (8–18)
Intubation time (days)	20 (2–42)	10.1 (3–10)	19.2 (6–28)	19.3 (8–15)
Hospital stay (days)	41.2 (2–96)	21.6 (3–32)	38.5 (6–57)	38.4 (8–37)
Creatinine >3.5 (mg/100 mL)	19 (38%)	1 (12.5%)	5 (41.6%)	2 (66.6%)
CVVH	28 (56%)	1 (12.5%)	7 (58.3%)	2 (66.6%)
CVVH time (days)	8.3 (6–11)	3 (4–7)	8.1 (6–14)	7.6 (5–10)
Bleeding/hemorrhage	29 (58%)	4 (50%)	4 (33.3%)	—
Transfusion	50 (100%)	8 (100%)	12 (100%)	3 (100%)
PRBCs	18 (3–52)	16.1 (3–48)	19.3 (3–51)	17.1 (3–55)
PLT units	16.5 (6–48)	15.8 (6–50)	15.9 (6–52)	16.1 (6–47)
FFP (1000 mL/unit)	5.6 (2–15)	5.2 (2–17)	6.1 (2–18)	5.1 (2–14)
Pulmonary complications	12 (24%)	1 (12.5%)	3 (25%)	—
Liver failure	21 (42%)	2 (25%)	5 (41.6%)	2 (66.6%)
Bilirubin >15 (mg/100 mL)	19 (38%)	1 (12.5%)	5 (41.6%)	1 (33.3%)
PLT count	125.6 (40–198)	115.8 (95–188.1)	133.6 (88–177.5)	123.4 (105–166.1)
PFH (mg/dL)	46.5 (28–165)	43.5 (15–148)	48.9 (26–158)	44.3 (18–95)
CK-MB relative index (%)	7.3 (3–28)	7.7 (4–20)	8.1 (3–25)	7.7 (3–19)
MOF	19 (38%)	1 (12.5%)	5 (41.6%)	1 (33.3%)
Sepsis	9 (18%)	—	2 (16.6%)	—
Brain death (cerebral hemorrhage)	9 (18%)	—	2 (16.6%)	—
Leg ischemia	4 (8%)	—	—	—
Survived on ECMO	31 (62%)	7 (87.5%)	7 (58.3%)	2 (66.6%)
Weaned from ECMO	30 (60%)	7 (87.5%)	6 (50%)	1 (33.3%)
Died on ECMO	19 (38%)	1 (12.5%)	5 (41.6%)	1 (33.3%)
Discharged	19 (38%)	7 (87.5%)	5 (41.6%)	2 (66.6%)
Bridge to VAD	1 (2%)	—	1 (8.3%)	1 (33.3%)
Bridge to Htx	—	—	—	—

Percutaneous Ventricular Support in 2014

Conclusion

- ❖ **IABP failed to improve outcomes in CS**
 - ❖ Probably due to inadequate LV support
 - ❖ Comparative trials in CS with other LV devices are very limited
- ❖ **Among the new devices, Impella offers the best balance of ease of use and hemodynamic support**
 - ❖ Improved hemodynamics in CS
 - ❖ More powerful devices (CP or 5.0) may be better
- ❖ **We need better tools to assess the presence of BiV failure where total LV support may be preferable**
 - ❖ Will require a dedicated CS team approach to best select advance therapies (ECMO, LVAD)



