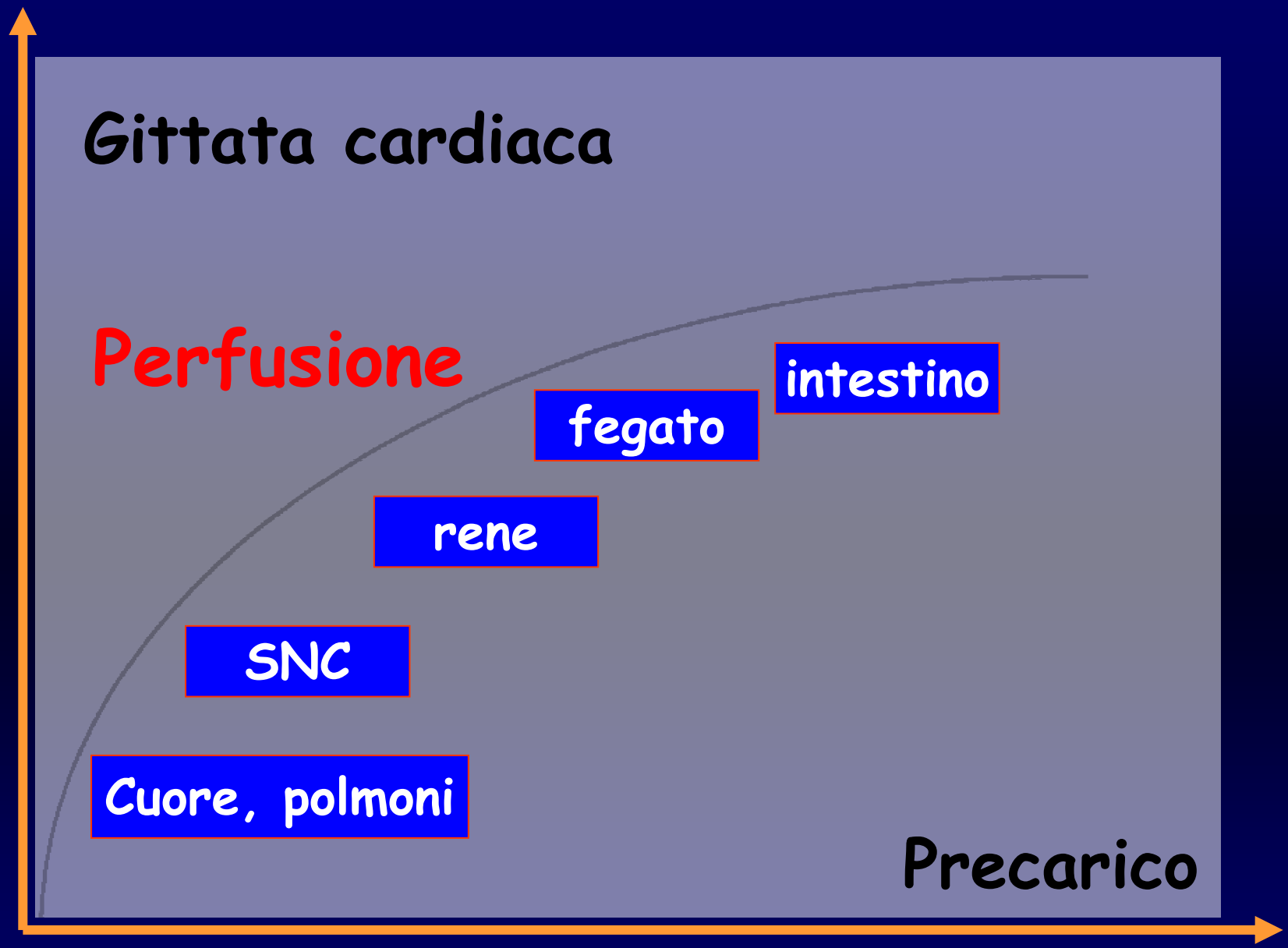
GITTATA CARDIACA, SVO2 ED OSSIFORESI

Nicola Brienza
Sezione Anestesiologia e Rianimazione
DETO
Università degli Studi di Bari

