

## “QUESTIONI” DI UTIC

Gli ultrasuoni in terapia intensiva cardiologica: oltre il minimal data set

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# PRESENTER DISCLOSURE INFORMATION

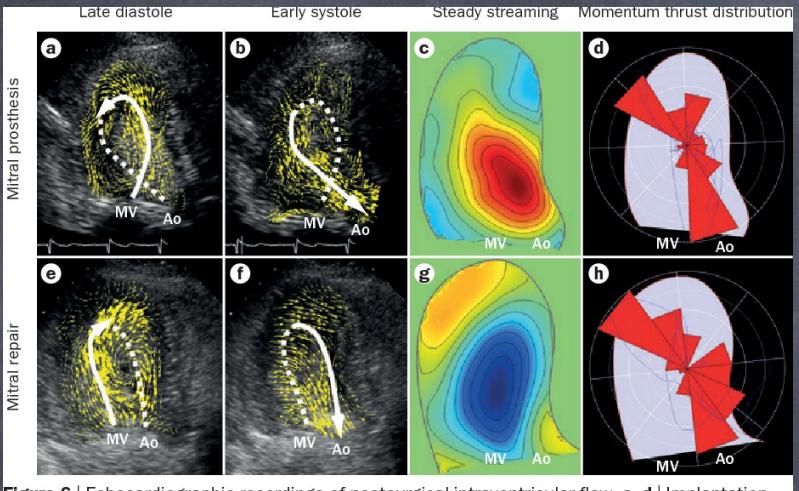
## Paolo Trambaiolo

Dichiaro che negli ultimi due anni non ho avuto rapporti di finanziamento con soggetti portatori di interessi commerciali in campo sanitario

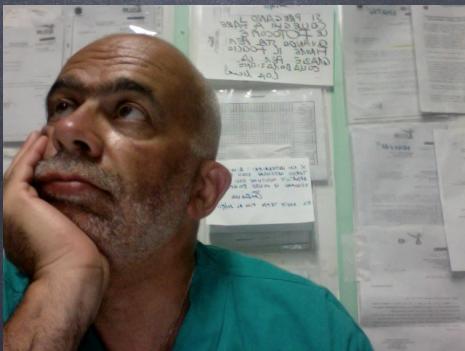




# Left Ventricle .....



**Figure 6** | Echocardiographic recordings of postsurgical intraventricular flow. **a-d** | Implantation



# “low profile” evaluation .....



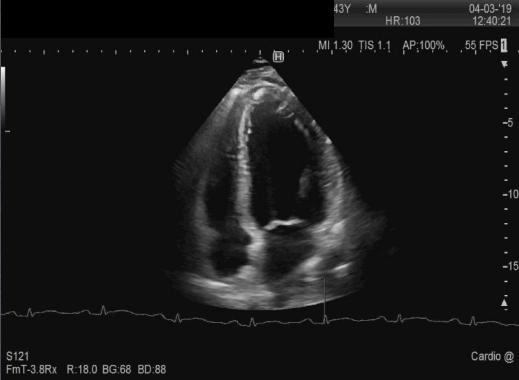
PUMP FUNCTION



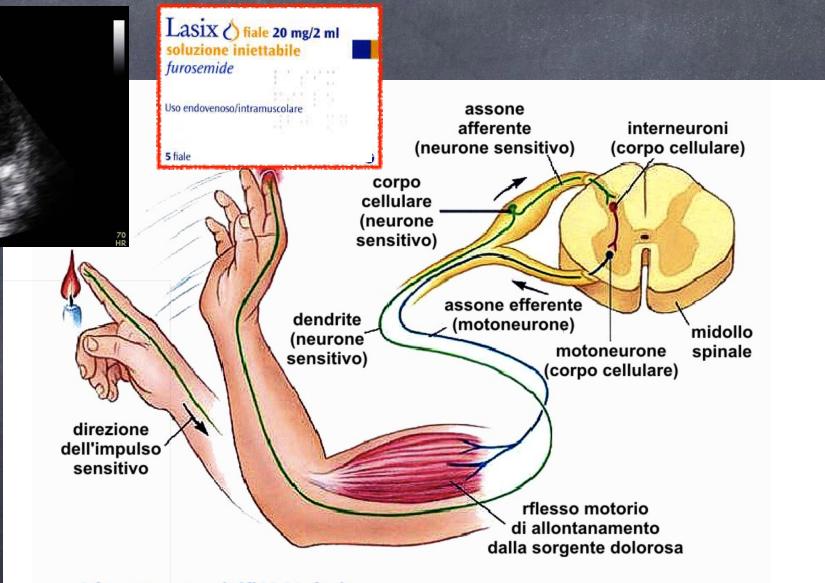
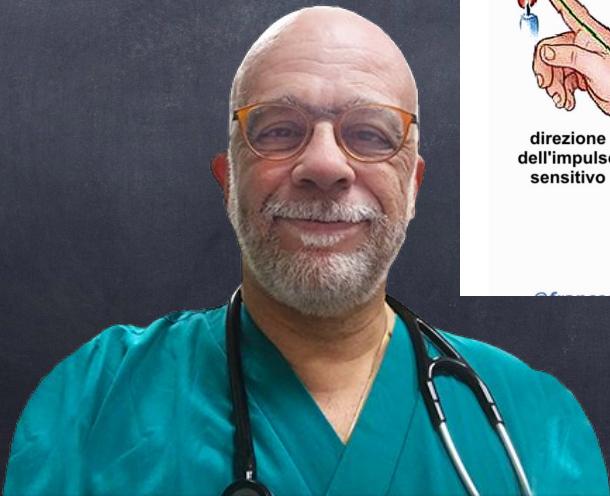
PRESSURE



# Il cardiologo la FE e ... la diuresi .....



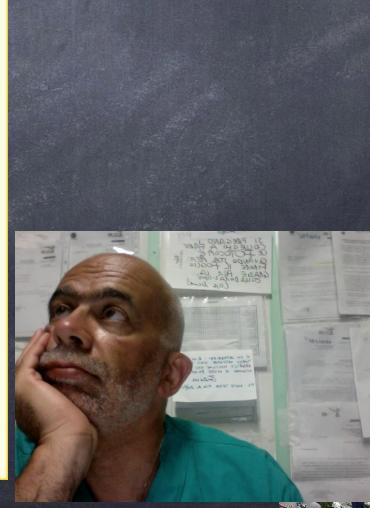
# FE e ... riflesso oculo- .....



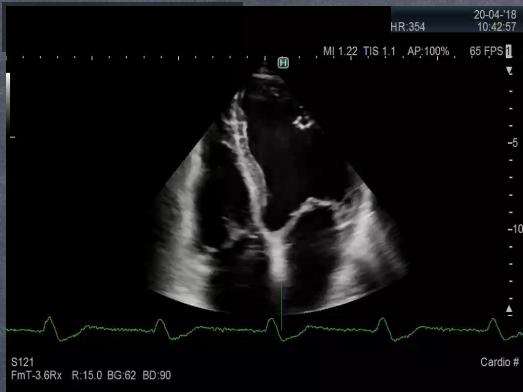
# 2016 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure



Hypoperfusion is not synonymous with hypotension, but often hypoperfusion is accompanied by hypotension.

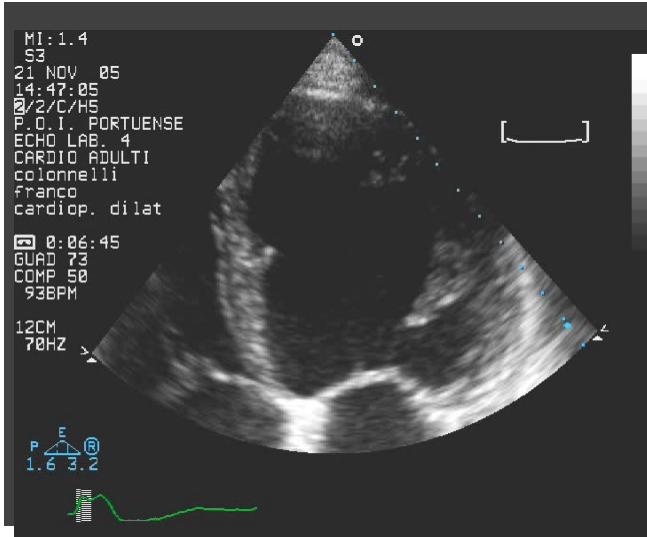


# ejection fraction

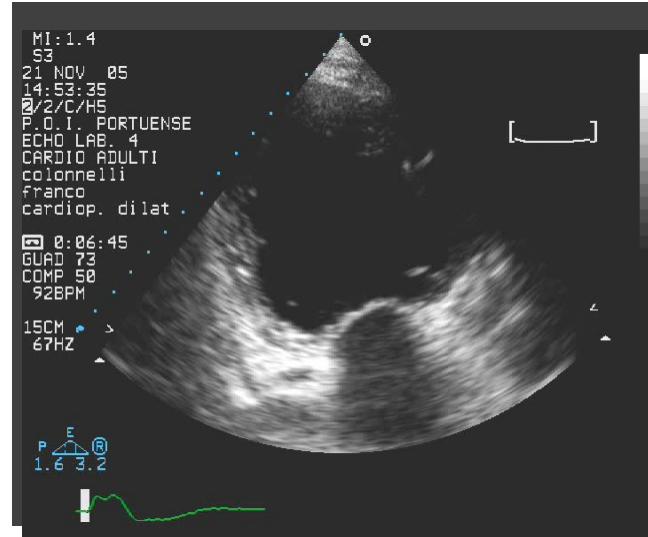


PUMP FUNCTION





LVEDV 246 ml  
LVESV 199 ml  
LVEF 19%



HEIGHT 169 cm  
WEIGTH 62 Kg  
BSA 1.71 m<sup>2</sup>

EF  
19%



$$SV \text{ } 47 \text{ ml} \times 92 \text{ bpm} = 4.3 \text{ l/min} / 1.7 \text{ m}^2 = 2.5 \text{ l/min/m}^2$$

# Stroke volume, Ejection Fraction and LV Dimensions



SV 70 cc  
EF 60%

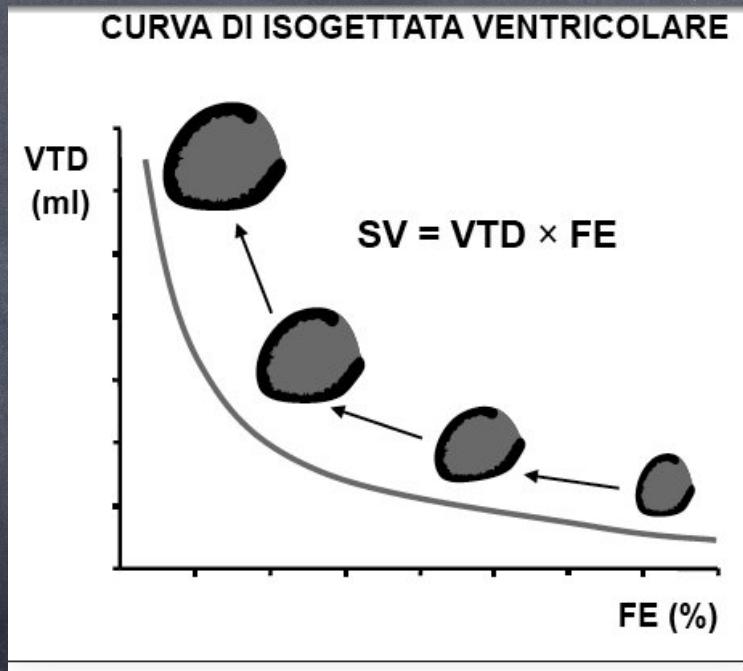


SV 70 cc  
EF 40%



SV 70 cc  
EF 25%

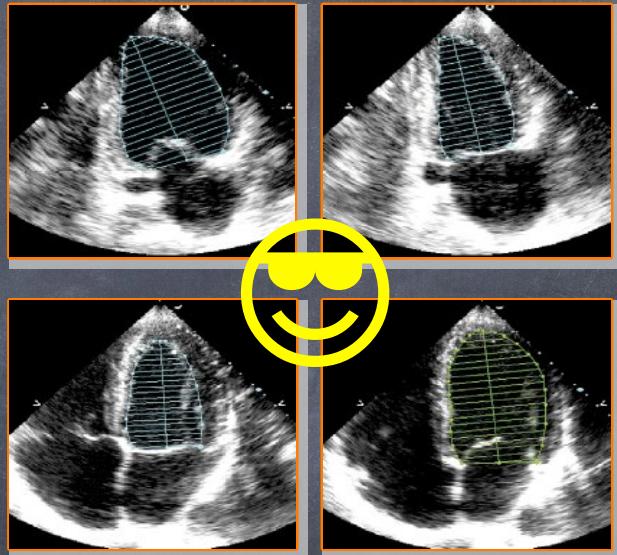
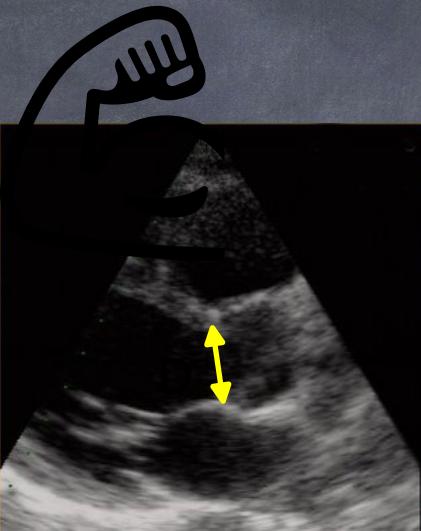
## Curve di isogittata ventricolare