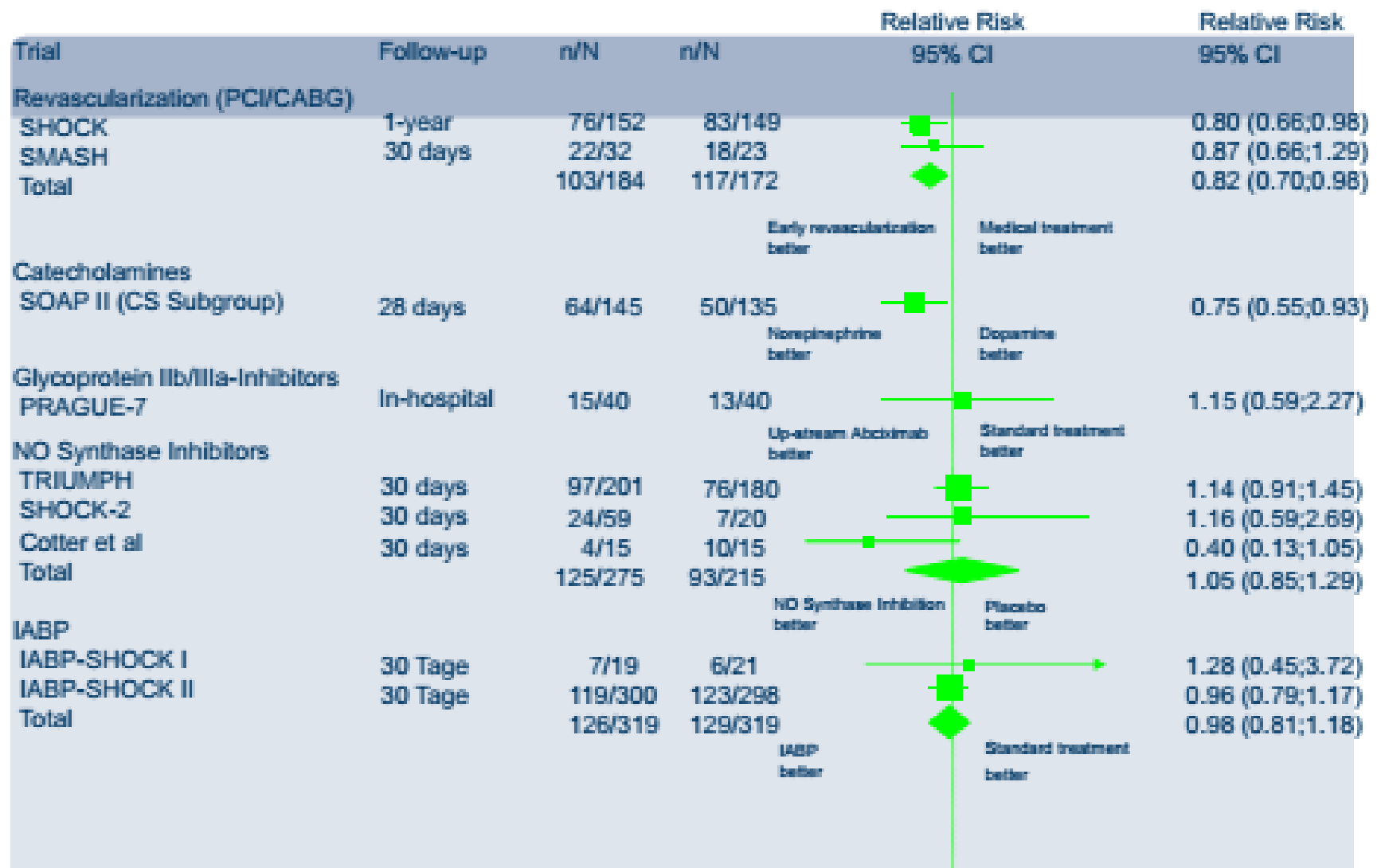
EU and US Guideline Recommendations

Indication	Assist device	ESC/EACTS [1, 2]		ACCF/AHA/SCAI [3-6]	
Cardiogenic shock	IABP	Class IIb (B)	Intra-aortic balloon pumping may be considered.	Class IIa [B]	The use of intra-aortic balloon pump (IABP) counterpulsation can be useful for patients with cardiogenic shock after STEMI who do not quickly stabilize with pharmacological therapy.
	Other devices	Class IIb (C)	LV assist devices may be considered for circulatory support in patients in refractory shock.	Class IIb [C]	Alternative LV assist devices for circulatory support may be considered in patients with refractory cardiogenic shock.

Burkhoff et al. Chapter 27: Percutaneous Circulatory Support: Intra-aortic Balloon Counterpulsation, Impella, TandemHeart, and Extracorporeal Bypass
 In: Baim & Grossman's Cardiac Catheterization, Angiography, and Intervention., 8th Edition, Editor: Mauro Moscucci



Randomized Trials in Cardiogenic Shock



0 0.25 0.5 0.75 1 1.5 2 2.5 3

Updated Thiele et al. Eur Heart J 2010; 31:1828–1835

Normal Values

Right Atrial Pressure, CVP	Mean	0-6mmHg
Pulmonary Artery Pressure	Systolic End-diastolic mean	15-30mmHg 4-12mmHg 9-19mmHg
PCWP	Mean	4-12mmHg
Cardiac Output		4-8 L/min
Mixed Venous O2 Sat		>70%
SVR		800-1200

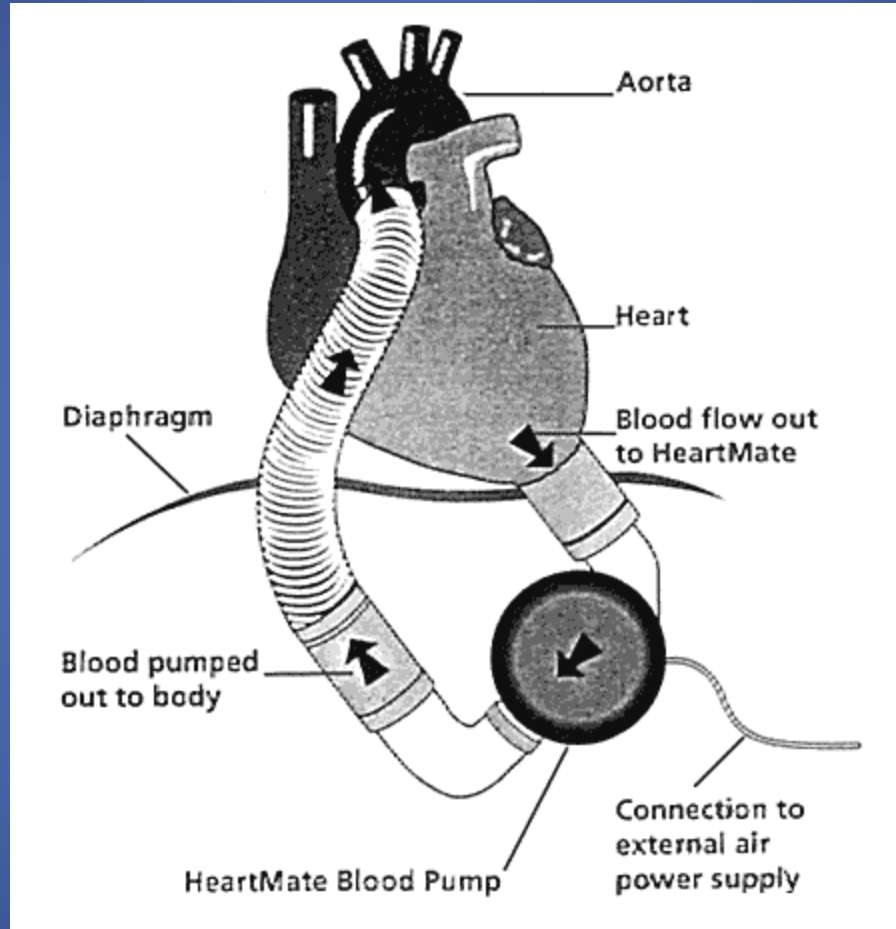
Differentiating Types of Shock

Physiologic variable	Preload	Pump function	Afterload	Tissue perfusion
Clinical measurement	Pulmonary capillary wedge pressure	Cardiac output	Systemic vascular resistance	Mixed venous oxygen saturation
Hypovolemic	↓	↓	↑	↓
Cardiogenic	↑	↓	↑	↓
Distributive	↓ or ↔	↑	↓	↑

Some of the Many Causes of Cardiogenic Shock

- MI (most common)
- Aortic dissection
- PE
- Cardiac tamponade
- Ruptured viscus
- Hemorrhage
- Sepsis
- Cardiomyopathy (restrictive or dilated), myocarditis
- Medication overdose (beta/calcium-channel blockers)
- Cardiotoxic drugs (doxorubicin)
- Electrolyte abnormalities (calcium, phosphate)
- Valvular abnormalities (mitral/aortic stenosis)
- Papillary muscle or ventricular free wall rupture