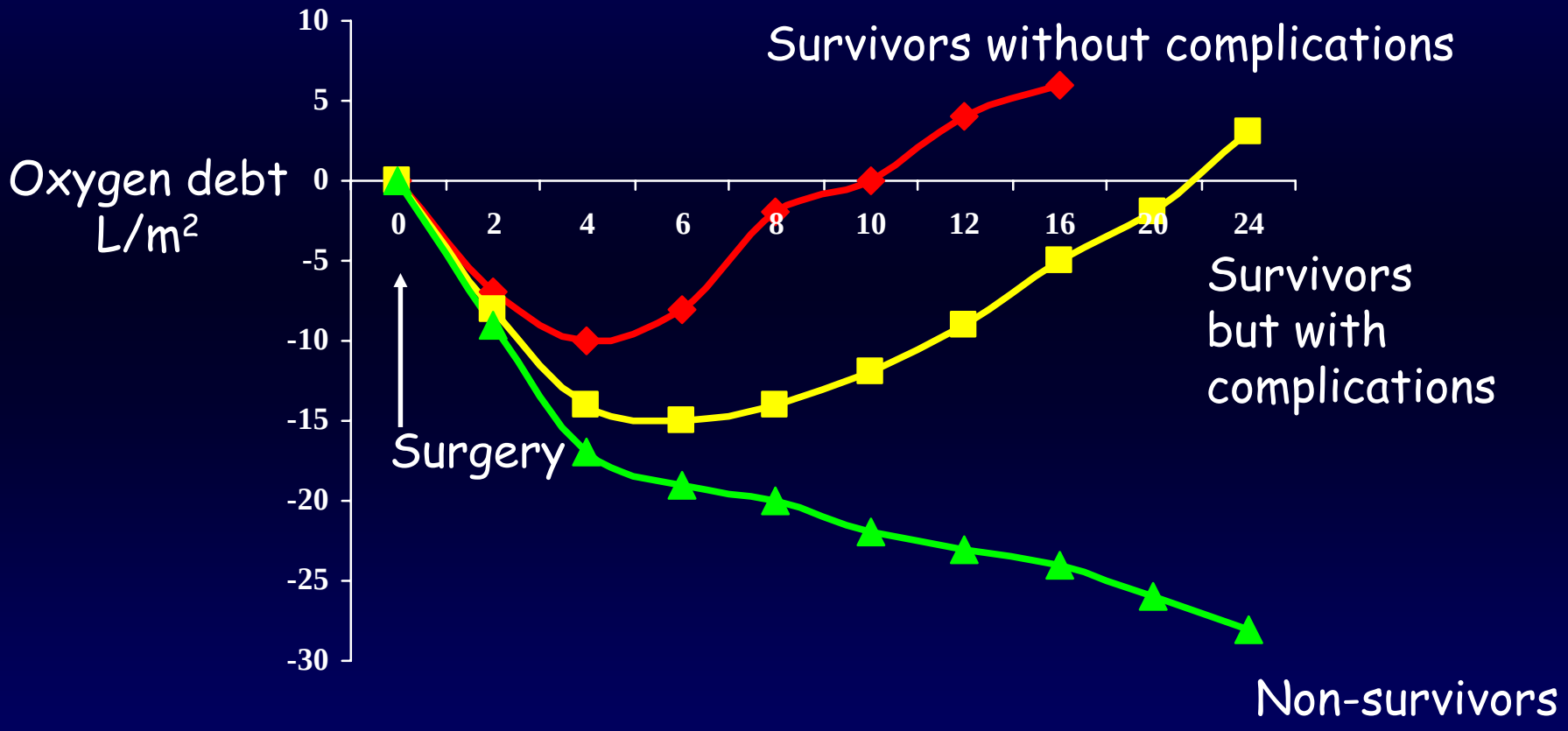
Metodi di monitoraggio della GC

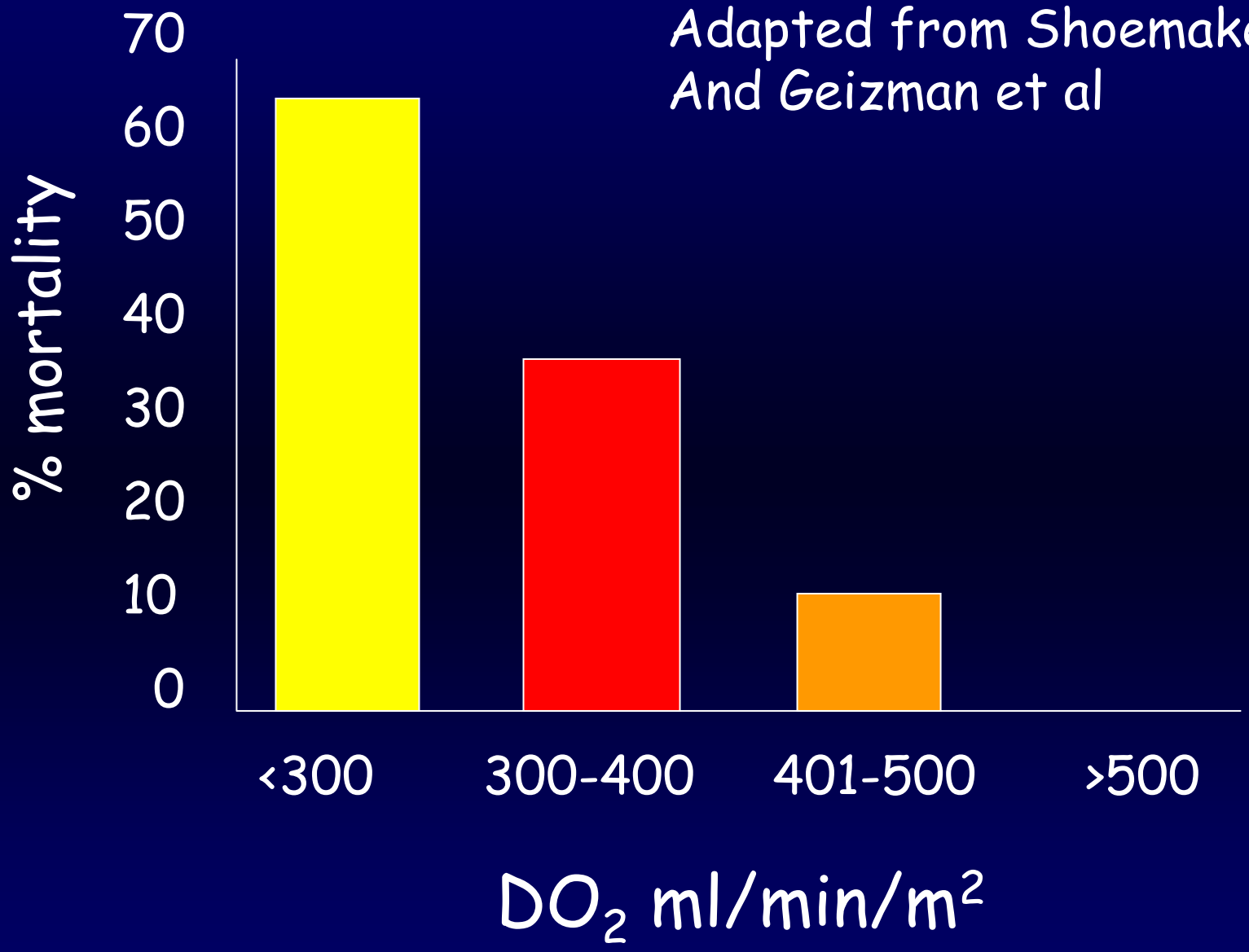
- Thoracic bioelectrical impedance
- Aortic Doppler techniques
- PiCCO
- LidCO
- Partial CO_2 rebreathing
- Termodiluizione



Modificata da Chang MC. *New Horizons* 1999;7:35-45

Shoemaker e debito di ossigeno




Adapted from Shoemaker
And Geizman et al
% mortality
70
60
50
40
30
20
10
0
<300
300-400
401-500
>500
DO2 ml/min/m2

Reducing the risk of major elective surgery: randomised controlled trial of preoperative optimisation of oxygen delivery

Wilson J, Woods I, et al. BMJ, 1999; 318: 1099-1103

138 pz chirurgia elettiva maggiore a rischio di complicanze postop randomizzati a ricevere

monitoraggio emodinamico invasivo fluidi e dopexamina

o adrenalina

per aumentare il trasporto di ossigeno nel preop e per almeno 12 ore nel postop

Il terzo gruppo riceve trattamento standard.