Cortesia di Frank Dini, Pisa



# Quindi in fase acuta: SV o FE?



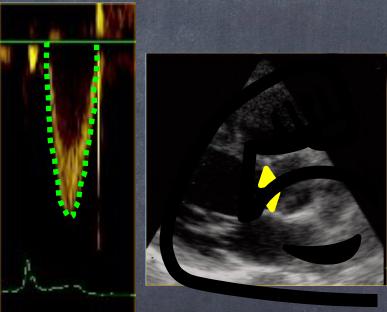
EF %

$$SV \text{ (ml)} = \text{Area (cm}^2\text{)} \times TVI$$

$$SV \text{ (ml)} = D^2 \times 0.785 \times TVI$$



# Take Home message (SV)

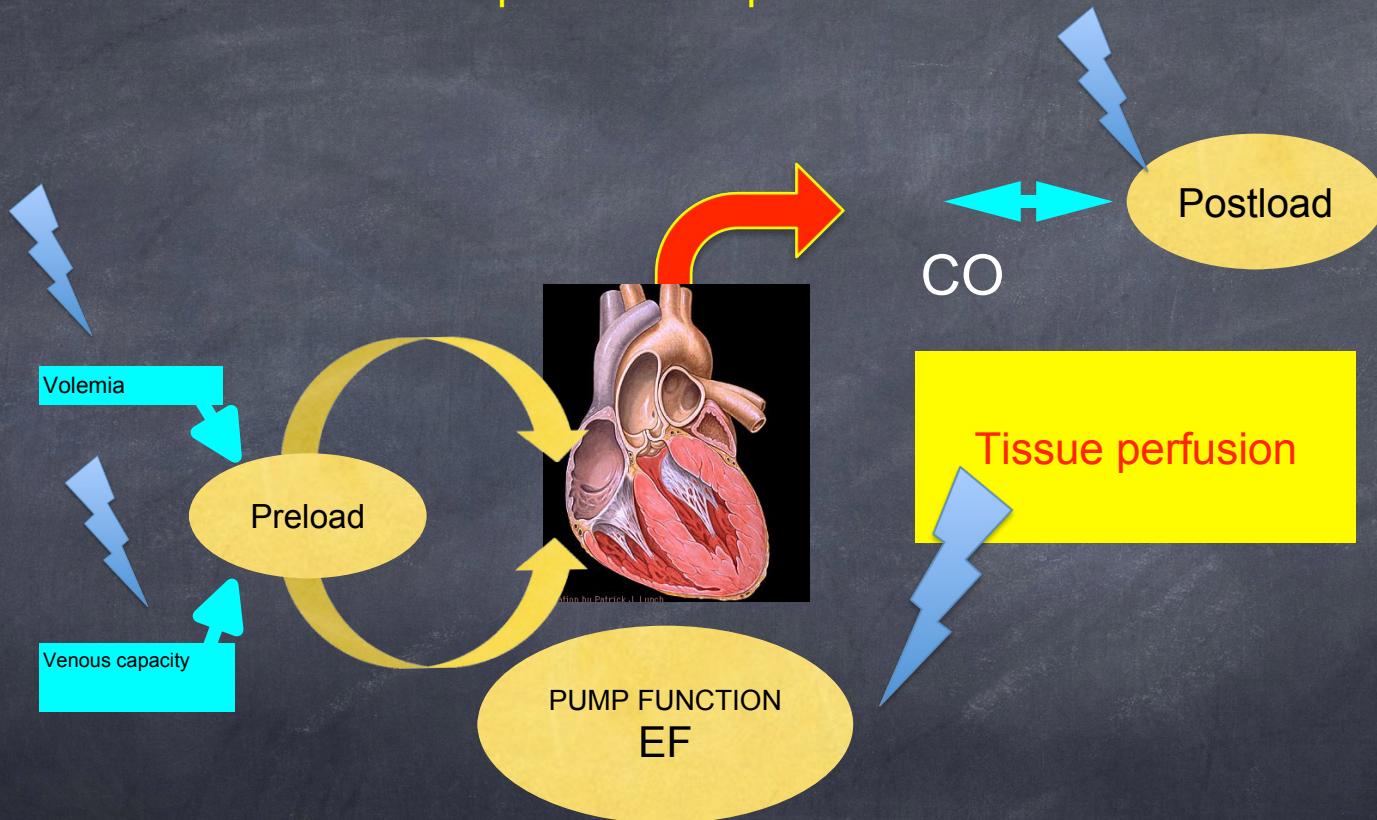


$$SV \text{ (ml)} = \text{Area} \left( \text{cm}^2 \right) \times TVI$$

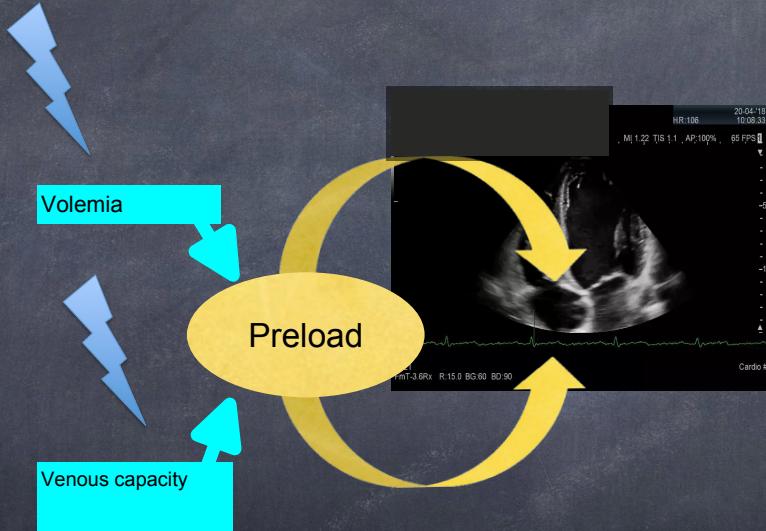
$$SV \text{ (ml)} = D^2 \times 0.785 \times TVI$$

- | There is no “normal” cardiac output value; any cardiac output value can be inadequate or excessive depending on the specific conditions of the individual at the time of measurement.
- | Determining whether or not a cardiac output is adequate for a patient must therefore include an assessment of tissue perfusion and the presence of compensatory mechanisms.
- | If cardiac output is inadequate, treatments can be aimed at one or more of its four determinants depending on the specific underlying causes and patient status: preload, afterload, myocardial contractility, and heart rate.”

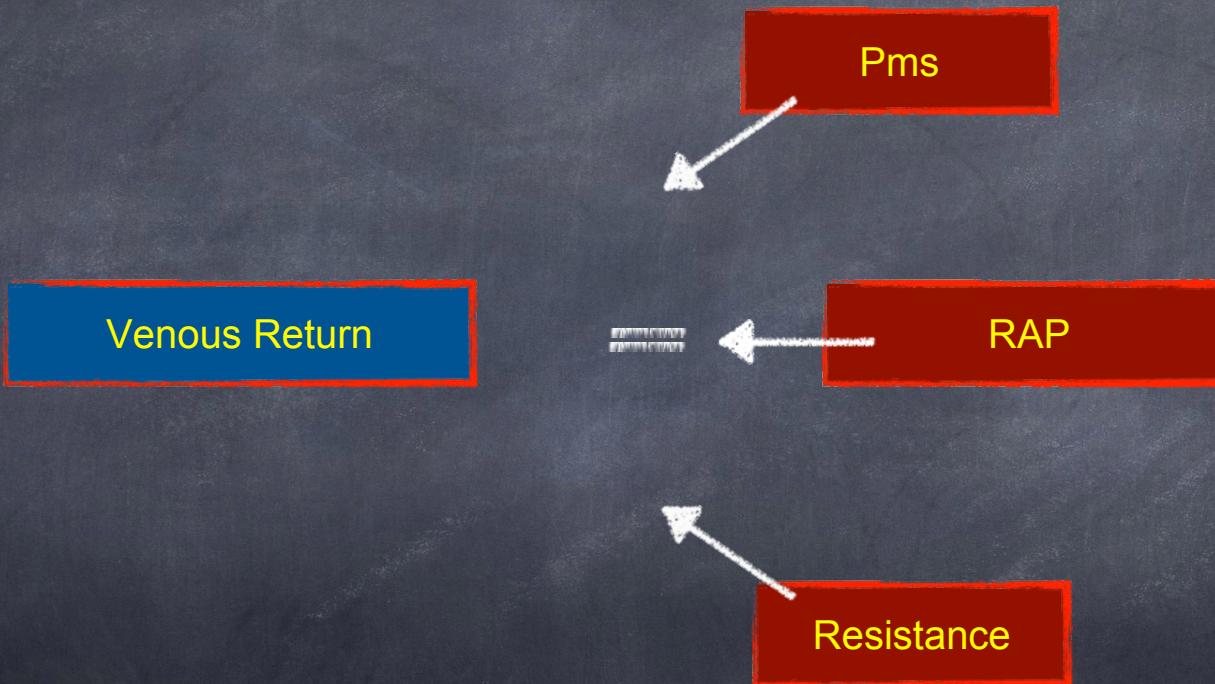
Tissue perfusion depend on .....



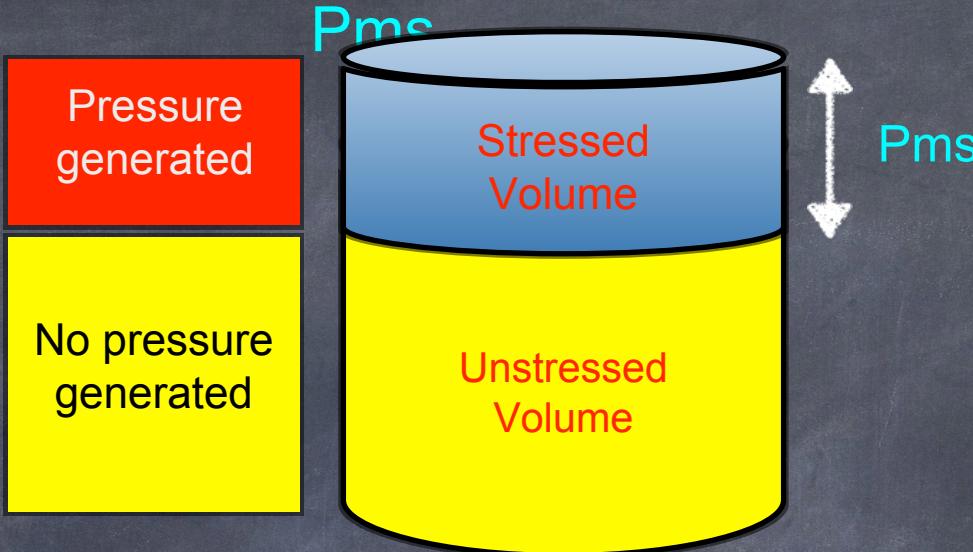
# clinical evaluation of .....



