FIRST ANNOUNCEMENT

BEYOND THE SLIDES 2015

1st UDINE ECMO WORKSHOP

DECEMBER 18-19, 2015 - AUDITORIUM HYPO ALPE ADRIA - TAVAGNACCO (UD)

Hemodynamic management of VV-ECMO

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Hemodynamic issues in VV-ECMO

- Respiratory failure + cardiocirculatory shock: VV or VA ECMO?
- Fluid balance
- Management of Cardiac Output
- Pulmonary Hypertension and prevention of Right Heart Failure

PNEUMOCOCCICAL PNEUMONIA WITH SEPTIC SHOCK

34 years-old Male, previously healthy

FiO_2 100%

MV 25x350

PEEP 20 cmH_20

Pplat 38 cmH_20

PawM 27

pO_2 48

pCO_2 90

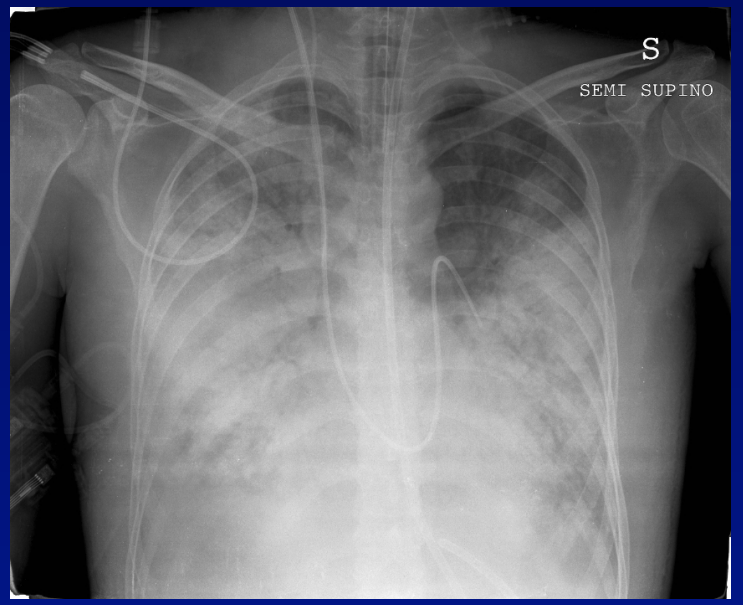
pH 6.925

Lactate 16

Norepinephrine 1 mcg/Kg/min

Vasopressin 0.02 UI/min

Dopamine 15 mcg/Kg/min



PNEUMOCOCCICAL PNEUMONIA WITH SEPTIC SHOCK

24 h after VV-ECMO BF 3.5 l/min

FiO_2	100%	80%
MV	25x450	10x350
PEEP	20 cmH_20	20 cmH_20
Pplat	38 cmH_20	27 cmH_20
PawM	27	23
pO_2	48	78
pCO_2	90	46
pH	6.925	7.325
Lactate	16	4
Norepinephrine	1 mcg/Kg/min	0.1 mcg/Kg/min
Vasopressin	0.02 UI/min	/
Dopamine	15 mcg/Kg/min	
Dobutamine		8 mcg/Kg/min