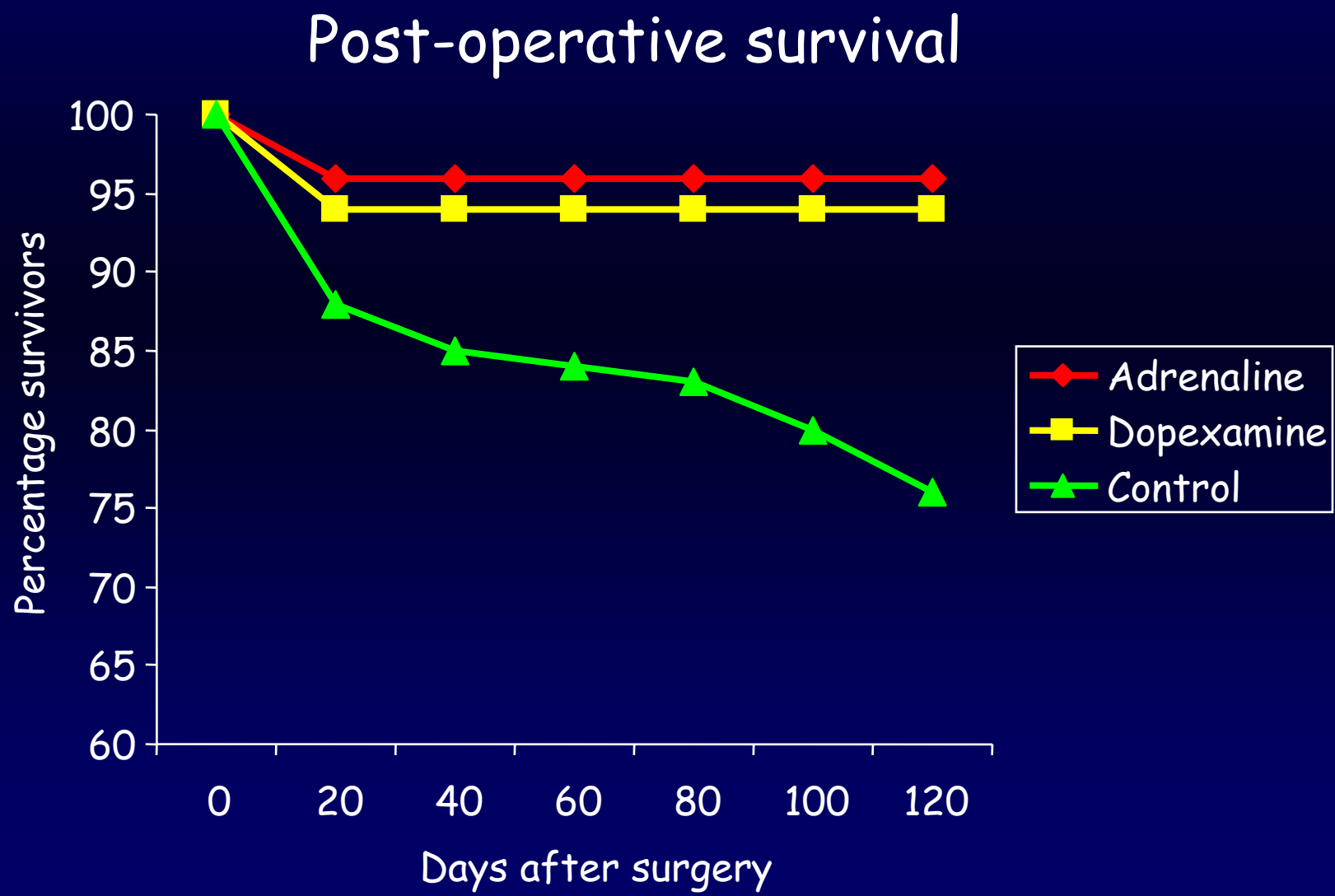
York Study

Wilson et al. BMJ 1999: 318; 1099

	Control	Adrenaline	Dopexamine
Number of patients	46	46	46
Total bed days	1008	875	596*
ICU bed days	192	176	152*
Bed days per patient	22	19	13*