# Venous return .....



# Determinants of venous return:



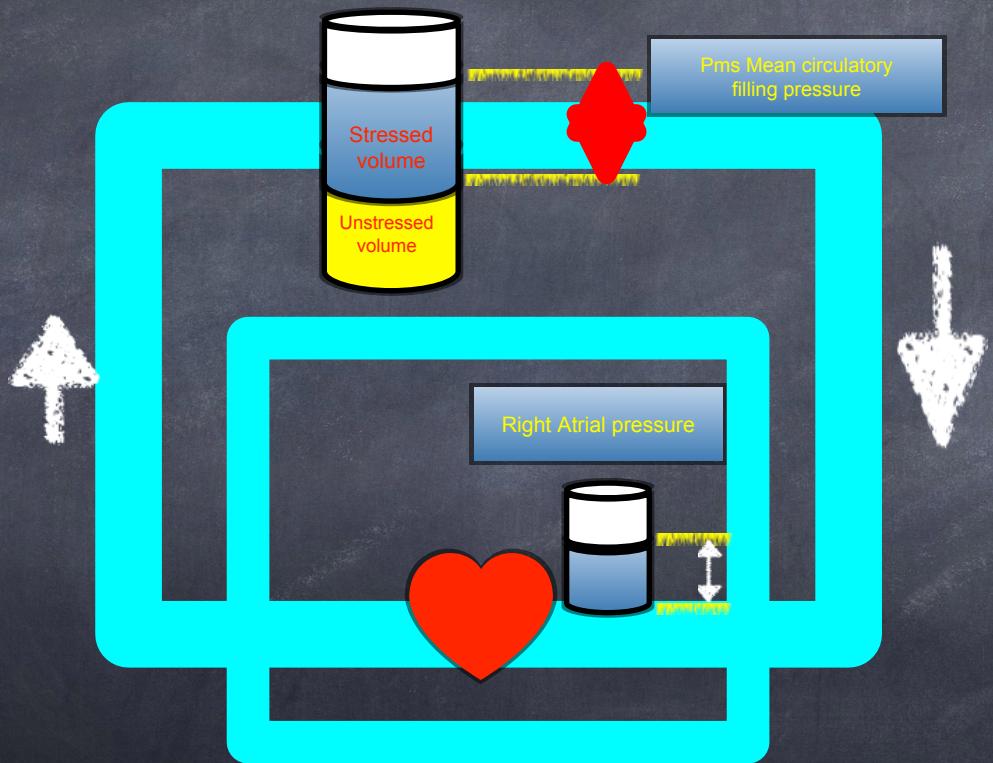
Pms: mean systemic filling pressure  
= 7 mmHg

= The mean systemic filling pressure (Pms)  
is the pressure in the whole vascular system when the heart is stopped and there is no fluid motion  
Proper measure of the volume state of the systemic circulation  
and depends only upon stressing volume and compliance (not affected by operation of the heart)



# Venous return

$$\frac{Pms - RAP}{RVR}$$



Fabio Cavallaro  
Claudio Sandroni  
Cristina Marano  
Giuseppe La Torre  
Alice Mannocci  
Chiara De Waure  
Giuseppe Bello  
Riccardo Maviglia  
Massimo Antonelli

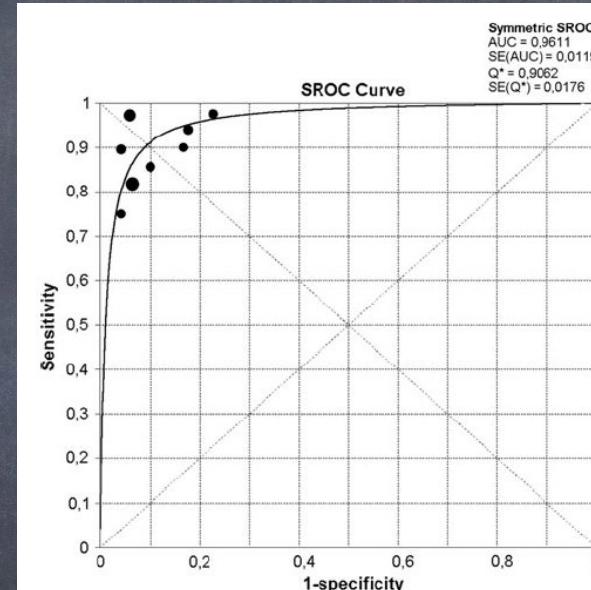
## Diagnostic accuracy of passive leg raising for prediction of fluid responsiveness in adults: systematic review and meta-analysis of clinical studies

Subgroup	Correlation $r$	$p^*$	AUC	$p^*$
Ventilation				
Adapted	0.81 (0.53–0.93)	0.97	0.94 (0.87–1.00)	0.74
Inspiratory efforts	0.81 (0.74–0.87)		0.95 (0.91–0.99)	
Cardiac rhythm				
Sinus rhythm	0.73 (0.58–0.84)	0.15	0.96 (0.92–0.99)	0.94
Arrhythmias	0.83 (0.75–0.89)		0.96 (0.89–1.03)	
Starting position				
Supine	0.78 (0.64–0.87)	0.39	0.93 (0.87–1.00)	0.62
Semirecumbent	0.83 (0.75–0.89)		0.95 (0.92–0.97)	

\* Test for interaction

## Conclusions

Passive leg raising-induced changes in cardiac output reliably predict fluid responsiveness regardless of ventilation mode, underlying cardiac rhythm and technique of measurement and can be recommended for routine assessment of fluid responsiveness in the majority of ICU population. PLR-induced changes in pulse pressure can be a viable alternative with lower predictive ability.



# Passive leg raising predicts fluid responsiveness in the critically ill\*

Xavier Monnet, MD, PhD; Mario Rienzo, MD; David Osman, MD; Nadia Anguel, MD; Christian Richard, MD; Michael R. Pinsky, MD, Dr hc; Jean-Louis Teboul, MD, PhD

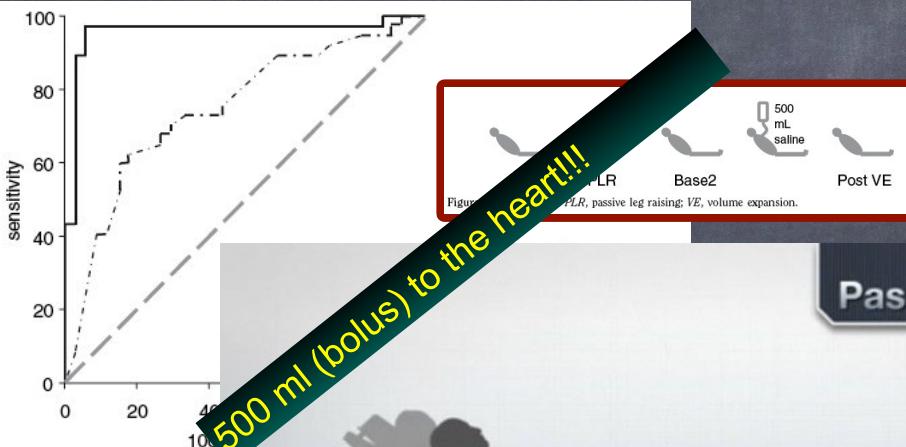


Figure 4. Receiver operating curves comparing pulse pressure (*PP*) induced by passive leg raising (PLR) and volume expansion (VE).

Figure 4. Receiver operating curves comparing pulse pressure (*PP*) induced by passive leg raising (PLR) and volume expansion (VE) to discriminate responders and nonrespon-



**Conclusions:** The changes in aortic blood flow induced by PLR predict preload responsiveness in ventilated patients, whereas with arrhythmias and spontaneous breathing activity, respiratory variations of arterial pulse pressure poorly predict preload responsiveness. (Crit Care Med 2006; 34:1402-1407)

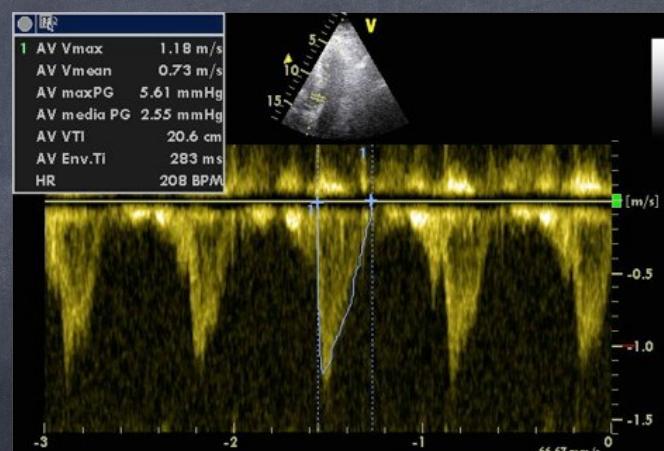
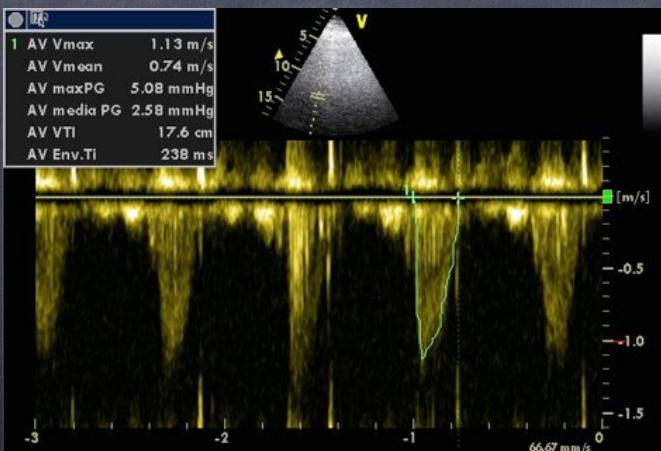
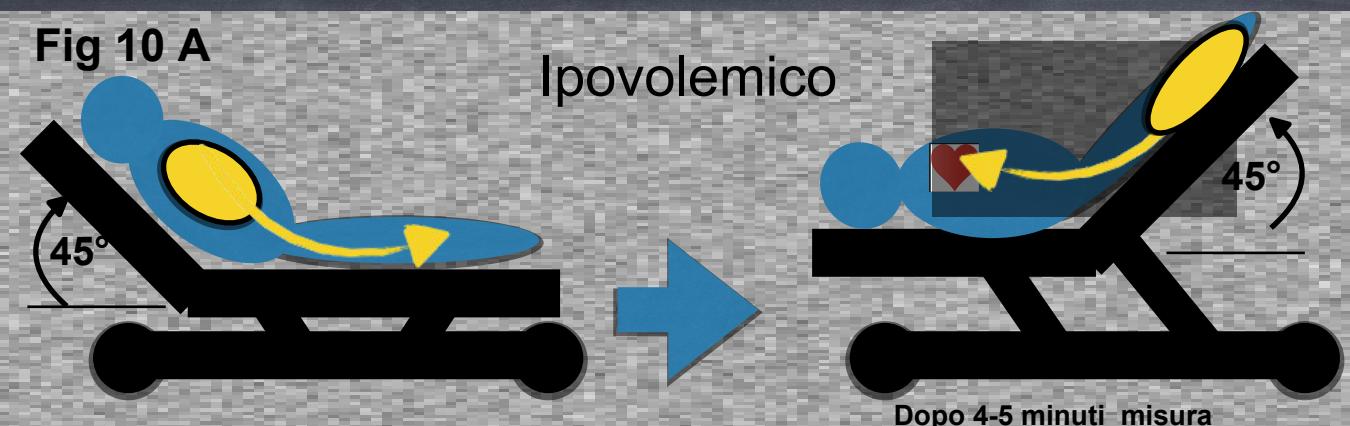
500 ml (bolus) to the heart!!!