↓ MEAN AIRWAY PRESSURE

Improve oxygenation and Oxygen delivery

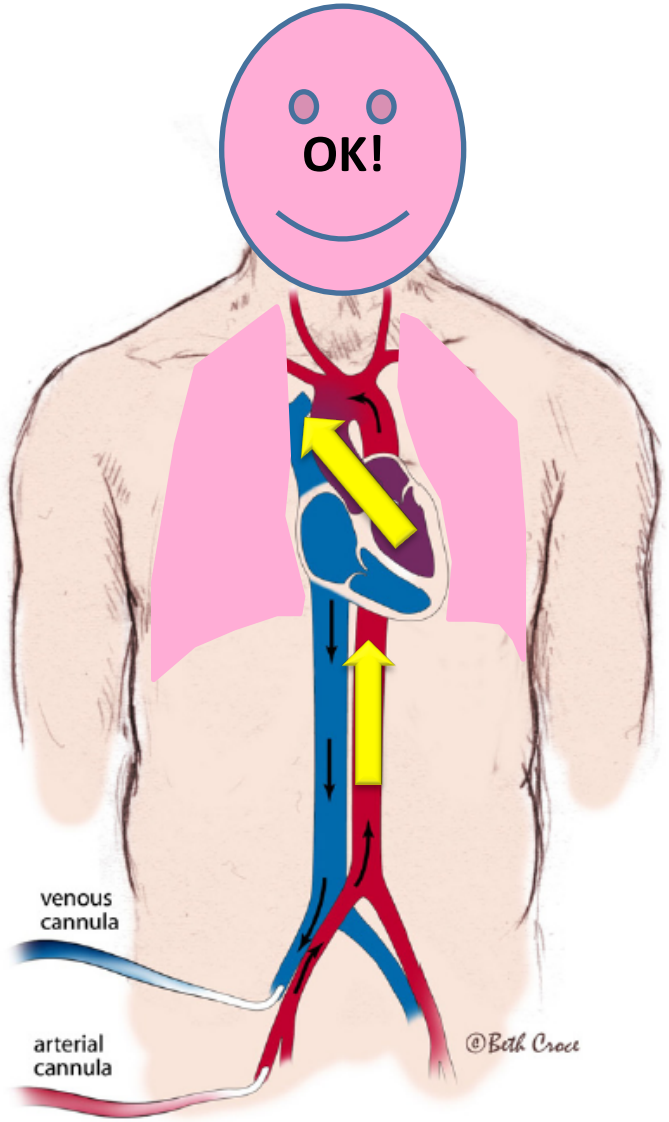
Decrease acidosis

↓ Pulmonary arterial pressure

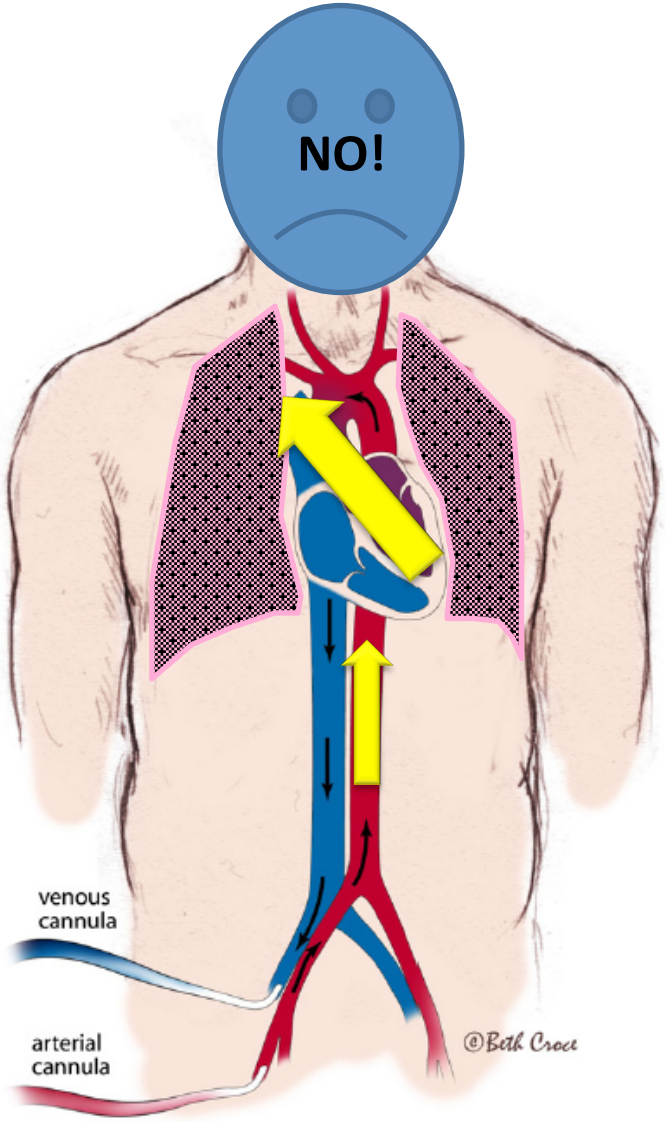
BETTER CARDIAC PERFORMANCE AND RELIEF OF SHOCK

ECMO V-A:

healthy lung…



sick lung…



MONZA EXPERIENCE

- 94 adult Pts with ARDS (2003-2015)
- SHOCK 46 (49 %) (no differrences dead vs survived)
  - 25 Pts Shock solved within 24 h
  - 14 Pts Shock solved between 24 and 48 h
  - 7 Pts Shock persisted after 48 h
  - 1 Pts converted from VV to V-VA (cardiogenic shock with low CO)
  - 2 died with shock

FLUID BALANCE

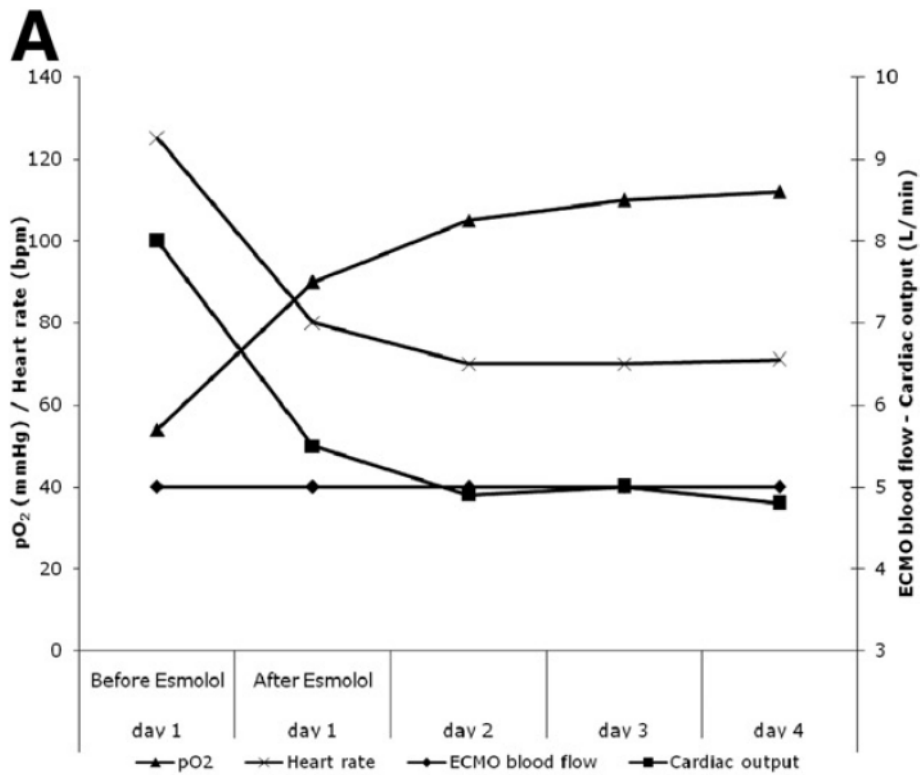
- Negative fluid balance to dry the lung
- Need of fluids to maintain desired BF
- Need of fluids to maintain adequate circulation (Cardiac output)