York Study

Wilson et al. BMJ 1999: 318; 1099



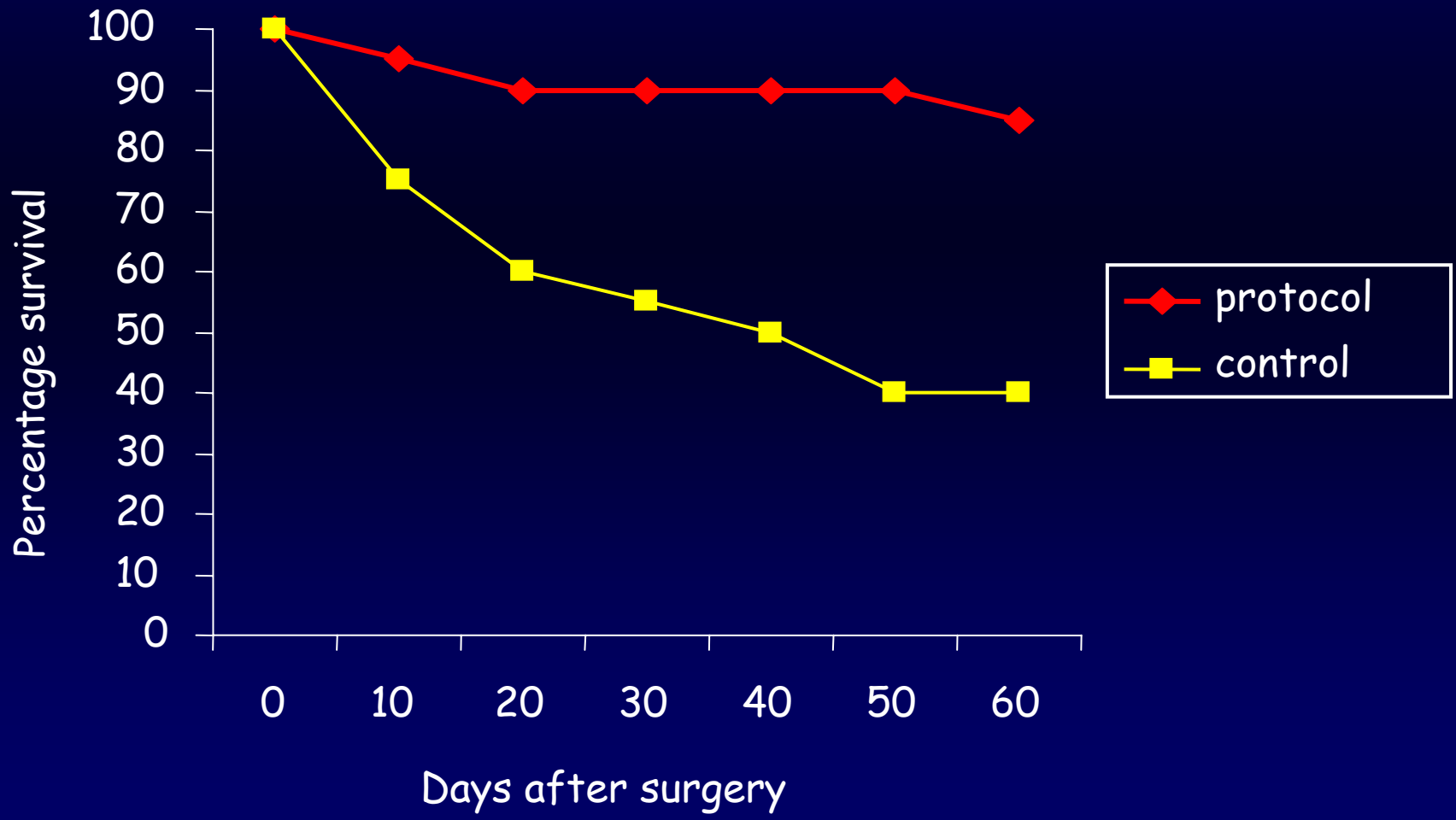
High Risk Surgical Patients

Lobo et al.2000: Crit.Care Med:28;3396.

- Studied effects of increasing DO_2 in very high risk surgical patients with an historical mortality of > 50%.
- DO_2 was increased pre-operatively and maintained during surgery and post-operatively for 24 hours
- Main outcome criteria was 60 day mortality and morbidity

High Risk Surgical Patients

Lobo et al.2000: Crit.Care Med:28;3396.