## Passive Leg Raising

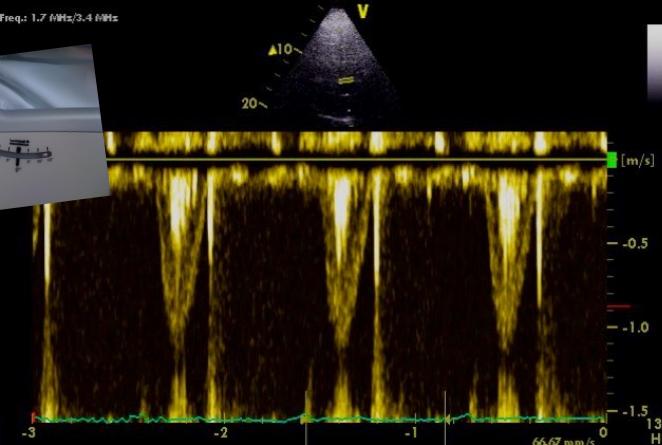
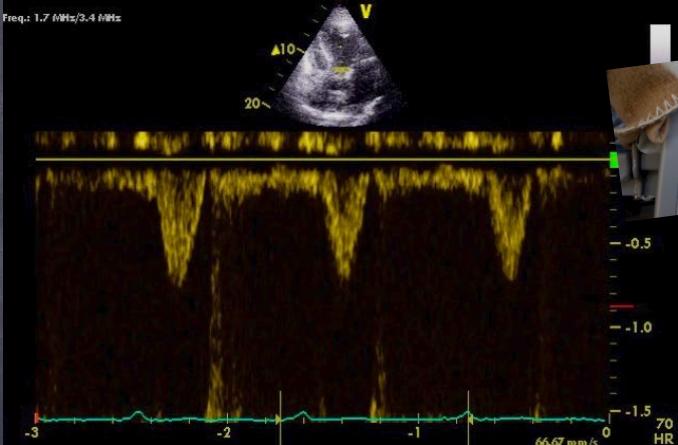
Fig 10 A

Ipoolemico

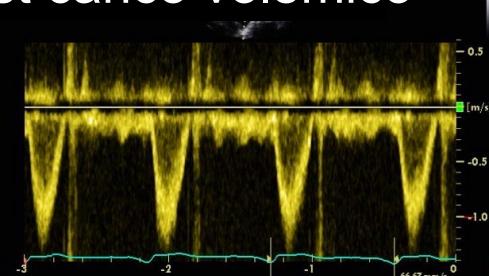


- Variazione dell'integrale velocità tempo (VTI) di LVOT > 18%
  - $\Delta VTI = 100 \times (20.6 - 17.6) / (20.6 + 17.6/2) = 15\%$

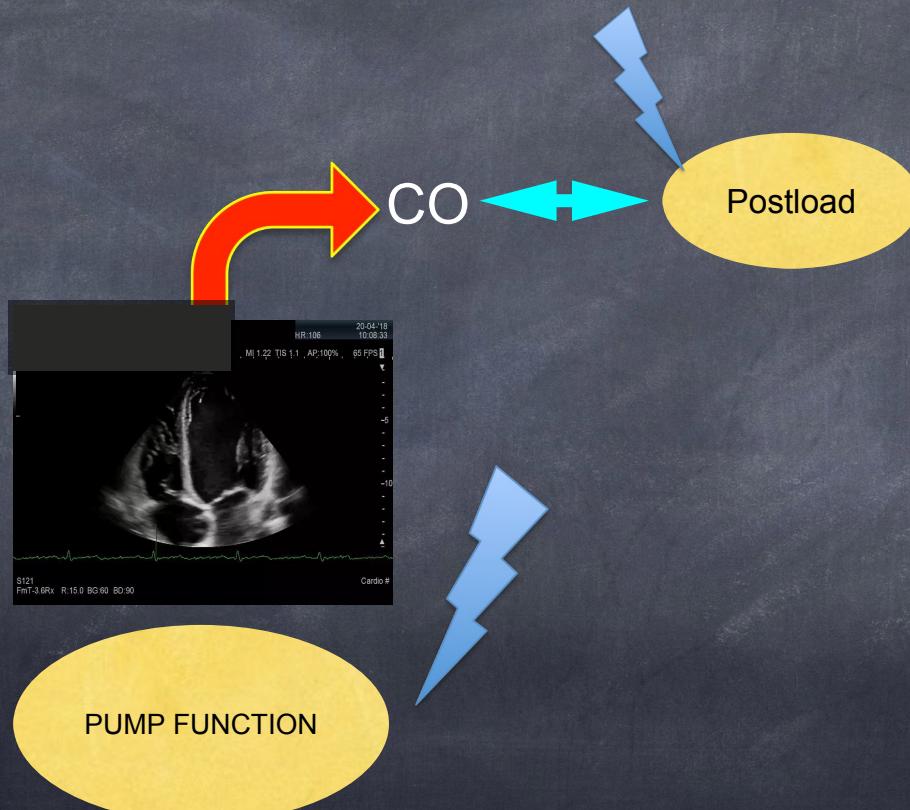
# 85/64 mmHg .... need fluid !?



Post carico volemico



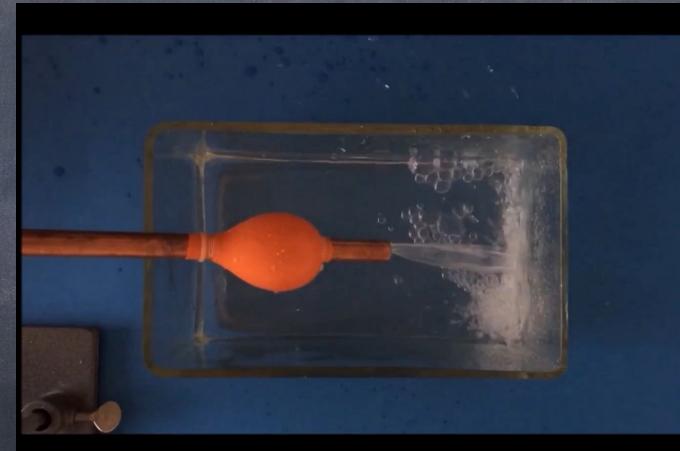
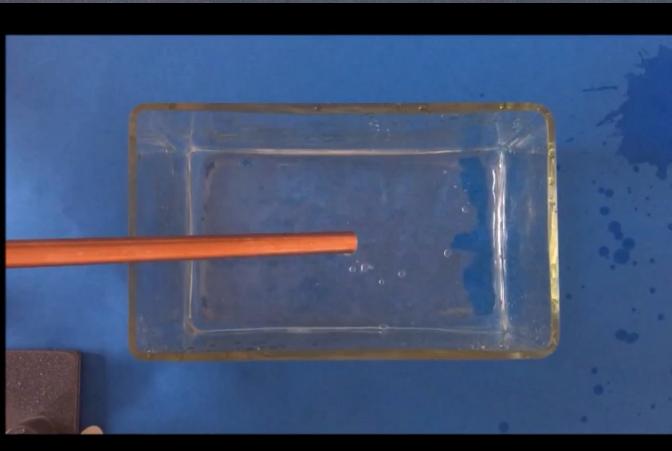
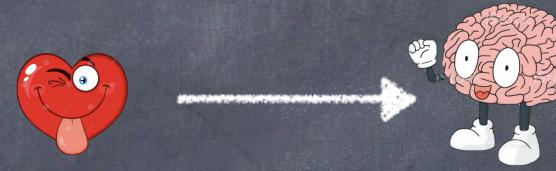
## clinical evaluation of .....



REVIEW

Ventriculo-arterial decoupling in acutely altered hemodynamic states

Fabio Guarracino\*, Rubia Baldassarri†, Michael R Pinsky\*



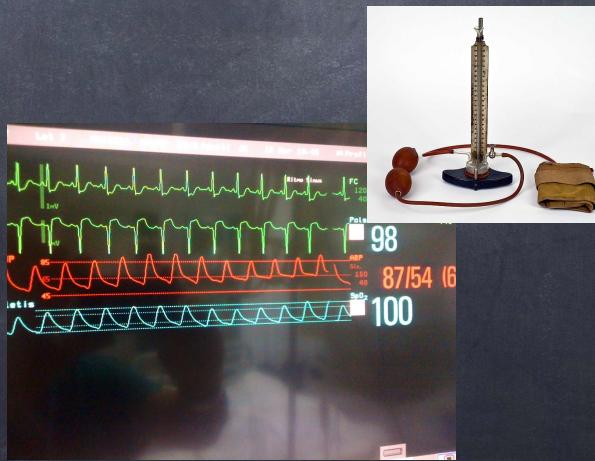
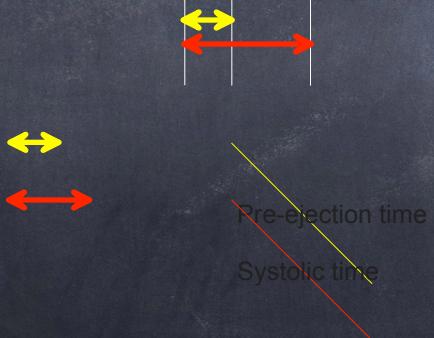
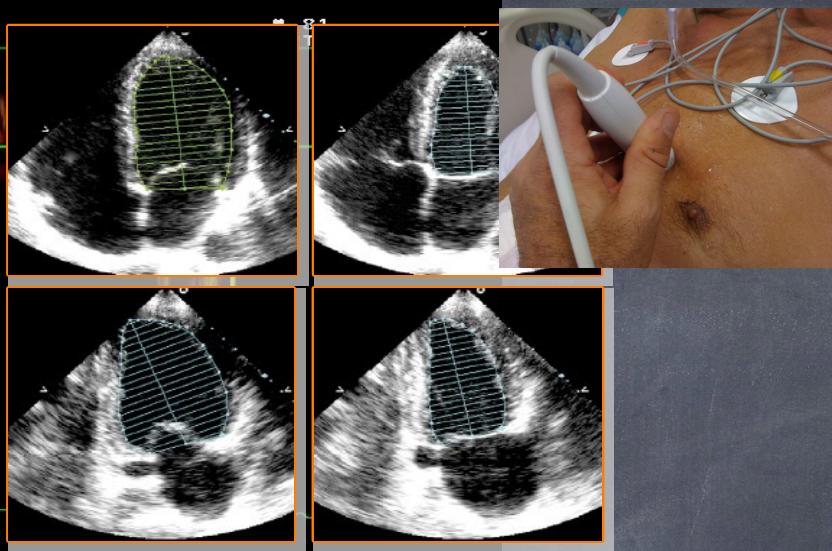
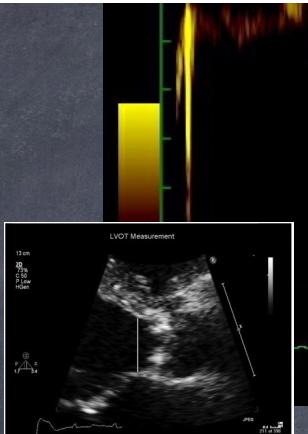
# L'accoppiamento ventricolo-arterioso

- ❑ Il sistema cardiovascolare ha la funzione di garantire la perfusione di tessuti e organi in condizioni di riposo e di stress.
- ❑ La sua performance dipende dall'interazione delle sue componenti, ovvero :
  - il ventricolo sinistro
  - il sistema arterioso.
- ❑ Questa interazione, definita accoppiamento ventricolo-arterioso, può essere espressa come il rapporto tra elastanza arteriosa e elastanza ventricolare sinistra.

REVIEW

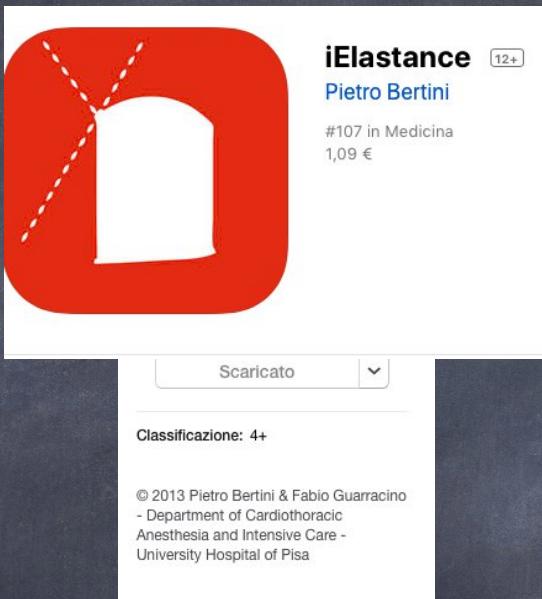
## Ventriculo-arterial decoupling in acutely altered hemodynamic states

Fabio Guerracino<sup>1\*</sup>, Rubia Baldassarri<sup>1</sup>, Michael R Pinsky<sup>2</sup>



# Noninvasive Single-Beat Determination of Left Ventricular End-Systolic Elastance in Humans

Chen-Huan Chen, MD,<sup>\*†</sup> Barry Fetics, MSE,<sup>‡</sup> Erez Nevo, MD, DSc,<sup>‡</sup> Carlos E. Rochitte, MD,<sup>‡</sup> Kuan-Rau Chiou, MD,<sup>\*†</sup> Phillip Yu-An Ding, MD, PhD,<sup>\*†</sup> Miho Kawaguchi, MD,<sup>‡</sup> David A. Kass, MD<sup>‡</sup>