CARDIAC OUTPUT and VV-ECMO

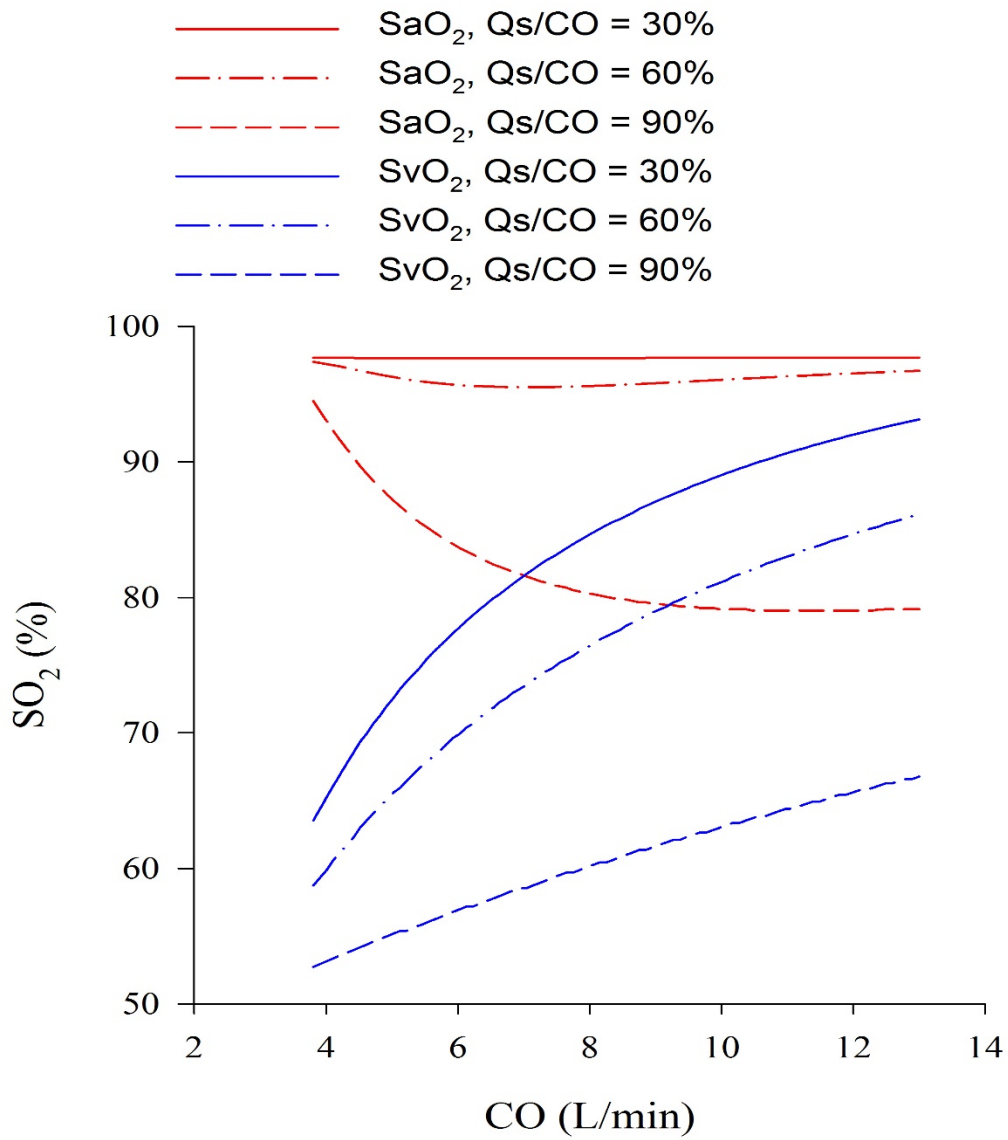
- In general PaO2 is a direct function of BF/CO ratio: higher ratio higher contribution of ECMO to oxygenation, higher arterial oxygenation
- Many review/books suggest BF/CO ratio of 50-70 % (?)
- However CO is seldom measured during ECMO
- If CO is constant: increase BF = increase BF/CO ratio = increase PaO2 and DO2
- If BF is constant: decrease CO = increase BF/CO ratio = increase PaO2 but decrease DO2