Left Ventricular Assist Device



Indication for IABP

Class I - There is evidence and/or general agreement that an IABP should be used in patients with acute MI in the following settings

- | |
|--|
| <ul style="list-style-type: none">• Hypotension (systolic pressure less than 90 mmHg or ≥ 30 mmHg below the baseline mean arterial pressure) that does not respond to other interventions unless further support is limited by patient's wishes or contraindications or unsuitability for further invasive care. |
| <ul style="list-style-type: none">• Low-output state |
| <ul style="list-style-type: none">• Cardiogenic shock not quickly reversed with pharmacologic therapy as a stabilizing measure for angiography and prompt revascularization. |
| <ul style="list-style-type: none">• Recurrent ischemic-type chest discomfort and hemodynamic instability, poor left ventricular function, or a large area of myocardium at risk. Such patients should be referred for urgent cardiac catheterization and, if appropriate, revascularization. |

Class IIa - The weight of evidence or opinion is in favor of benefit from an IABP in patients with acute MI in the following setting

- | |
|---|
| <ul style="list-style-type: none">• Refractory polymorphic ventricular tachycardia in an attempt to diminish myocardial ischemia. |
|---|

Class IIb - The evidence or opinion is less well established for an IABP in patients with acute MI in the following setting
--

- | |
|--|
| <ul style="list-style-type: none">• Refractory pulmonary congestion. |
|--|

Pathophysiology of RV Shock

- **Predominant RV shock only 5% cases**
- **RV failure may limit LV filling by decrease in CO, ventricular interdependence**
- **RV EDP often > 20mm Hg**
 - May result in shifting of septum towards LV, impair LV filling
- **Common practice of aggressive fluid resuscitation may be misguided**
- **Inotropic therapy indicated when RV filling optimized**
- **RV EDP of 10-15mmHg optimal**



Contraindications to IABP

- Significant aortic regurgitation or significant arteriovenous shunting
- Abdominal aortic aneurysm or aortic dissection
- Uncontrolled sepsis
- Uncontrolled bleeding disorder
- Severe bilateral peripheral vascular disease
- Bilateral femoral popliteal bypass grafts for severe peripheral vascular disease.

Complications of IABP

- Cholesterol Embolization
- CVA
- Sepsis
- Balloon rupture
- Thrombocytopenia
- Hemolysis
- Groin Infection
- Peripheral Neuropathy

Ventricular Septal Rupture Management

- Echo
- IABP
- Inotropic Support
- Surgical Timing is controversial, but usually < 48°

Free Wall Rupture

- Occurs during first week after MI
- Classic Patient: Elderly, Female, Hypertensive
- Early thrombolysis reduces incidence but Late increases risk
- Treat with pericardiocentesis and early surgical repair