# iElastance

Systolic Blood Pressure (mmHg) 105

Diastolic Blood Pressure (mmHg) 70

Stroke Volume (ml) 33

Ejection Fraction (%) 43

Pre-Ejection Time (ms) 124

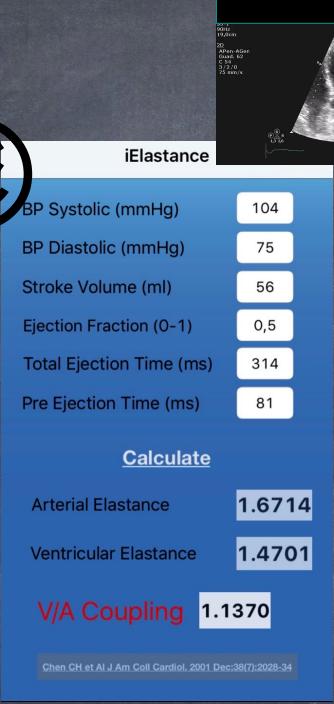
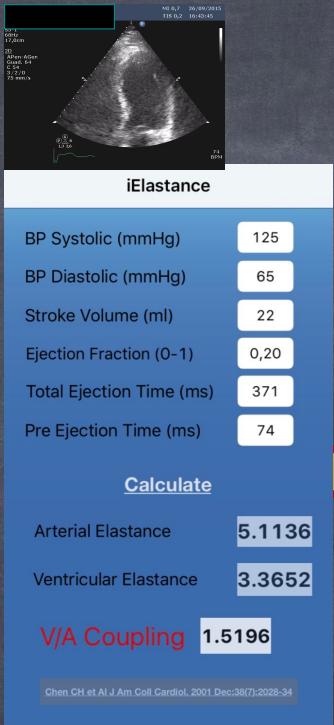
Total Ejection Time (ms) 300  
**CALCULATE**

Arterial Elastance 2.863636  
3

Ventricular Elastance 1.444346  
2

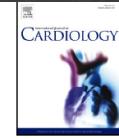
VAC 1.982652  
3





- Ricovero
- Pa 125/65
- FC 74 bpm

- 24 ore dopo Levosimendan
- Pa 104/75
- FC 76 bpm



## Evaluation of ventriculo-arterial coupling in ST elevation myocardial infarction with left ventricular dysfunction treated with levosimendan

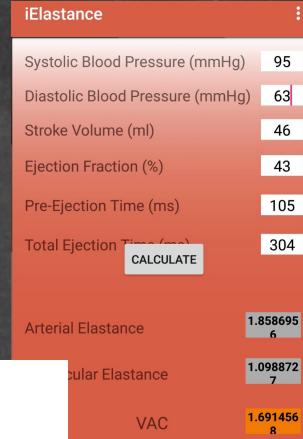
Paolo Trambaiolo <sup>a,\*</sup>, Pietro Bertini <sup>b</sup>, Nunzia Borrelli <sup>c</sup>, Marco Poli <sup>a</sup>, Silvio Romano <sup>c</sup>, Giuseppe Ferraiuolo <sup>a</sup>, Maria Penco <sup>c</sup>, Fabio Guaraccino <sup>b</sup>

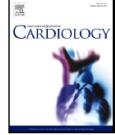
**Table 2**

Effect of levosimendan on echocardiographic parameters.

	Baseline	24 h	p-Value
EF (0–1)	0.29 ± 0.1	0.32 ± 0.1	=0.03
Total ejection time (ms)	332 ± 53	319 ± 45	=0.10
Pre-ejection time (ms)	87 ± 29	74 ± 22	=0.02
Arterial elastance (mm Hg/ml/m <sup>2</sup> )	2.34 ± 1.09	1.74 ± 0.5	<0.001
Ventricular elastance (mm Hg/ml/m <sup>2</sup> )	1.57 ± 0.12	1.24 ± 0.09	=0.021
V-A coupling	1.74 ± 0.8	1.66 ± 0.7	=0.56
WMSI	2.16 ± 0.47	2.05 ± 0.54	=0.025
Stroke volume (ml)	48 ± 17	60 ± 21	<0.01
Aortic VTI	14.6 ± 4.6	18.2 ± 6.4	<0.001
B-lines (%)	79	55	<0.01

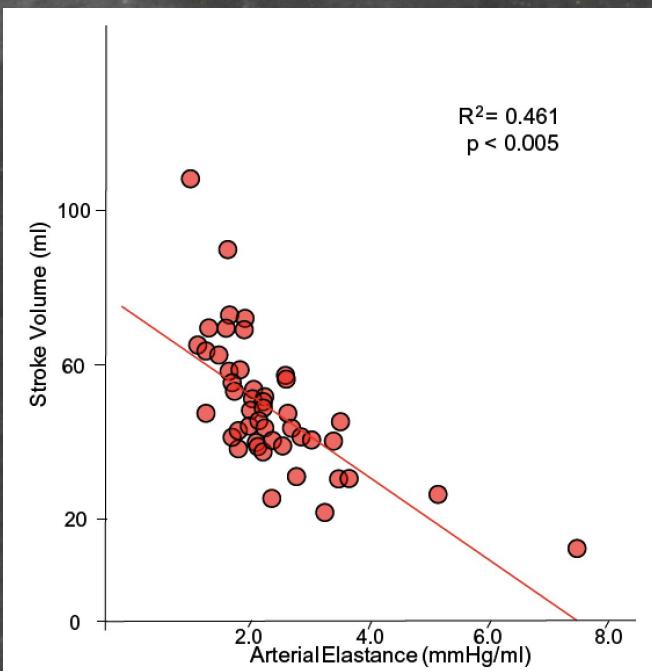
EF = ejection fraction, V-A coupling = ventriculo arterial coupling, WMSI = Wall Motion Score Index, VTI = velocity time integral.





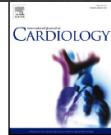
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iElastance	⋮
Systolic Blood Pressure (mmHg)	95
Diastolic Blood Pressure (mmHg)	63
Stroke Volume (ml)	46
Ejection Fraction (%)	43
Pre-Ejection Time (ms)	105
Total Ejection Time (ms)	304
CALCULATE	
Arterial Elastance	1.858695 6
Ventricular Elastance	1.098872 7
VAC	1.691456 8

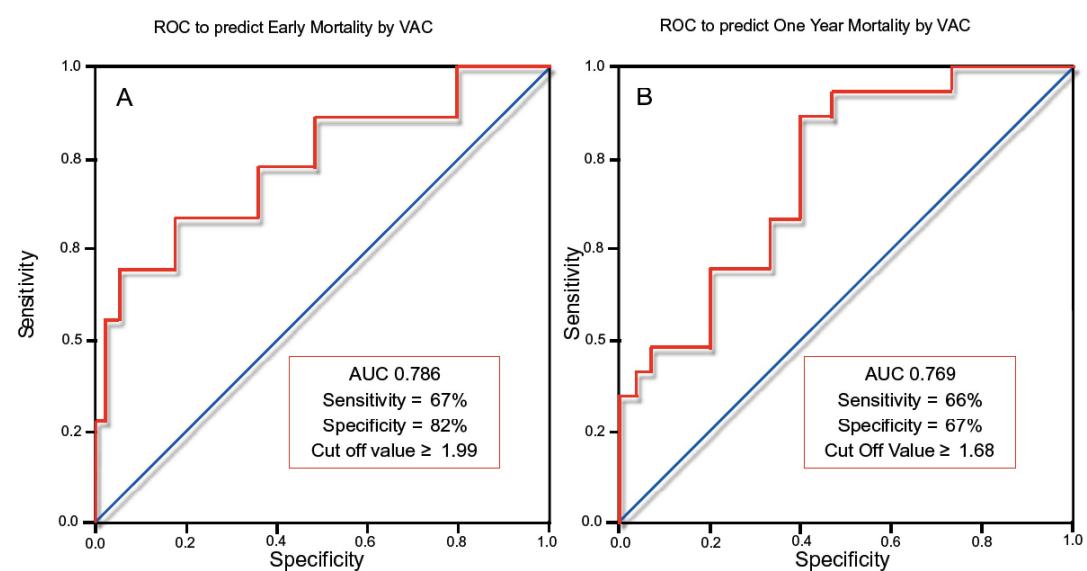




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iElastance	
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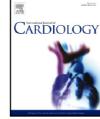




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Paolo Trambaiolo <sup>a,\*</sup>, Pietro Bertini <sup>b</sup>, Nunzia Borrelli <sup>c</sup>, Marco Poli <sup>a</sup>, Silvio Romano <sup>c</sup>, Giuseppe Ferraiuolo <sup>a</sup>,  
Maria Penco <sup>c</sup>, Fabio Guerraccino <sup>b</sup>

In this study, the use of levosimendan in STEMI patients with LV dysfunction significantly increased stroke volume after 24-hour treatment. The increase in stroke volume and the concomitant improvement of EF seems to be facilitated by Ea reduction, as demonstrated by a statistically significant correlation between Ea reduction and SV increase. VAC at the baseline seemed to predict early and late mortality and early and prolonged use of NE, however, this needs to be tested in larger series of patients and multivariate adjustments for other prognostic predictors.

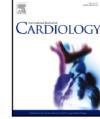




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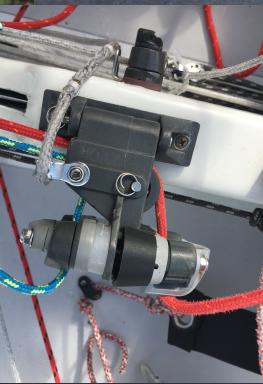
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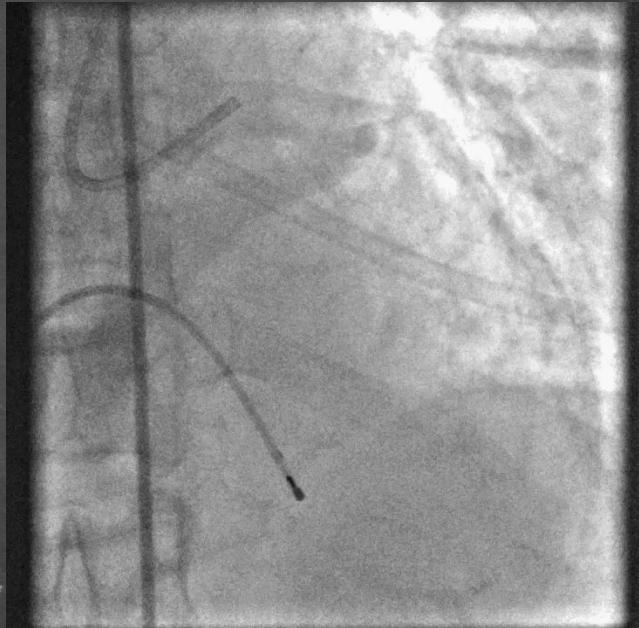
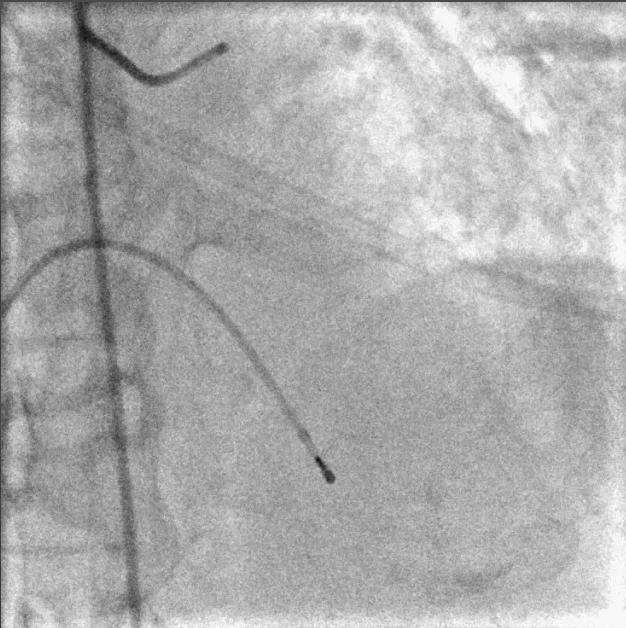
These data show that in STEMI patients admitted with LV dysfunction a more pathophysiological approach might lead to a more personalised treatment. In the light of such results we speculate that the need for levosimendan should be based on an “echo-dynamic” approach which takes into account both myocardial contractility and arterial elastance.



real world .....