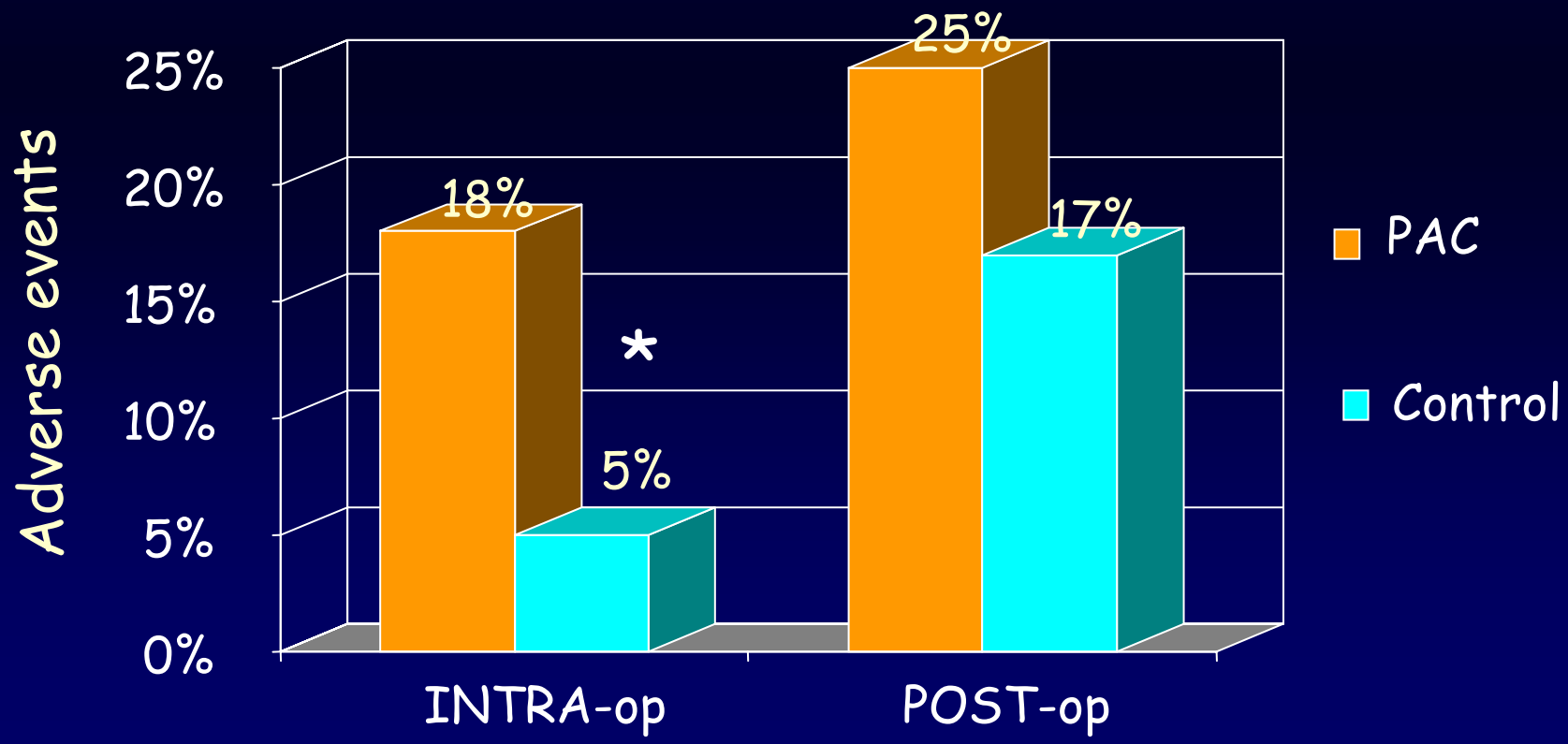


Effectiveness of PAC in aortic surgery: a randomized trial

Valentine RJ, Duke ML, et al. J Vasc Surg, 1998; 27: 203-211

120 pz chirurgia aortica randomizzati a ricevere

- SG per ottimizzazione prima della chirurgia
- idratazione ev e monitoraggio intraop senza SG



Meta-analysis of hemodynamic optimization in high-risk patients*

Jack W. Kern, PharmD; William C. Shoemaker, MD

Objective: The aim of this evidence-based report was to review pertinent randomized controlled studies that describe hemodynamic goals in acute, critically ill patients and to evaluate outcome of resuscitation therapy in association with physiologic, clinical, and therapeutic influences.