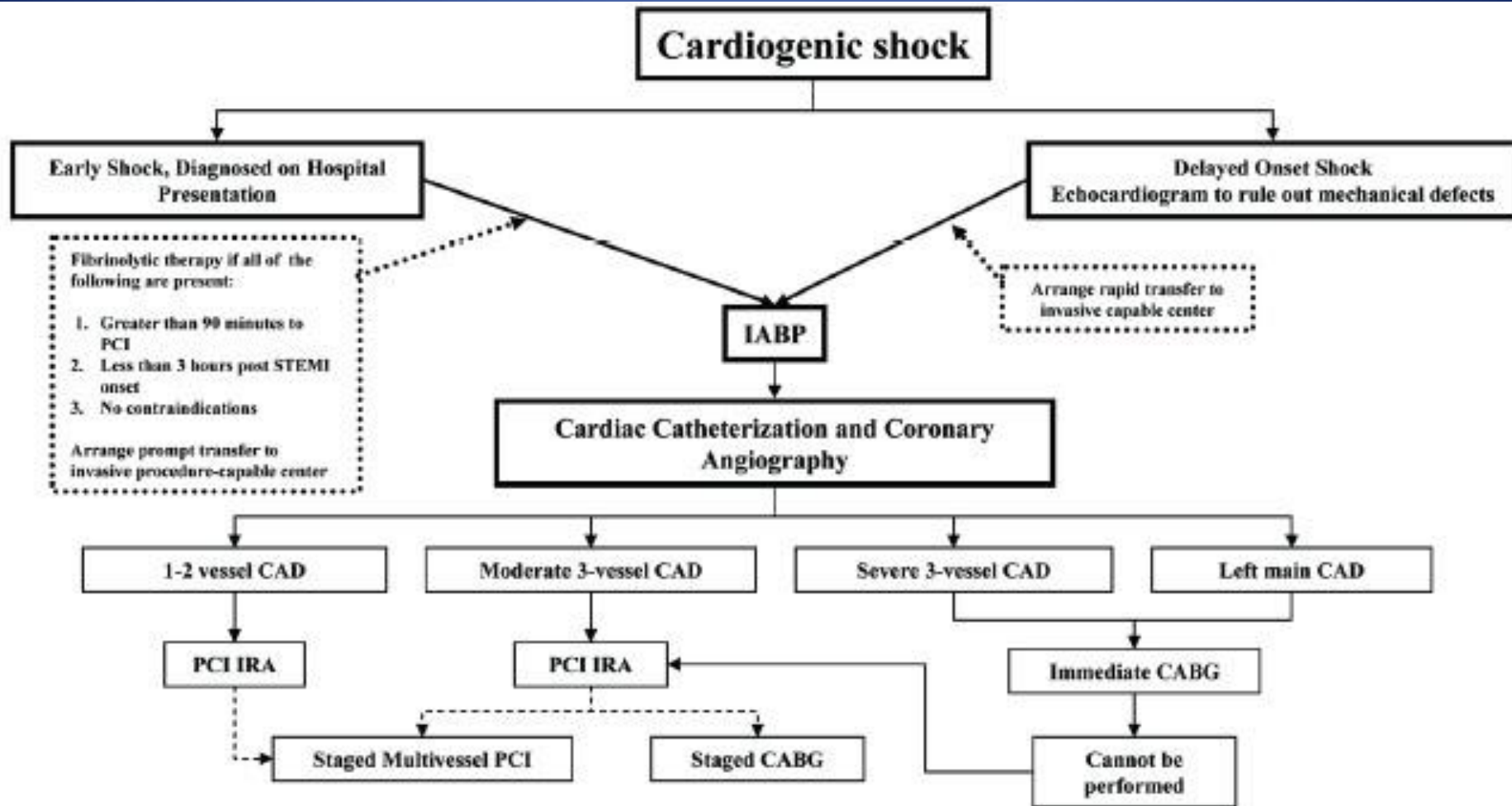
Acute MR Management

- Echo for Differential Diagnosis:
 - Free-wall rupture
 - VSD
 - Infarct Extension
- PA Catheter
- Afterload Reduction
- IABP
- Inotropic Therapy
- Early Surgical Intervention

RV Infarction Management

- Cardiogenic Shock secondary to RV Infarct has better prognosis than LV Pump Failure
- IVF Administration
- IABP
- Dobutamine
- Maintain A-V Synchrony
- Mortality with Successful Reperfusion = 2% vs. Unsuccessful = 58%

ACC/AHA Guidelines 2004



ACC/AHA Guidelines for Cardiogenic Shock

Class I

1. IABP is recommended for STEMI patients when cardiogenic shock is not quickly reversed with pharmacological therapy. The IABP is a **stabilizing measure** for angiography and prompt revascularization.
2. Intra-arterial monitoring is recommended for the management of STEMI patients with cardiogenic shock.

ACC/AHA Guidelines for Cardiogenic Shock

Class I

1. Early revascularization, either PCI or CABG, is recommended for **patients < 75 years old** with ST elevation or new LBBB who develop shock unless further support is futile due to patient's wishes or unsuitability for further invasive care.
2. Fibrinolytic therapy should be administered to STEMI patients with cardiogenic shock who are unsuitable for further invasive care and do not have contraindications for fibrinolysis.
3. Echocardiography should be used to evaluate mechanical complications unless assessed by invasively

ACC/AHA Guidelines for Cardiogenic Shock

Class IIa

1. Pulmonary artery catheter monitoring can be useful for the management of STEMI patients with cardiogenic shock.
2. Early revascularization, either PCI or CABG, is reasonable for selected **patients > 75 years** with ST elevation or new LBBB who develop shock **< 36 hours of MI** and who are suitable for revascularization that is **performed < 18 hours of shock**.

Patients with good prior functional status who agree to invasive care may be selected for such an invasive strategy.

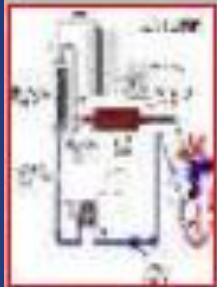
Cardiogenic Shock Definition

1. Persistent hypotension - SBP <80 to 90 mmHg or MAP 30 mmHg lower than baseline.
1. Reduction in Cardiac index
 - < 1.8 L/ min per m² without support
 - < 2.0 to 2.2 L/ min per m² with support.
3. Adequate or elevated filling pressures
4. Other causes of shock excluded

Reynolds et al. Circulation

2008;117:686-97.

Evolution of the Short-term support Technology Over Time



ECMO



IABP



CPS



Hemopump



TandemHeart



Impella



Tandem Heart

- Percutaneously placed in the cath lab, and requires a trans-septal puncture (21F left atrial, and 15-17F for the femoral artery)
- Can be configured for RV support (RA-PA cannulation).
- Supports cardiac output by an additional 4 L/min, and can be used up to one week
- **Issues:** Bleeding, limb ischemia, technique, LA thrombus



Meta-analysis of Percutaneous LVAD in CGS

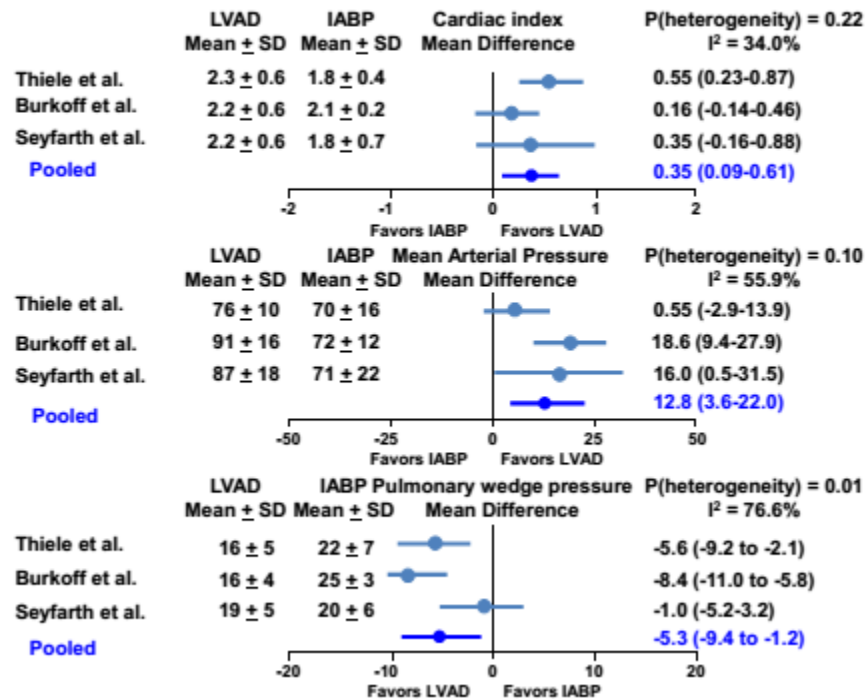
	Thiele et al.	Burkhoff et al.	Seyfarth et al.
Percutaneous LVAD used	TandemHeart	TandemHeart	Impella LP25
Control	IABP	IABP	IABP
Total number of patients	41	33	26
Setting	Single-centre	Multi-centre	Two-centre
Randomization	Yes	Yes	Yes
Sequence generation	Drawing Envelopes	Not reported	Not reported
Concealment of allocation	Sealed envelopes	Not reported	Not reported
Blinding	Not possible	Not possible	Not possible
Handling of patient attrition	Complete follow-up	Complete follow-up	Complete follow-up

* Not reported whether the envelopes were opaque and sequentially numbered.
IABP, intra-aortic balloon pump; LVAD, left ventricular assist device.