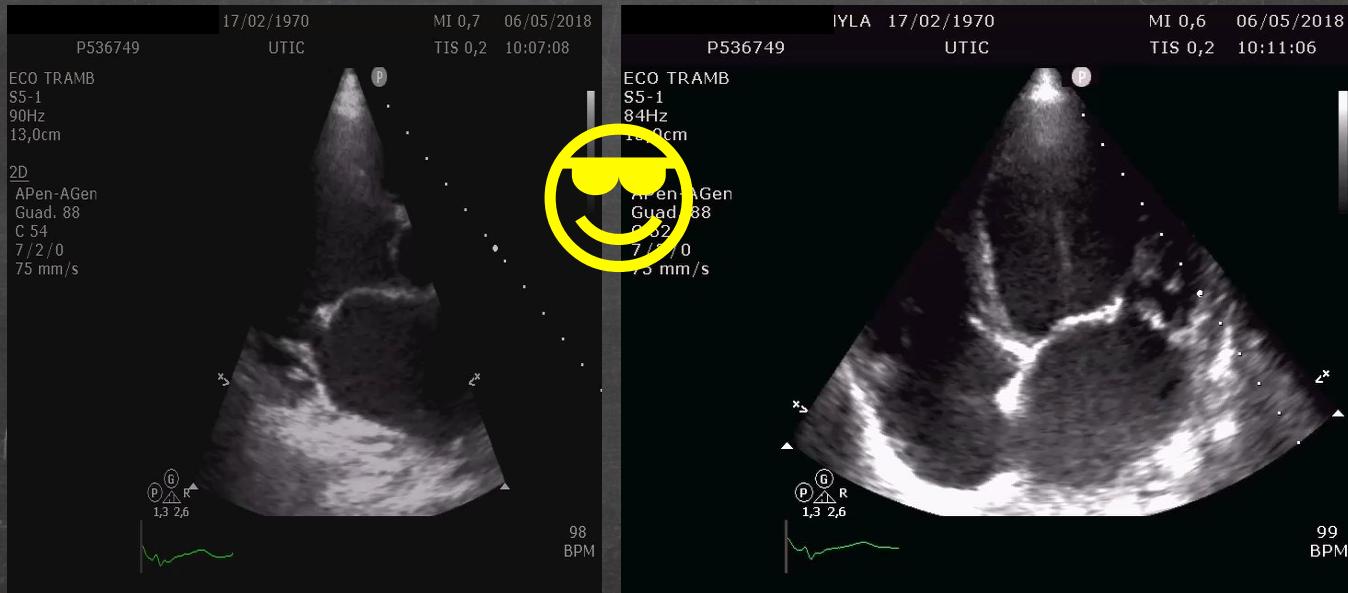
# STEMI



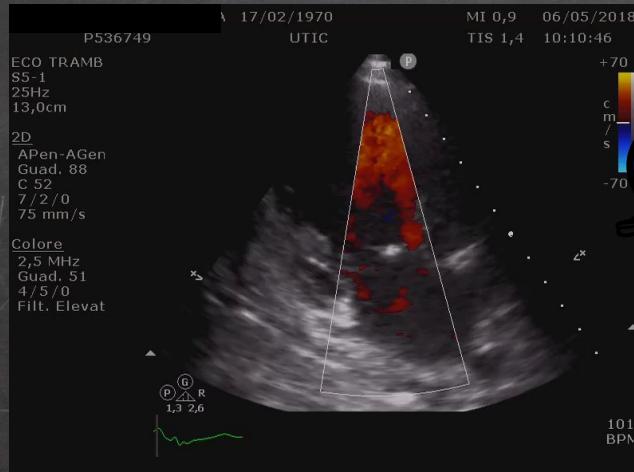
- ❖ Posizionato Contropulsatore Aortico (IABP) per ipotensione e slow flow
- ❖ Posizionato Pacemaker Temporaneo



# Ecocardiogramma transtoracico



# Ecocardiogramma transtoracico



## 3 giornata ricovero UTIC

- PA 90/65 mmHg
- Rimosso PMT (mai entrato)
- Paziente stabile
- Ecocardiogramma invariato
- Diuresi - 3000cc
- Terminato ciclo di levosimendan

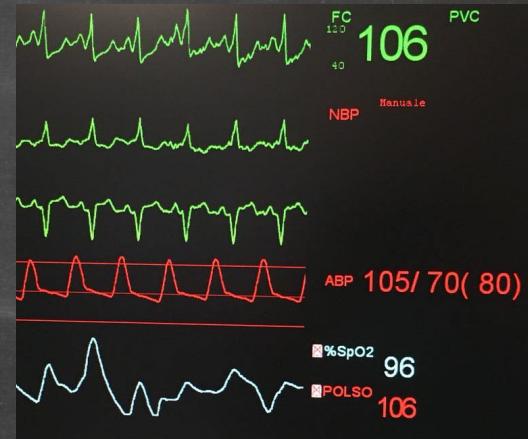


# IABP

# IABP



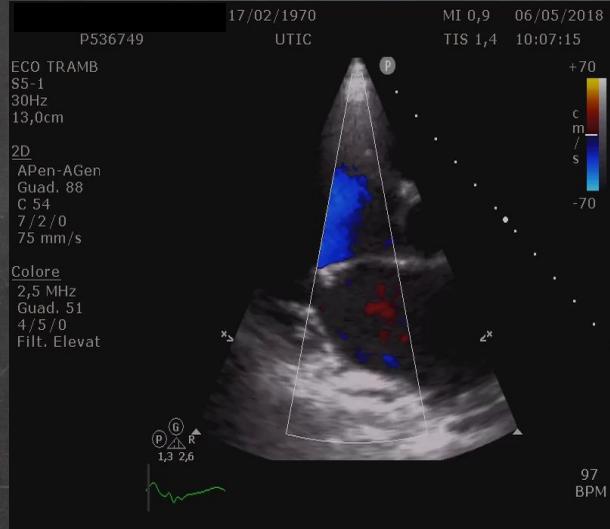
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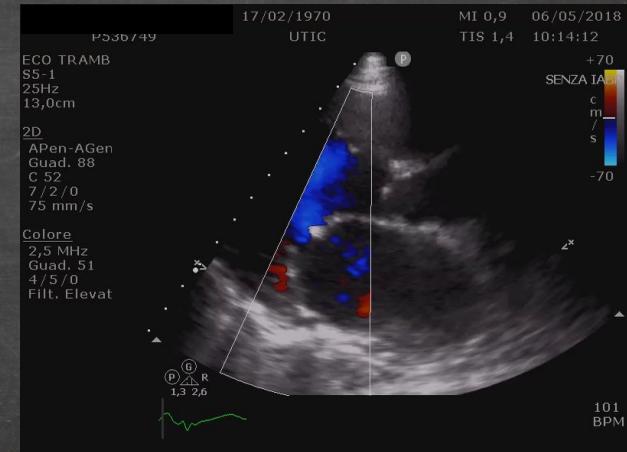
RIMUOVO?



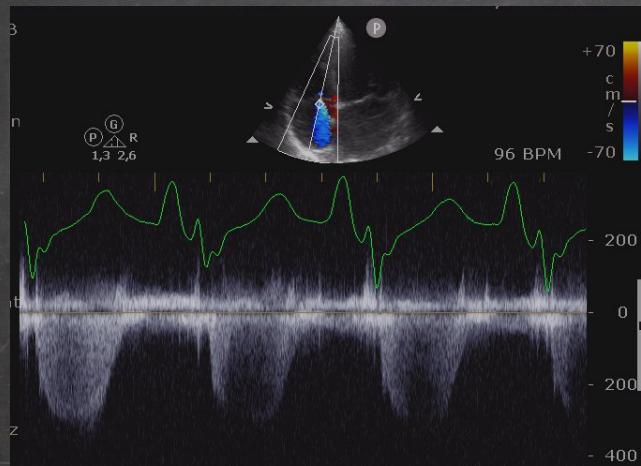
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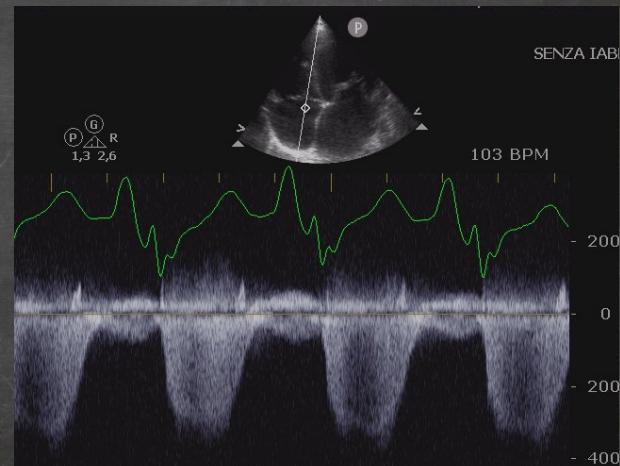
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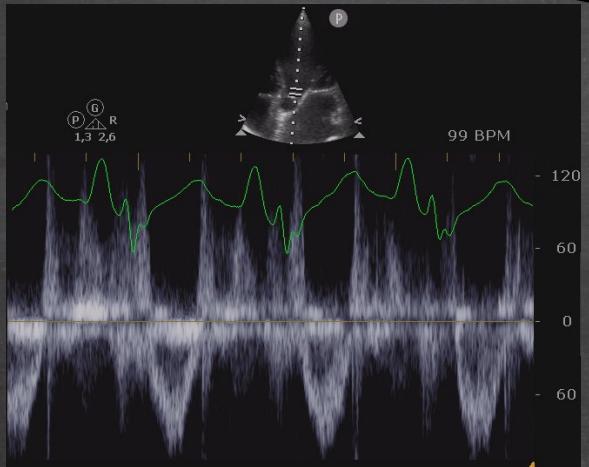
IABP



No IABP

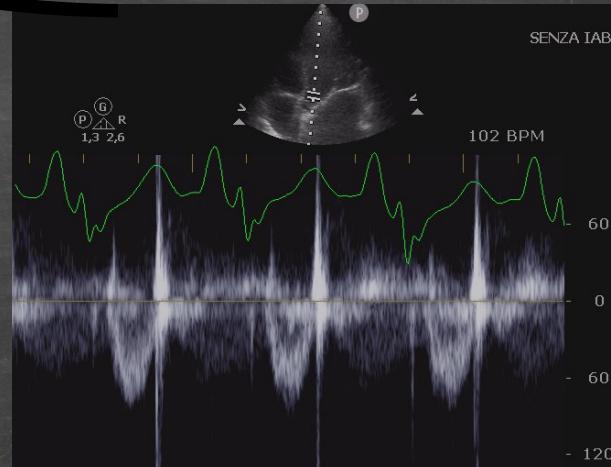


IABP



VTI 18 mm  
LVOT 18 mm  
SV 46 cc  
CO 4,5 l/min

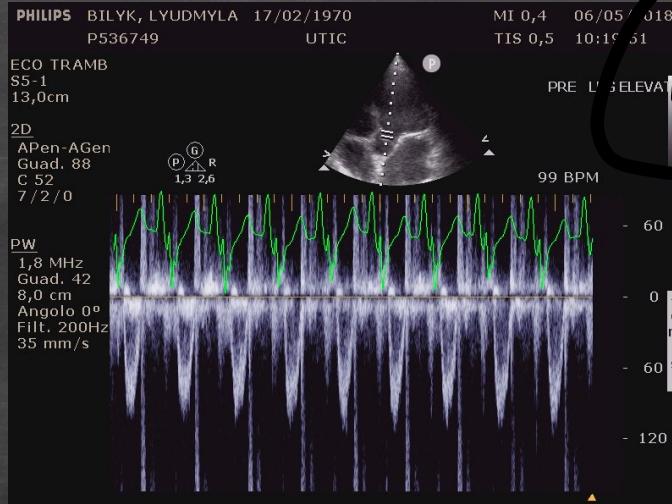
No IABP



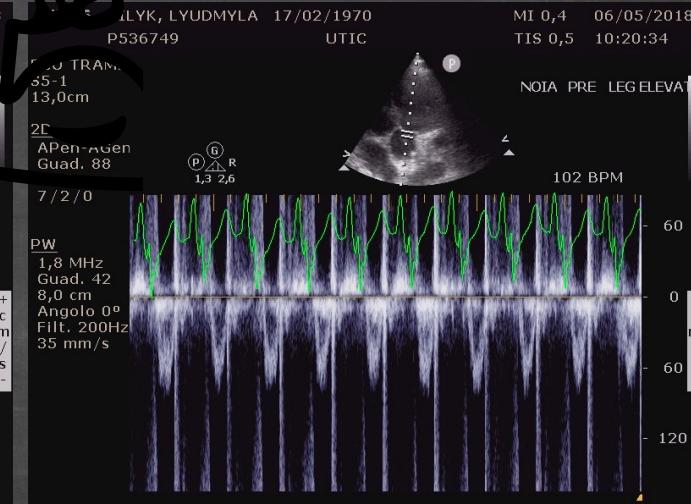
VTI 13 mm  
LVOT 18 mm  
SV 33 cc  
CO 3,3 l/min