Methods: MEDLINE was the source of randomized controlled studies written in English. The inclusion criteria were acutely ill, high-risk elective surgery, trauma, and septic patients. The goals of therapy were to resuscitate to either normal or supranormal values; the latter were described as a cardiac index of >4.5 $L \cdot min^{-1} \cdot m^{-2}$, pulmonary artery occlusion pressure of <18 mm Hg, oxygen delivery of >600 $mL \cdot min^{-1} \cdot m^{-2}$, and oxygen consumption of >170 $mL \cdot min^{-1} \cdot m^{-2}$. The outcome criterion was survival or death. We found 21 randomized clinical trials described in 20 articles. The studies were divided into groups based on the time that goals were implemented (i.e., "early," 8 to 12 hrs postoperatively or before organ failure, vs. "late," or after onset of organ failure) and the severity of illness, determined by the control group mortality as >20% (12 studies) or <15% (nine studies).

Results: In severely ill patients (control mortalities group >20%), six studies had a 23% mortality difference ($p < .05$) between the control and protocol groups with early optimization, but seven studies optimized after the development of organ failure did not have significantly improved mortality. Moreover, outcome was not significantly improved in less severely ill patients (control mortalities group <15%) and normal values as goals or when therapy did not improve oxygen delivery.

Conclusion: Review of 21 randomized controlled trials with various approaches to treatment revealed statistically significant mortality reductions, with hemodynamic optimization, when patients with acute critical illness were treated early to achieve optimal goals before the development of organ failure, when there were control group mortalities of >20% and when therapy produced differences in oxygen delivery between the control and protocol groups. (Crit Care Med 2002; 30:1686–1692)

KEY WORDS: noninvasive hemodynamic monitoring; bioimpedance cardiac output; thermodilution cardiac output; pulse oximetry; transcutaneous oxygen and CO_2 monitoring; trauma; high-risk surgery; acute septic shock; therapeutic hemodynamic goals; organ failure

Kern JW, Shoemaker WC
Meta-analysis of hemodynamic optimization in high-risk patients
Crit Care Med, 2002.

- 21 RCTs
- Inclusion criteria: acutelly ill, high-risk elective surgery,trauma and septic patients.
- Goals of therapy: resuscitate to either normal or supranormal values.

IC > 4,5 L/min/m^2
PCWP < 18 mmHg
DO2 > 600 ml/min/m^2
VO2 > 170 ml/min/m^2

- Outcome criterion: survival or death.

❖The studies were divided into groups based on:

1) THE TIME THAT GOALS WERE IMPLEMENTATED:

early → 8 to 12 hrs postop or before organ failure

late → after onset of organ failure

2) SEVERITY OF ILLNESS, determined by the control group mortality as:

>20% (12 studies)

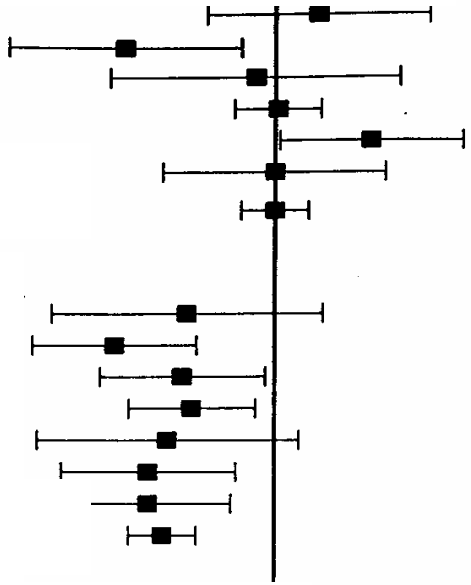
<15% (9 studies)

RESULTS

Control group mortality >20%

Late optimization
Subtotal: 0,0 (+/-0,7)
p > 0,05

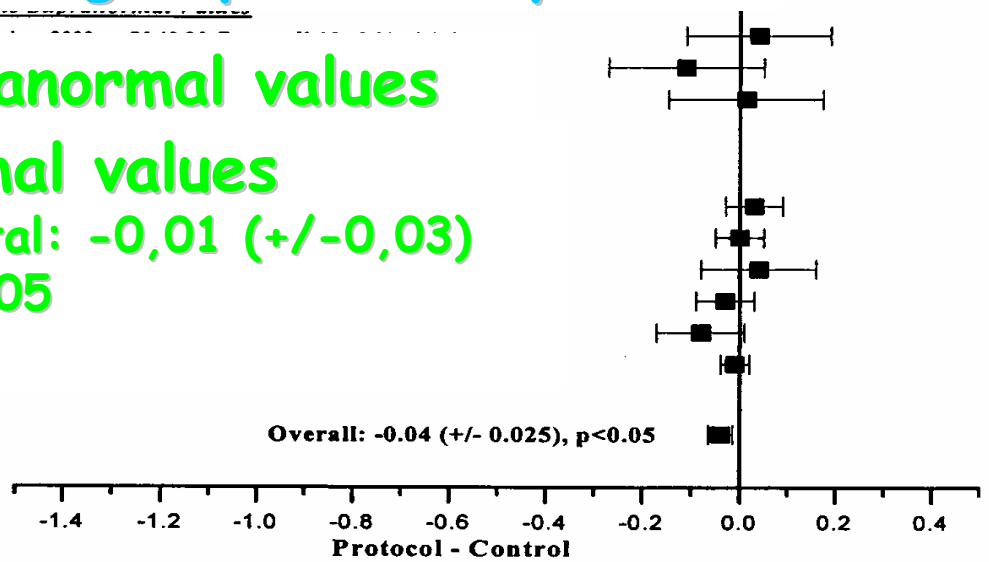
Early optimization
Subtotal: -0,23 (+/-0,07)
p < 0,05