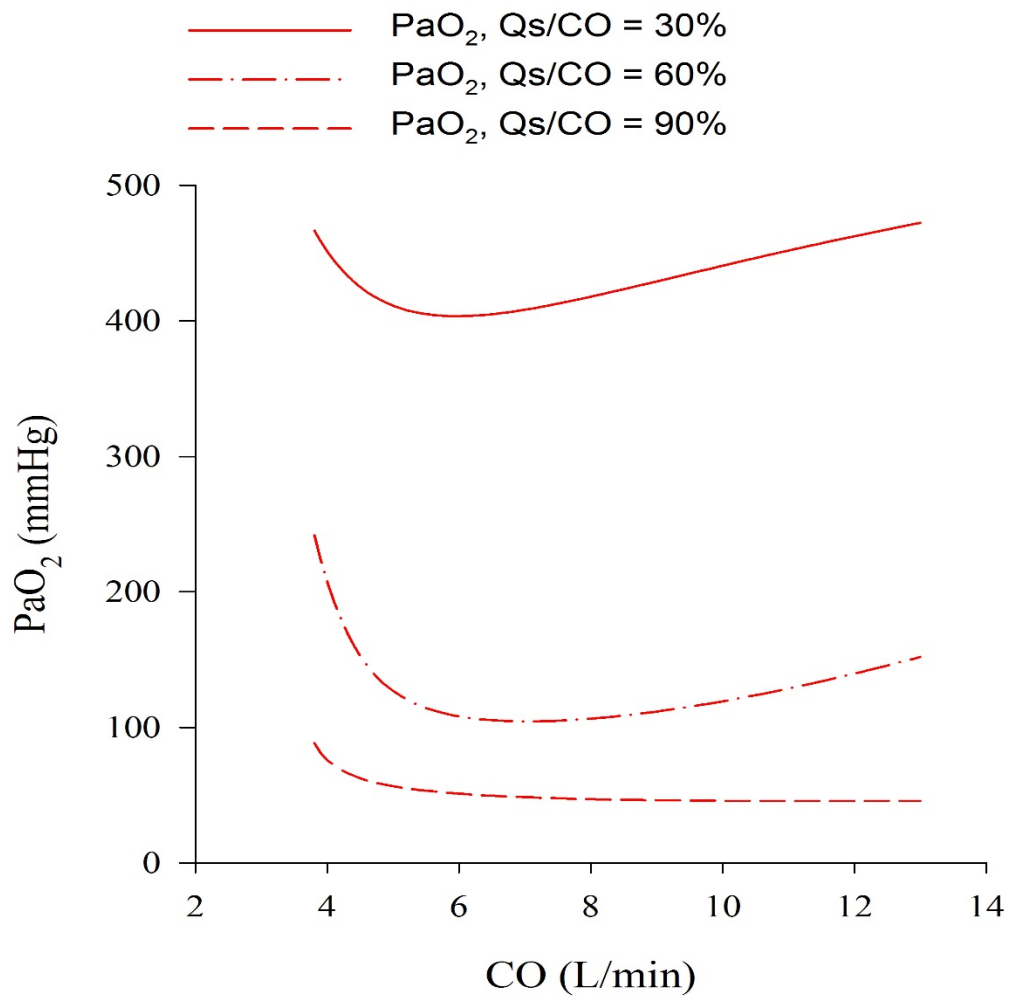
β-Blockers to Optimize Peripheral Oxygenation During Extracorporeal Membrane Oxygenation: A Case Series

Fabio Guarracino, MD,* Alberto Zangrillo, MD,† Laura Ruggeri, MD,† Marina Pieri, MD,† Maria Grazia Calabrò, MD,† Giovanni Landoni, MD,† Maurizio Stefani, MD,* Luca Doroni, MD,* and Federico Pappalardo, MD†



Journal of Cardiothoracic and Vascular Anesthesia, Vol 26, No 1 (February), 2012: pp 58-63


SaO2, Qs/CO = 30%
SaO2, Qs/CO = 60%
SaO2, Qs/CO = 90%
SvO2, Qs/CO = 30%
SvO2, Qs/CO = 60%
SvO2, Qs/CO = 90%
100
90
80
70
60
50
SO2 (%)
2
4
6
8
10
12
14
CO (L/min)


PaO2, Qs/CO = 30%
PaO2, Qs/CO = 60%
PaO2, Qs/CO = 90%
500
400
300
200
100
0
PaO2 (mmHg)
2
4
6
8
10
12
14
CO (L/min)

Management of Refractory Hypoxemia During Venovenous Extracorporeal Membrane Oxygenation for ARDS

Andrea Montisci, Giulia Maj, Alberto Zangrillo, Dario Winterton, and Federico Pappalardo