# IABP



# No IABP



# IABP

iElastance	:
Systolic Blood Pressure (mmHg)	95
Diastolic Blood Pressure (mmHg)	63
Stroke Volume (ml)	46
Ejection Fraction (%)	43
Pre-Ejection Time (ms)	105
Total Ejection Time (ms)	304
CALCULATE	
Arterial Elastance	1.858695 6
Ventricular Elastance	1.098872 7
VAC	1.691456 8

# No IABP

iElastance	:
Systolic Blood Pressure (mmHg)	105
Diastolic Blood Pressure (mmHg)	70
Stroke Volume (ml)	33
Ejection Fraction (%)	43
Pre-Ejection Time (ms)	124
Total Ejection Time (ms)	300
CALCULATE	
Arterial Elastance	2.863636 3
Ventricular Elastance	1.444346 2
VAC	1.982652 3





Contents lists available at ScienceDirect

International Journal of Cardiology



journal homepage: [www.elsevier.com/locate/ijcard](http://www.elsevier.com/locate/ijcard)

## Ventriculo-arterial coupling in the intensive cardiac care unit: A non-invasive prognostic parameter

Paolo Trambaiolo <sup>a,\*<sup>1</sup></sup>, Ilaria Figliuzzi <sup>a</sup>, Marta Salvati <sup>a</sup>, Pietro Bertini <sup>b</sup>, Giulia Brizzi <sup>b</sup>, Giuliano Tocci <sup>c</sup>, Massimo Volpe <sup>c</sup>, Giuseppe Ferraiuolo <sup>a</sup>, Fabio Guaraccino <sup>b</sup>

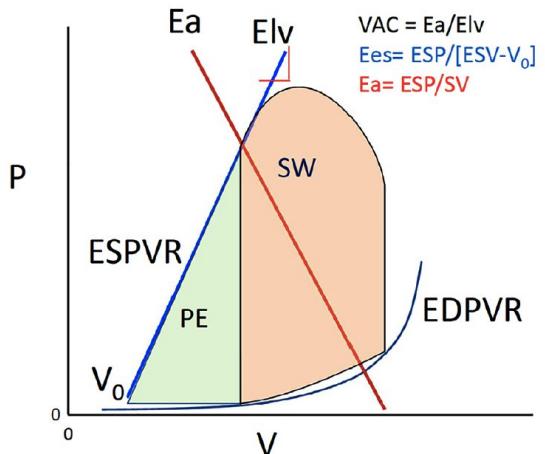
<sup>a</sup> ICCU, Sandro Pertini Hospital, Rome, Italy

<sup>b</sup> Cardiothoracic and Vascular Anesthesia and Intensive Care, Azienda Ospedaliero-Universitaria Pisa, Pisa, Italy

<sup>c</sup> Cardiology Department, Sapienza University of Rome, Rome, Italy

2021

### Ventriculo-Arterial Coupling



- Valutare la relazione tra i valori
  - VAC
  - Ea
  - Elv

e sviluppo di eventi intraospedalieri

- Valutare la predittività dei valori di VAC rispetto all' outcome clinico composito di eventi intraospedalieri associati a ridotta perfusione periferica

#### Eventi intraospedalieri:

- Decesso
- Anuria
- AKI
- Amine
- IABP
- MOF
- IOT
- cPAP

## MATERIALI E METODI

Dicembre 2018-Settembre 2019

Unità di terapia intensiva cardiaca (UTIC) dell'ospedale Sandro Pertini di Roma

#### 393 pazienti consecutivi con diagnosi di:

- Scompenso cardiaco acuto
- Shock cardiogeno
- NSTEMI
- STEMI
- Angina instabile
- Miocardite acuta
- Pericardite acuta
- BAV



#### Criteri di esclusione:

- Età inferiore a 18 anni
- Insufficienza aortica severa
- Stenosi aortica severa
- Ostruzione all'efflusso ventricolare sinistro
- Rifiuto del consenso informato alla raccolta dei dati
- Impossibilità di ottenere i parametri necessari per il calcolo non invasivo del VAC

Popolazione finale di 333 pazienti



2021

### Model 2

Variables	Univariate		Multivariate	
	OR (95% CI)	P value	OR (95% CI)	P value
VAC	2,069 (1,318-3,248)	0,002	1,674 (1,018-2,755)	0,042
SPI	0,970 (0,967-0,971)	0,000	0,972 (0,922-1,010)	0,209
HR	1,019 (1,001-1,038)	0,041	1,006 (0,986-1,027)	0,542
SBP	0,982 (0,969-0,994)	0,005	0,986 (0,973-0,998)	0,027

Adjusted comorbidities (model 1) and hemodynamic parameters (model 2).

# 2021

Ventriculo-arterial coupling in the intensive cardiac care unit: A non-invasive prognostic parameter

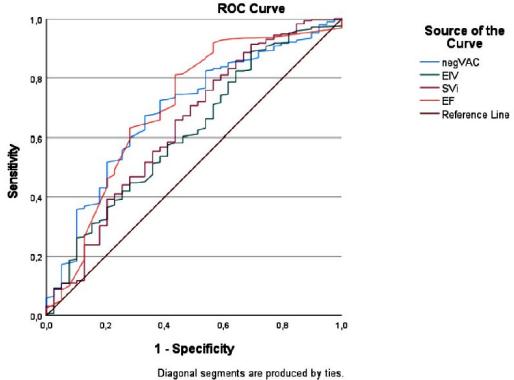
Paolo Trambaiolo<sup>a,\*</sup>, Ilaria Figliuzzi<sup>a</sup>, Marta Salvati<sup>a</sup>, Pietro Bertini<sup>a</sup>, Giulia Brizzi<sup>b</sup>, Giuliano Tocci<sup>c</sup>, Massimo Volpe<sup>c</sup>, Giuseppe Ferraini<sup>c</sup>, Fabio Guaracino<sup>b</sup>

<sup>a</sup>I.C.U., Sondrio Perito Hospital, Italy

<sup>b</sup>Cardiology Department, Sondrio Hospital, Intensive Care, Attiolo Ospedale Università Pavia, Italy

<sup>c</sup>Cardiology Department, Sapienza University of Rome, Rome, Italy

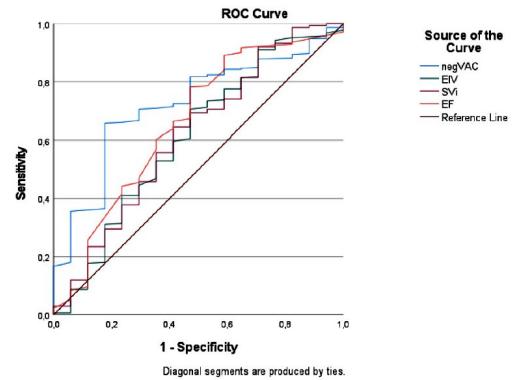
**A**



**Area Under the Curve**

Test Result Variable(s)	Area	Std. Error <sup>a</sup>	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
negVAC	.691	.044	.000	.603 .778
EIV	.616	.049	.019	.521 .711
SVI	.639	.051	.005	.538 .739
EF	.700	.050	.000	.602 .797

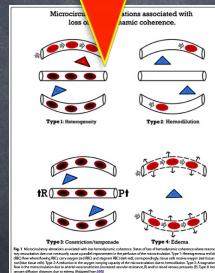
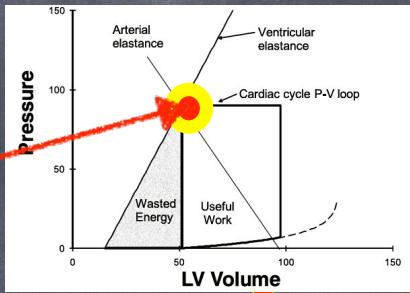
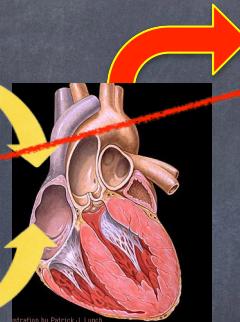
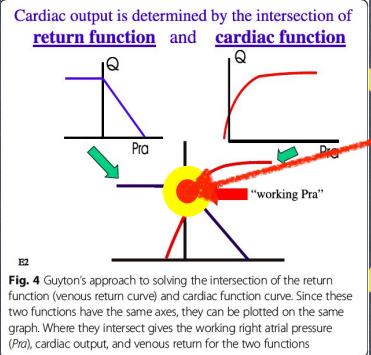
**B**



**Area Under the Curve**

Test Result Variable(s)	Area	Std. Error <sup>a</sup>	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
negVAC	.722	.056	.002	.613 .832
EIV	.609	.077	.130	.458 .760
SVI	.618	.076	.102	.468 .767
EF	.658	.075	.029	.511 .804

# Tissue perfusion depends on .....

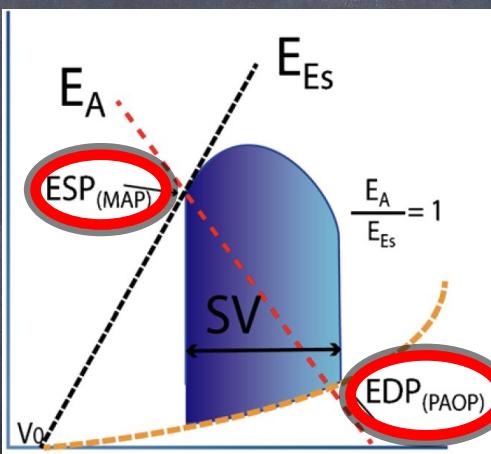
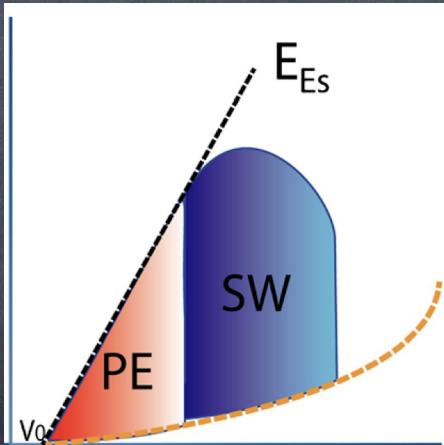




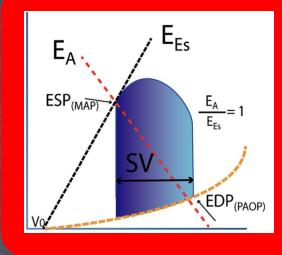
## Septic Shock and the Heart

Pietro Bertini<sup>1</sup> • Fabio Guaracino<sup>1</sup>

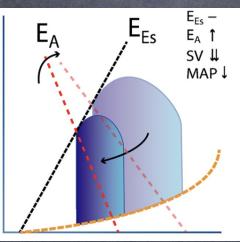
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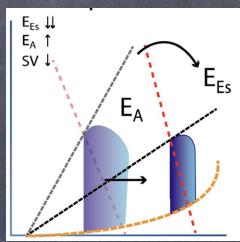
Normal PVL