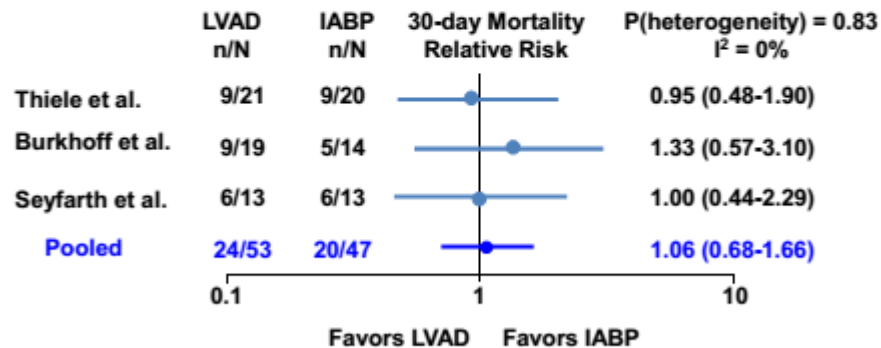
Cheng et al, European Heart Journal
2009;30:2102-2108



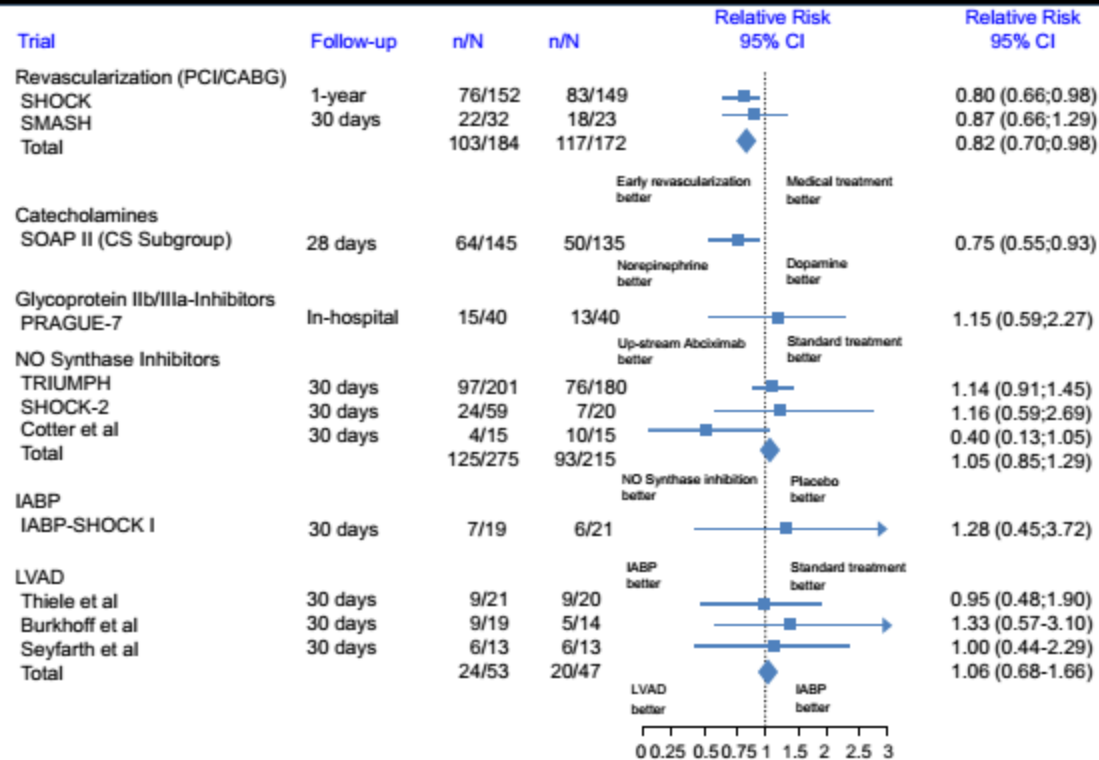
Hemodynamics



30 Day Mortality



Randomized Studies in Cardiogenic Shock



Thiele et al. Eur Heart J 2010;31:1828-1835

Review and Comparison of Cardiac Support Strategies

Strategy	Therapy / Device	Mechanism
Medical Management	Inotropes / Pressors	Increase Contractility, HR, TPR
Counterpulsation	IABP	Aortic Pressure Augmentation
Extracorporeal Bypass Pump	TandemHeart	LA -> AO flow
	ECMO	RA -> AO flow
Implantable Transvalvular Pump	Impella 2.5/4.0/5.0	LV -> AO flow

ECMO vs Direct LV Unloading

ECMO

- Provides effective cardiac support, especially in the setting of RV failure
- Improved systemic oxygenation
- CAUTION: LV can be overloaded and pulmonary edema can be exacerbated

Transvalvular Percutaneous LVAD

- Improves systemic hemodynamics
- Unloads the LV
- Oxygenation can be improved secondary to reduced PCWP

Conclusions: CGS in AMI

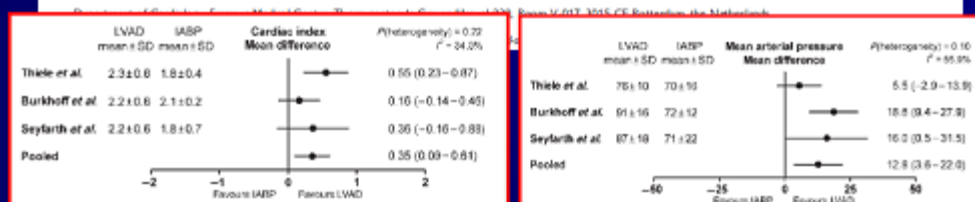
- There is no unequivocal benefit to LV support in CGS
- IABP is clearly not the answer (though may be useful to increase coronary flow with no reflow or residual stenosis)
- LVAD support makes most sense upfront in hypotensive patients for PCI to support the procedure and allow decisions for possible bridging
- ECMO is best for total “crash and burns”