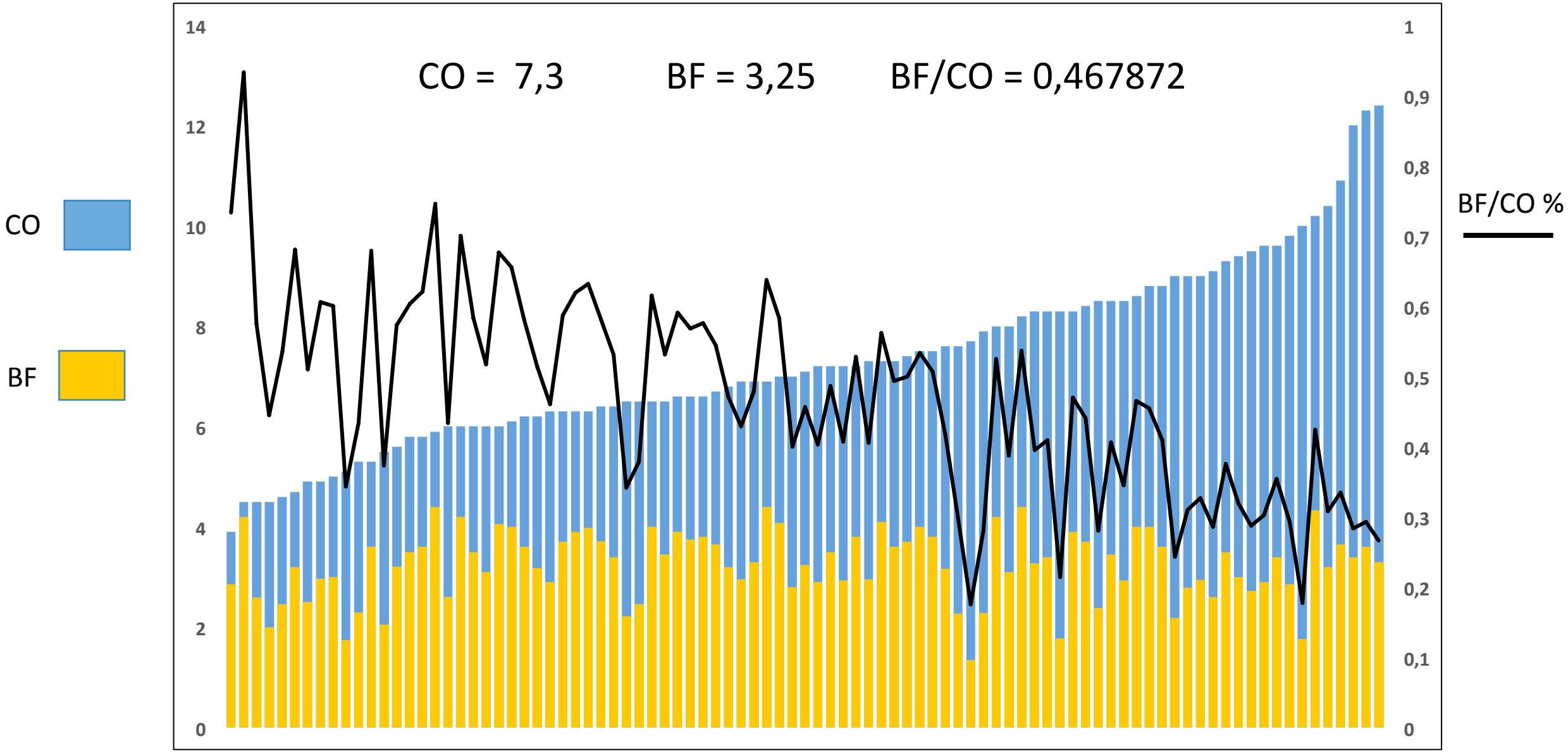
A possible objection could be that reduction of CO might jeopardize peripheral oxygen delivery. However, this technique does not entail a low CO state, which should be strictly monitored by means of markers of tissue hypoxia, such as lactates or metabolic acidosis.

MONZA hemodynamic management

- Swan Ganz catheter: mixed SvO2, PAP, pulmonary shunt, CO (if fem-fem VV)
- Frequent Ultrasound evaluation
- Clinical signs of organ perfusion

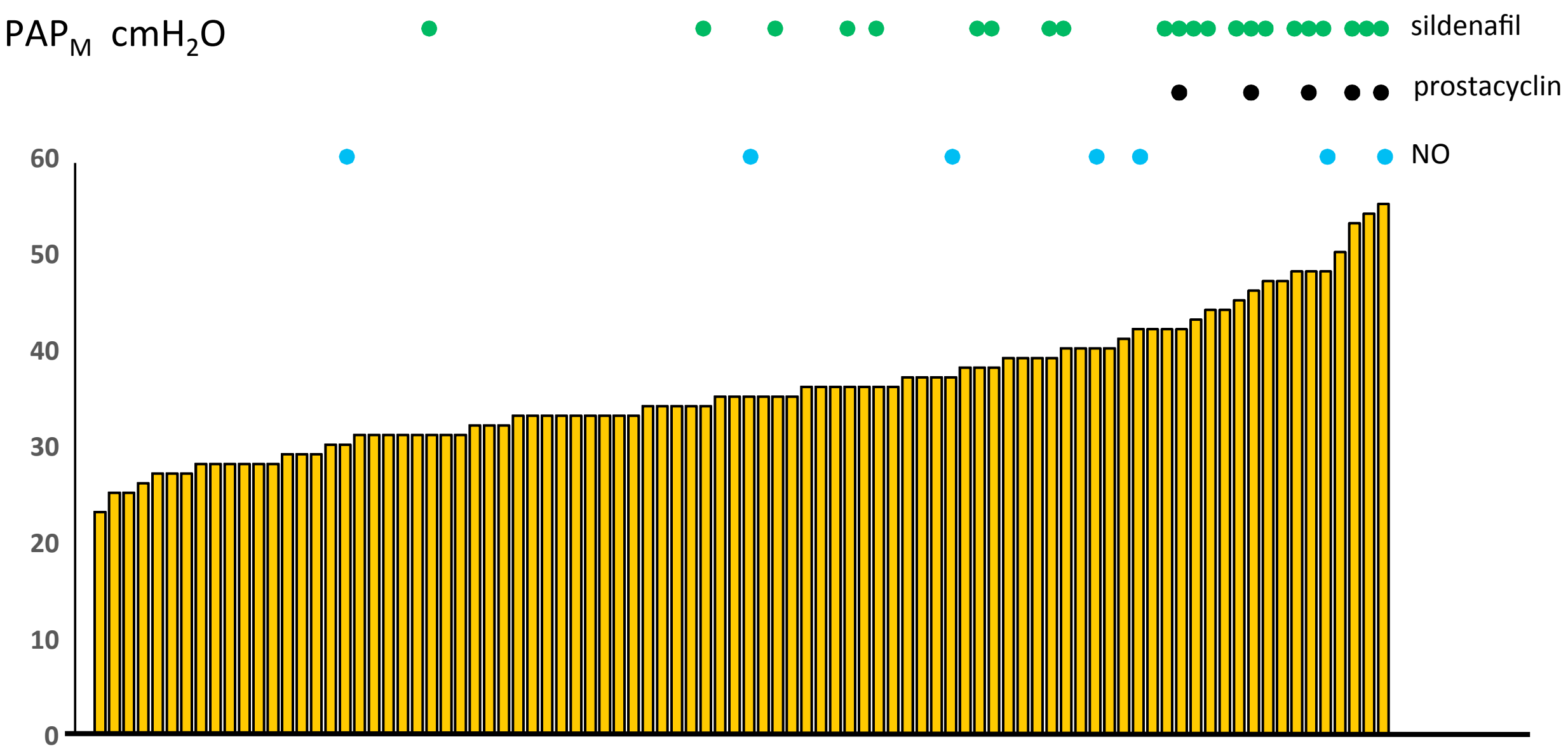
- Normal to Moderate level of CO/ Forced negative balance
- Frequent use of Dobutamine or Dobutamine+Norepinephrine (or others inotropes if needed)