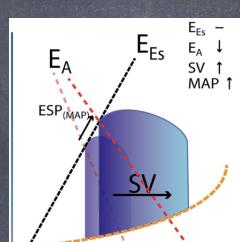
Septic shock



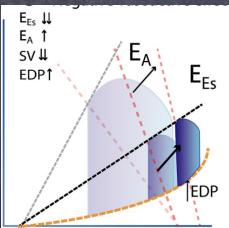
Septic shock and HF



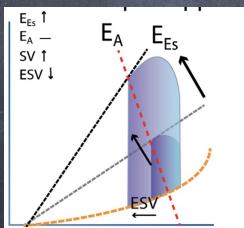
VE Resuscitation



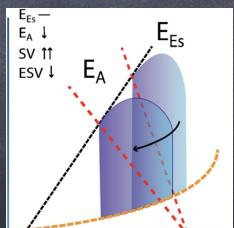
Negative vasoactive effect



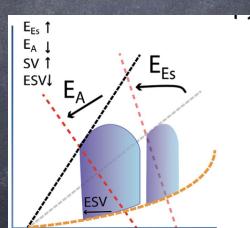
Inotropic support



Ea reduction



Inodilatator therapy



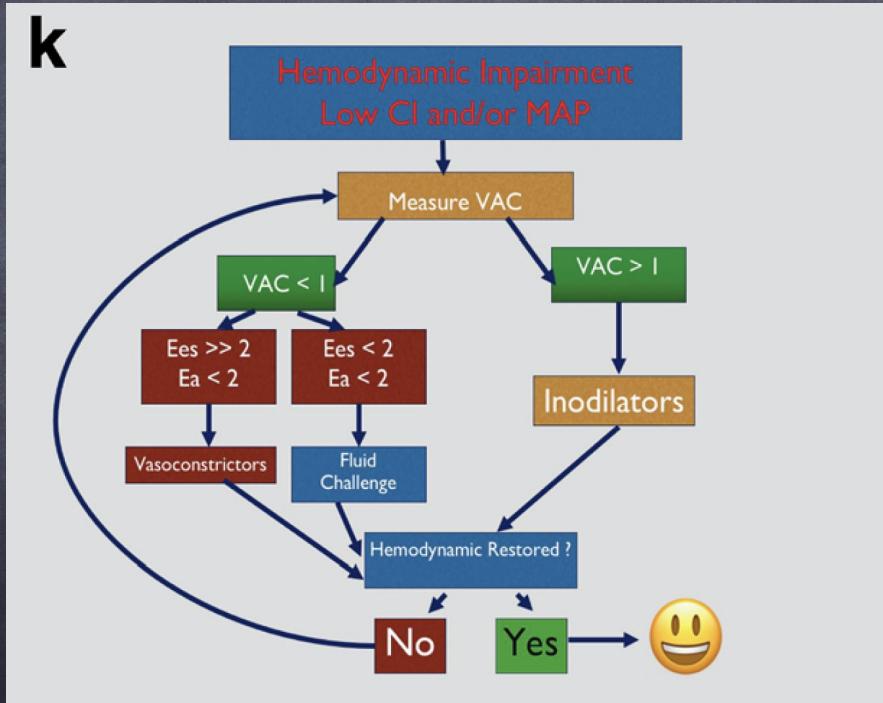


## Algorithm of treatment for hemodynamic instability in septic shock **with** inodilatator

### Septic Shock and the Heart

Pietro Bertini<sup>1</sup> · Fabio Guaracino<sup>1</sup>

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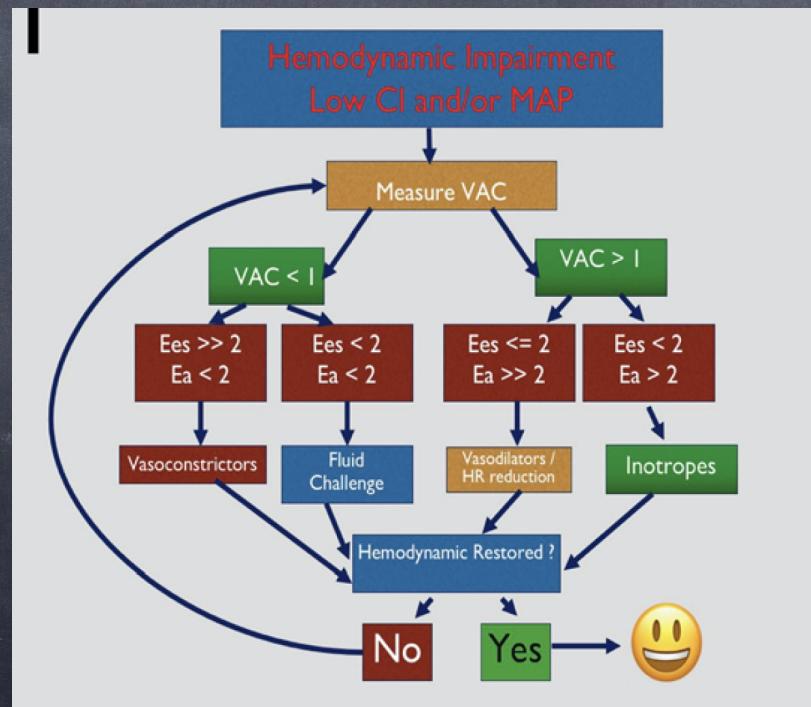


## Septic Shock and the Heart

Pietro Bertini<sup>1</sup> • Fabio Guaracino<sup>1</sup>

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## Algorithm of treatment for hemodynamic instability in septic shock without inodilatator

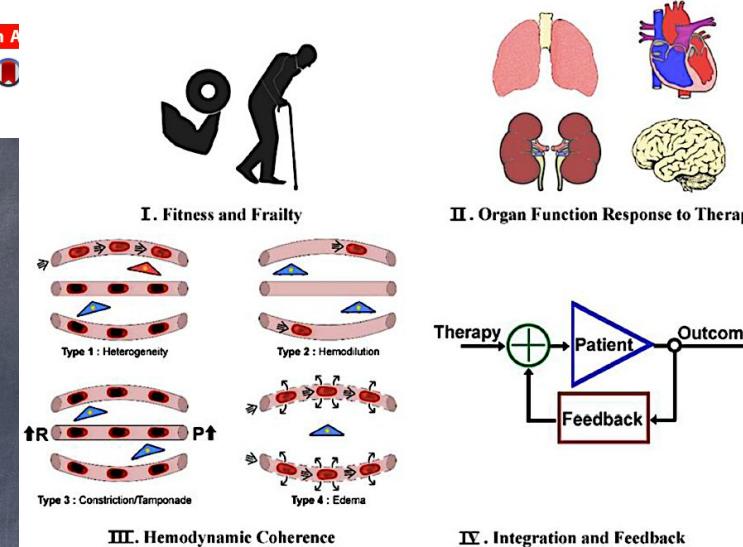


REVIEW

Open Access

## Personalized physiological medicine

Can Ince<sup>1,2</sup>



a physiological approach to personalized medicine must be focused on the phenotype of the patient as well as on the functional properties of their organs and ultimately their cells as they change over time in response to disease and therapy.

**ICU**  
MANAGEMENT & PRACTICE



Surviving Sepsis Campaign Guidelines and Individualised Care



Published on : Mon, 29 Nov 2021

Vincent et al. *Critical Care* (2021) 25:389  
<https://doi.org/10.1186/s13054-021-03813-0>

Critical Care

EDITORIAL

Open Access



## Equilibrating SSC guidelines with individualized care

Jean-Louis Vincent<sup>1</sup> , Mervyn Singer<sup>2</sup>, Sharon Elnav<sup>3</sup>, Rui Moreno<sup>4</sup> , Julia Wendon<sup>5</sup>, Jean-Louis Teboul<sup>6</sup>, Jan Bakker<sup>7,8,9,10</sup>, Glenn Hernandez<sup>11</sup>, Djillali Annane<sup>12</sup>, Angélique M. E. de Man<sup>13</sup>, Xavier Monnet<sup>14</sup>, V. Marco Ranieri<sup>15</sup>, Céline Hamzaoui<sup>16</sup>, Jukka Takala<sup>17</sup>, Nicole Juffermans<sup>18,19</sup>, Jean-Daniel Chiche<sup>20</sup>, Sheila N. Myatra<sup>21</sup> and Daniel De Backer<sup>22</sup>

1. Individualising the timing of ICU admission.
2. Individualising the decision to admit a patient to the ICU.
3. Individualising the timing of antibiotic therapy.
4. Individualising the need for and timing of tracheal intubation.
5. Individualising respiratory settings in mechanically ventilated patients.
6. Individualising oxygenation targets.
7. Individualising sedation therapies.
8. Individualising initial fluid resuscitation.
9. Individualising fluid therapy.
10. Individualising the type of intravenous fluid administered.
11. Monitoring chloride levels.
12. Individualising the initiation of vasopressor therapy.
13. Individualising arterial blood pressure levels.
14. Optimising oxygen delivery.
15. Using a multimodal approach to assessing tissue perfusion.
16. Individualising blood transfusion.
17. Individualising administration of inotropic agents.
18. Individualising the decision to administer corticosteroids.
19. Involving senior colleagues and consultants.
20. Measuring and monitoring the effects of any therapeutic measures undertaken.

By P.Trambaiolo

EDITORIAL

Open Access

## The future of AI in critical care is augmented, not artificial, intelligence



Vincent X. Liu<sup>1,2\*</sup>

chemistry to the forefront of our clinical practice. Returning to Sackett: "*Evidence based medicine is not "cookbook" medicine. (...) External clinical evidence can inform, but can never replace, individual clinical expertise, and it is this expertise that decides whether the external evidence applies to the individual patient at all and, if so, how it should be integrated into a clinical decision.*" [9]. Sepsis is clearly one instance where "*one size does not fit all*".

By P.Trambaiolo

## Functional Hemodynamic Monitoring



Michael R. Pinsky, MD, CM, Dr hc, MCCM

«Functional hemodynamic monitoring reflects the assessment of the dynamic interactions of hemodynamic variables in response to a defined perturbation»

Crit Care Clin 31 (2015) 89–111

Novel applications of bedside monitoring to plumb patient hemodynamic state and response to therapy

Fabio GUARRACINO <sup>1</sup> \*, Pietro BERTINI <sup>1, 2</sup>, Michael R. PINSKY <sup>3</sup>

Minerva Anestesiol 2018;84:858-64.

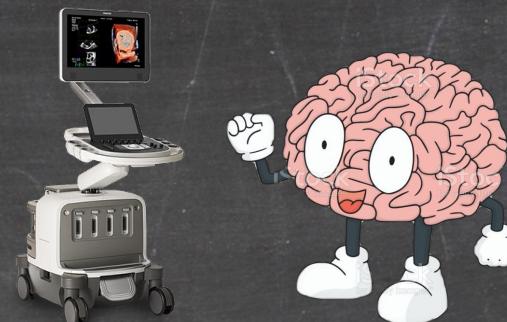
«FHM is the measurement of the hemodynamic response exerted by a determined intervention and its result is used to understand pathophysiological condition of the patient and predict its response to further therapies»

By P.Trambaiolo



## Take Home messages

- ✓ Conoscere la fisiopatologia
- ✓ Come valutarla: metodo invasivo e non invasivo
- ✓ Monitoraggio funzionale
- ✓ Perfusione vs pressione
- ✓ Volume
- ✓ Ritorno venoso



- ✓ Gittata
- ✓ Coupling
- ✓ Rivalutare, rivalutare, rivalutare rivalutare....
- ✓ Personalizzare o medicina di precisione
- ✓ AUGMENTED Intelligence

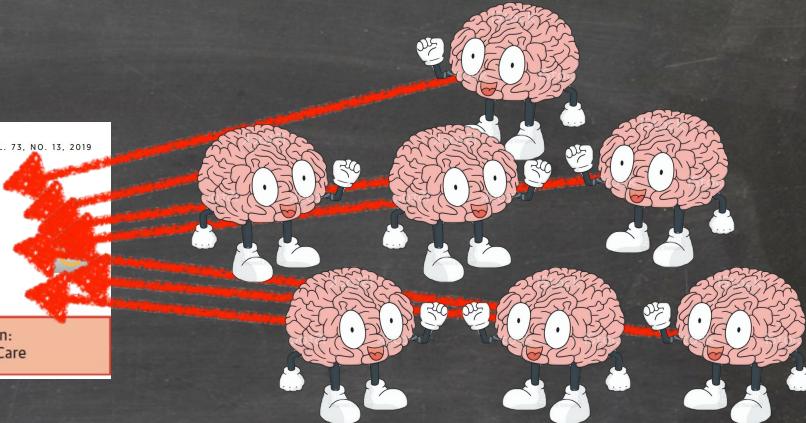
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VOL. 73, NO. 13, 2019

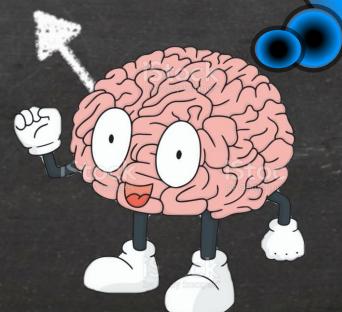
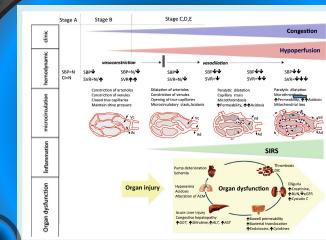
## Standardized Team-Based Care for Cardiogenic Shock



Activate Shock Team through a one-call line for multidisciplinary discussion:  
Interventional Cardiology; Cardiac Surgery; Advanced Heart Failure; Critical Care



## Standardized MIND-Based care for cardiogenic shock





Grazie !!!