Current Pharmacology & Devices

	Inotropes	IABP	ECMO	Tandem-Heart	Impella	Surgical VAD
<u>Advantages</u>						
Flow (L/min.)	<0.5	0.5	4	3.5	2.5 - 5.0	6.0
Coronary Perfusion	↑	↑↑	-	-	↑↑	↑↑
LVEDP	↑	↓	↑↑↑↑	↓↓	↓↓↓	↓↓↓↓
<u>Limitations</u>						
Arrhythmia	+++	-	-	-	-	-
Stroke	-	++	++	+	+	+++
Limb ischemia	N.A	+	+++	++	+	N.A
Bleeding	N.A	++	++++	+++	+ / ++	++++
Cost	\$	\$	\$\$\$	\$\$\$	\$\$\$	\$\$\$\$\$

Percutaneous left ventricular assist devices vs. intra-aortic balloon pump counterpulsation for treatment of cardiogenic shock: a meta-analysis of controlled trials

Jin M. Cheng, Corstiaan A. den Uil*, Sanne E. Hoeks, Martin van der Ent, Lucia S.D. Jewbali, Ron T. van Domburg, and Patrick W. Serruys



Cardiac Index

Blood Pressure



Duke Clinical Research Institute
DUKE UNIVERSITY MEDICAL CENTER

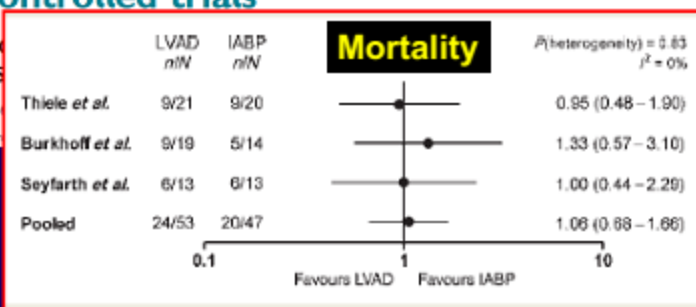
Cheng et al EHJ 2009

Percutaneous left ventricular assist devices vs. intra-aortic balloon pump counterpulsation for treatment of cardiogenic shock: a meta-analysis of controlled trials

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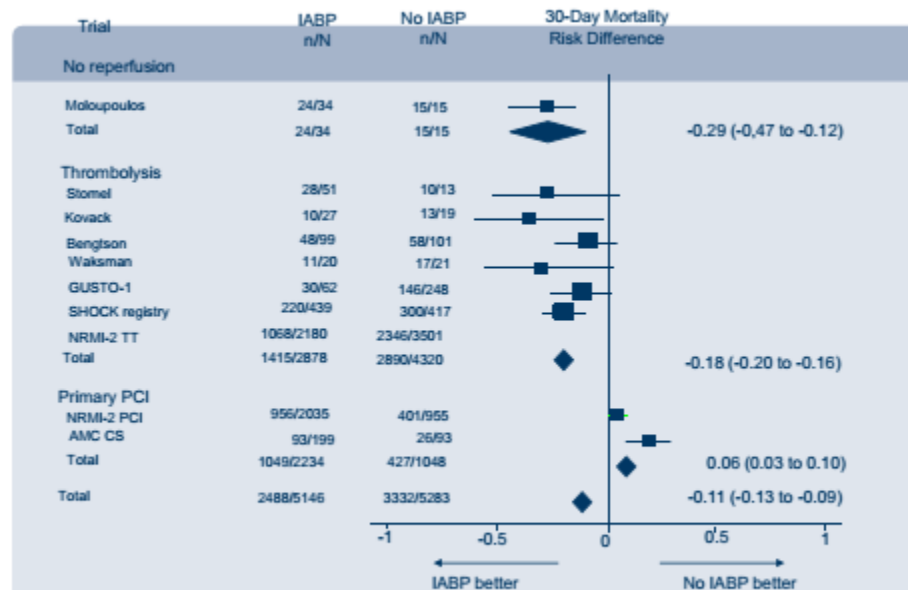
Received 20 Jan



Cardiogenic Shock

- Systemic hypoperfusion secondary to severe depression of cardiac output and sustained systolic arterial hypotension despite elevated filling pressures.