- Dobutamine and Furosemide are the most frequent drugs

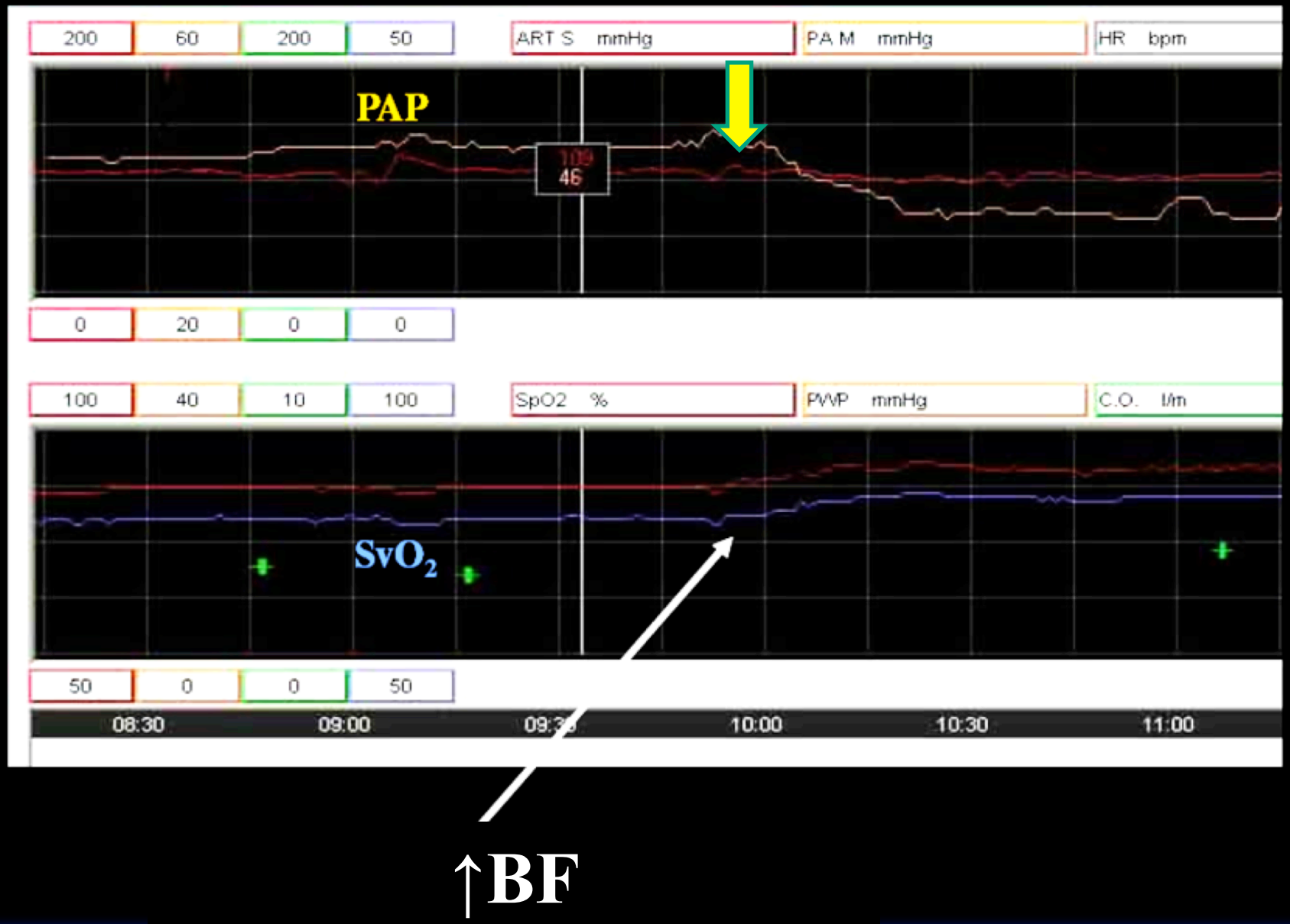

CO = 7,3
BF = 3,25
BF/CO = 0,467872
CO
BF
BF/CO %
14
12
10
8
6
4
2
0
1
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0

PULMONARY HYPERTENSION

- Very common in ARDS pts
- How common during VV-ECMO?
- CAUSES:
  - Hypoxic pulmonary vasoconstriction
  - Hypercapnia/acidosis
  - High Pwa_M
  - Left heart failure (high PAOP)
  - High CO
  - Vascular micro-trombosys
  - Vascular occlusion