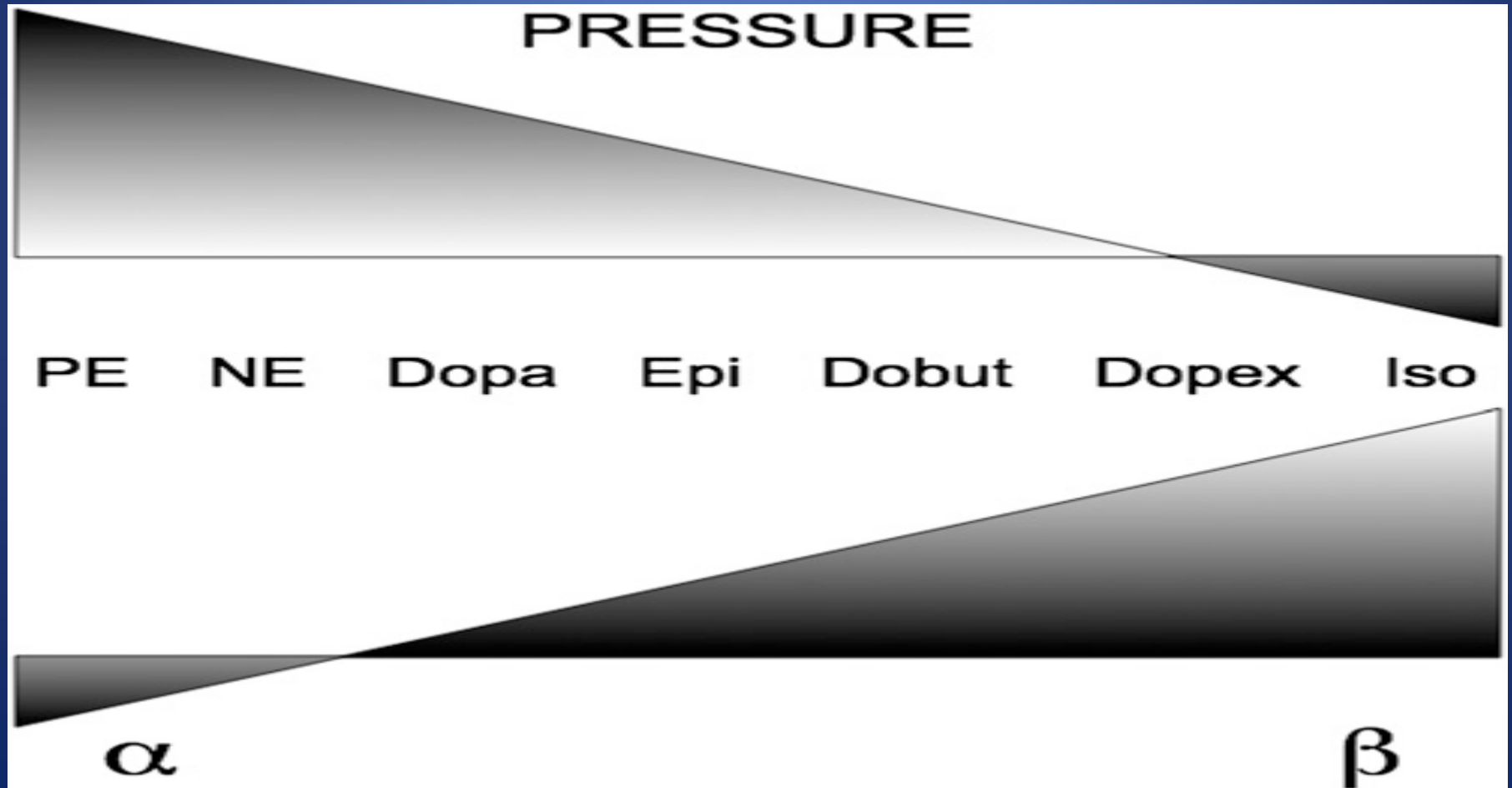
Mortality IABP vs $\emptyset$ IABP - Metaanalysis



Classic Criteria for Diagnosis of Cardiogenic Shock

- 1. Systemic Hypotension**
systolic arterial pressure < 80 mmHg
- 2. Persistent Hypotension**
at least 30 minutes
- 3. Reduced Systolic Cardiac Function**
Cardiac index < $1.8 \times \text{m}^2/\text{min}$
- 4. Tissue Hypoperfusion**
Oliguria, cold extremities, confusion
- 5. Increased Left Ventricular Filling**
Pulmonary capillary wedge pressure > 18 mmHg

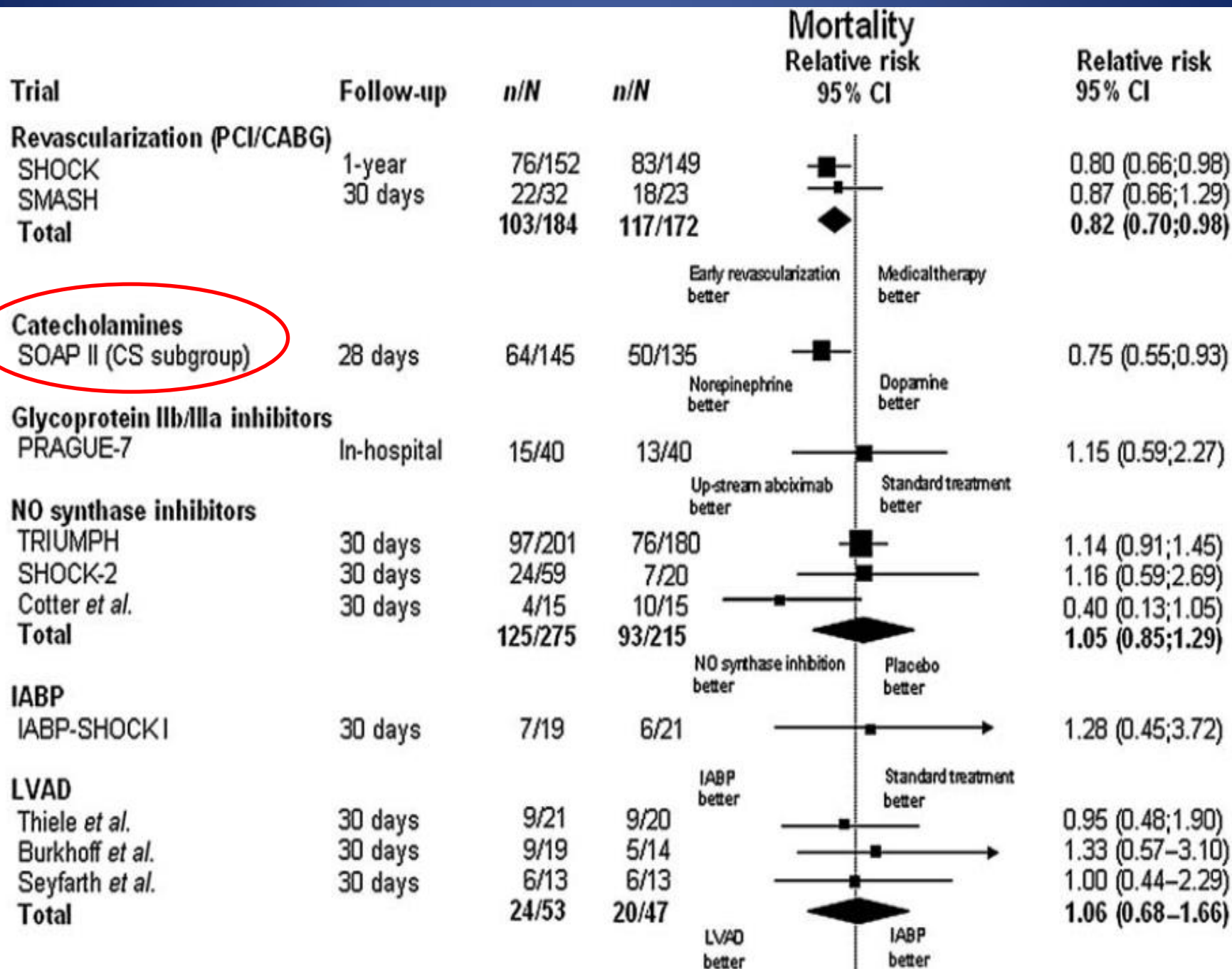
Những catecholamine khác nhau do tác dụng trên thụ thể alpha và beta khác nhau. **Thụ thể alpha**: gây co mạch, **thụ thể beta1**: tăng tần số tim và tăng co bóp cơ tim, **thụ thể beta2**: giãn mạch ngoại biên.