PAP_M cmH_2O
sildenafil
prostacyclin
NO
60
50
40
30
20
10
0

SvO_2 and PAP


200
60
200
50
ART S mmHg
PA M mmHg
HR bpm
PAP
46
0
20
0
0
100
40
10
100
SpO2 %
PVP mmHg
C.O. l/m
SvO2
50
0
0
50
08:30
09:00
10:00
10:30
11:00
↑BF

Extracorporeal membrane oxygenation for pandemic H1N1 2009 respiratory failure

B. HOLZGRAEFE [1], M. BROOMÉ [1], H. KALZÉN [1], D. KONRAD [1, 3], K. PALMÉR [1], B. FRENCKNER [2]

(Minerva Anestesiol 2010;76:1043-51)

13 H1N1 Pts: 12 vv and 1 va (respiratory+cardiogenic shock)

Four patients were converted from v-v to v-a ECMO, three because of right heart failure and one because of life threatening arrhythmias with circulatory instability that did not respond to conventional treatment. Patients with right heart

Extracorporeal membrane oxygenation for pandemic H1N1 2009 respiratory failure

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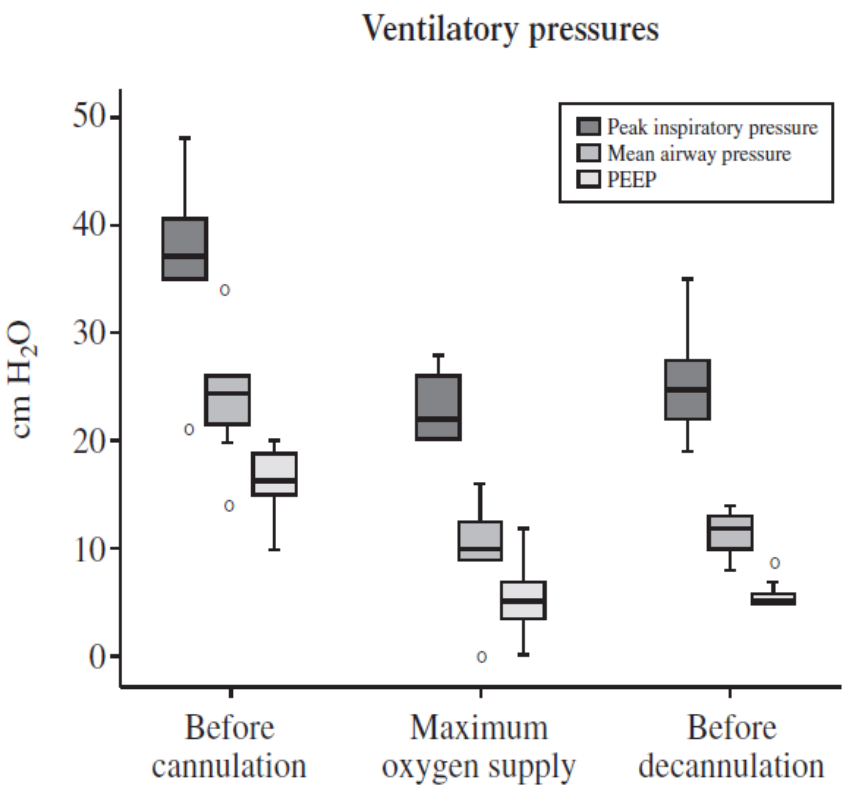
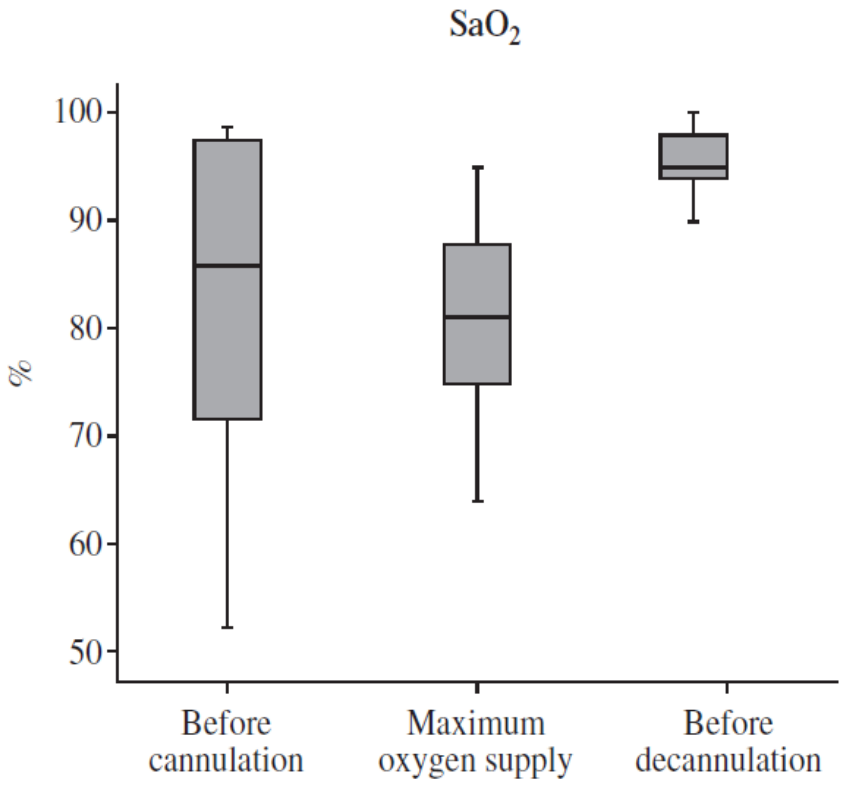




Intensive Care Med (2009) 35:2105–2114
DOI 10.1007/s00134-009-1661-7

ORIGINAL

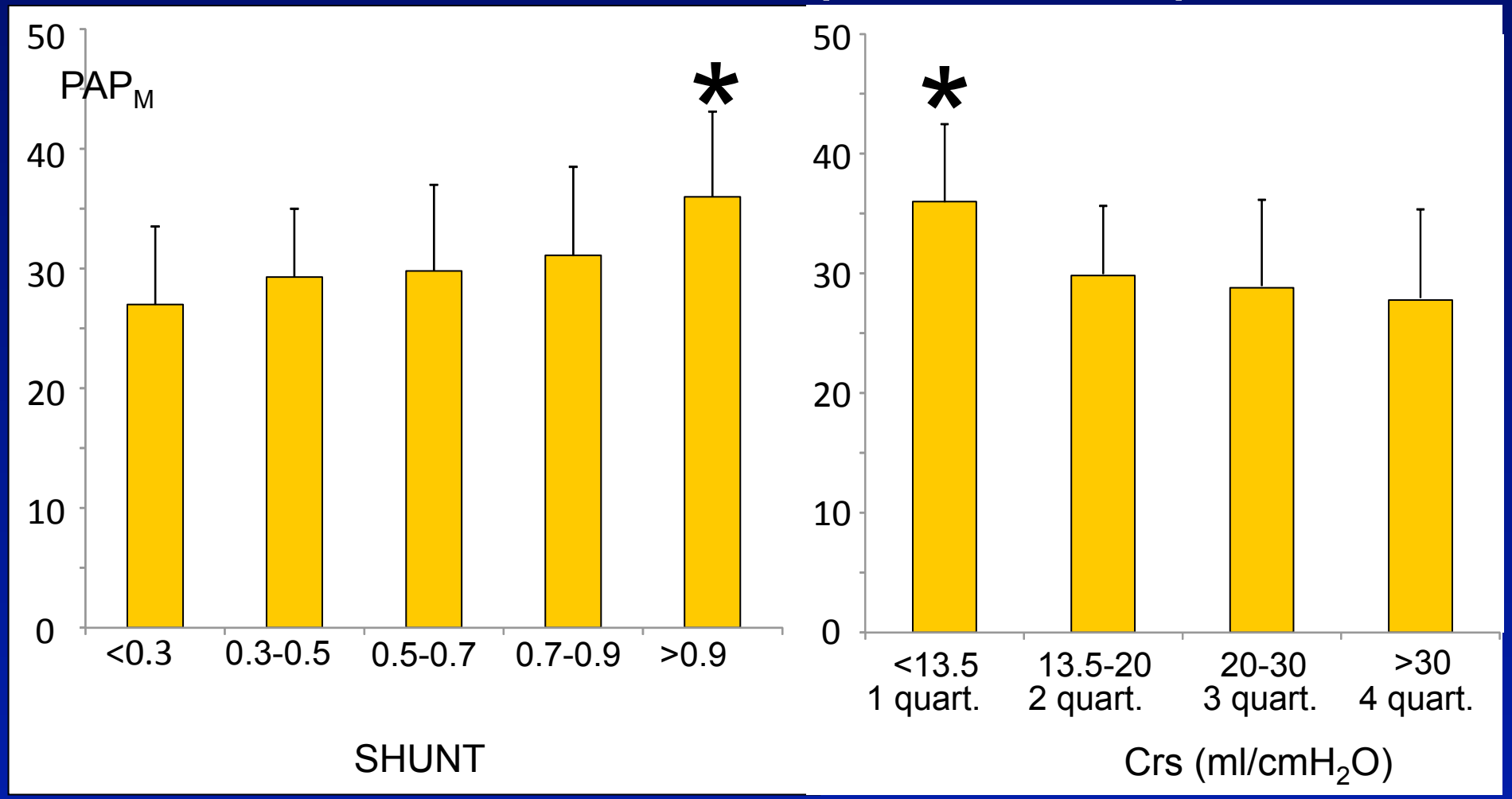
Thomas V. Brogan
Ravi R. Thiagarajan
Peter T. Rycus
Robert H. Bartlett
Susan L. Bratton

Extracorporeal membrane oxygenation in adults with severe respiratory failure: a multi-center database

Variable	All patients (1986–2006)			Most recent patients (2002–2006)		
	Survivors (n = 741)	Non-survivors (n = 732)	p value	Survivors (n = 301)	Non-survivors (n = 299)	p value
ECMO mode n (%)			<0.001			<0.001
Venoarterial	116 (16)	181 (25)		63 (21)	100 (33)	
Venovenous	405 (55)	298 (41)		222 (74)	173 (58)	
Venovenous to venoarterial	10 (1)	40 (5)		6 (2)	18 (6)	
Other	16 (2)	16 (2)		10 (3)	7 (2)	
Missing	194 (26)	197 (27)		0 (0)	1 (0)	

The majority of patients were initially supported with VV ECMO (78%),

Pulmonary pressure and lung derecrutiment during ECMO 53 Patients (MONZA)



CONCLUSIONS

- Hemodynamics extemely important: need for monitoring
- VV ECMO always first choice for respiratory ECMO
- Cardiac output managed to optimize circulation (not PaO2)
- Pulmonary Hypertension should be treated (sildenafil, prostacyclin, dobutamine,…..)
- Preservation of Native Lung is the best way to prevent right heart failure
- If right heart failure: convert to V-VA or VA (attention to brain oxygenation)