SHOCK Registry: Mortality by Shock Categories



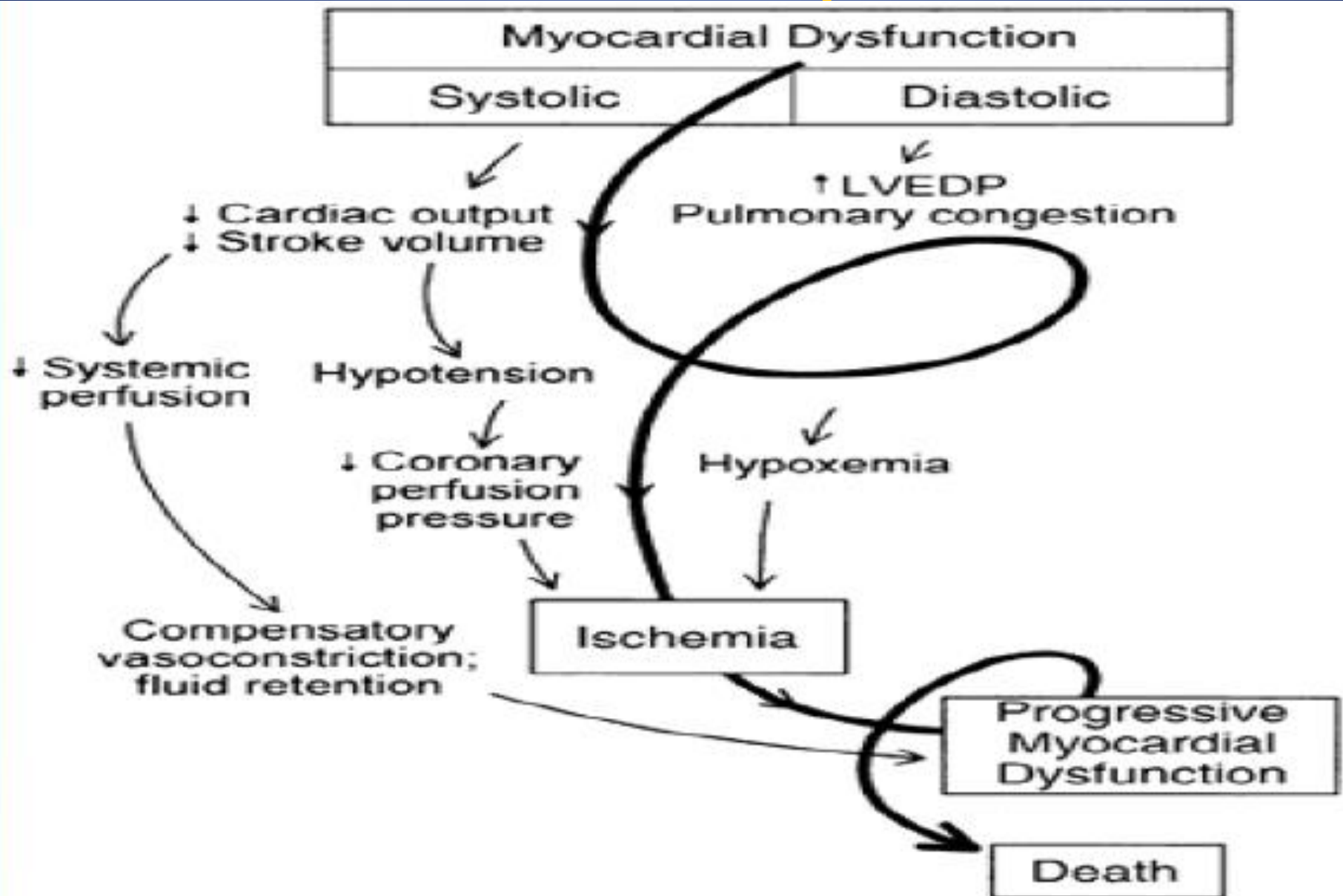
$p=0.001$ 6 Group;
VSR vs each $p<0.01$



ĐỊNH NGHĨA

- Định nghĩa choáng: là một hội chứng do hệ tuần hoàn suy giảm không cung cấp đủ tưới máu mô.
- Choáng tim: giảm tưới máu mô do giảm cung lượng tim và huyết áp thấp kéo dài mặc dù có sự tăng áp lực đổ đầy thất.

SINH LÝ BỆNH



MỘT SỐ ĐIỂM CHÚ Ý KHI ĐIỀU TRỊ THUỐC VẬN MẠCH

- Huyết áp là mục tiêu điều trị vận mạch, tuy nhiên giữ HA ở mức nào còn là câu hỏi bởi vì:
 - Hiện tượng tự điều hòa huyết áp khác nhau với từng bệnh nhân (bệnh nhân bình thường, bệnh nhân choáng, bệnh nhân THA).
- Mục tiêu nâng huyết áp trong **sốc nhiễm trùng**: chưa biết chính xác trị số. Guideline duy trì MAP 60-65 mmHg.
- Trong **sốc tim**, huyết áp thấp có thể làm thiếu máu cơ tim nhiều hơn nữa do giảm lưu lượng mạch vành, thuốc vận mạch có thể dùng để duy trì lưu lượng vành.