Control group mortality <15%

Supranormal values

Normal values
Subtotal: -0,01 (+/-0,03)
p > 0,05



Kern JW, Shoemaker WC, 2002

Potenziale beneficio in termini di mortalità
di una ottimizzazione emodinamica precoce in
pazienti ad alto rischio
da sottoporre a chirurgia maggiore
e gravati da elevata mortalità
in un contesto
esperto nella gestione dello SG.

A randomized, controlled trial of the use of Pulmonary Artery Catheters in high-risk surgical patients.

Sandham JD, Hull RD et al, for the Canadian Critical Care Trials Group
N Engl J Med, 2003; 348(1): 5-14

Di 3803 pazienti ad alto rischio >60 anni, ASA III e IV sottoposti a interventi chirurgici d'urgenza o a procedure elettive di chirurgia maggiore, e poi trasferiti in terapia intensiva (dal marzo 1990 al luglio 1999) ne furono randomizzati 1994 a ricevere PAC per terapia volta a garantire

Trasporto di ossigeno 550-600 ml/min/m2
Indice cardiaco 3.5-4.5 l/min/m2
PAM 70 mmHg Pcwp 18 mmhg
FC <120/min HTC>27%

Table 2. **In-Hospital Mortality and Perioperative and Postoperative Morbidity.***

Variable	Standard-Care Group	Catheter Group	P Value
Length of hospital stay — days			
Median	10	10	0.41
Interquartile range	7–15	7–15	
In-hospital mortality — no. (%)	77 (7.7)	78 (7.8)	0.93
Myocardial infarction — no. (%)	33 (3.4)	40 (4.3)	0.41
Congestive heart failure — no. (%)	108 (11.2)	119 (12.6)	0.36
Supraventricular tachycardia — no. (%)	88 (9.1)	84 (8.9)	0.95
Ventricular tachycardia — no. (%)	2 (0.2)	2 (0.2)	1.00
Pulmonary embolism — no. (%)	0	8 (0.9)	0.004
Renal insufficiency — no. (%)	95 (9.8)	70 (7.4)	0.07
Hepatic insufficiency — no. (%)	26 (2.7)	23 (2.4)	0.84
Sepsis from central venous catheter or pulmonary-artery catheter — no. (%)	13 (1.3)	12 (1.3)	0.95
Wound infection — no. (%)	83 (8.6)	66 (7.0)	0.23
Pneumonia — no. (%)	70 (7.3)	63 (6.7)	0.70
Adverse events due to pulmonary-artery catheters or central venous catheters — no. (%)			
Pulmonary infarction	0	1 (0.1)	1.00
Hemothorax	0	2 (0.2)	0.24
Pulmonary hemorrhage	0	3 (0.3)	0.12
Pneumothorax	4 (0.4)	8 (0.9)	0.36
Arterial puncture	1 (0.1)	3 (0.3)	0.37

Nessun beneficio dalla terapia guidata da PAC rispetto alla standard care in un gruppo di pazienti chirurgici, anziani, ad alto rischio (mortalità gruppo controllo 7.8%)

Sandham JD, et al. N Engl J Med, 2003

Early Goal-directed therapy in the treatment of severe sepsis and septic shock
Rivers E, et al.
New England Journal of Medicine
345, 19: november 8 2001: 1368-1377

263 pazienti con sepsi grave e shock settico
arrivati al Pronto Soccorso
sono stati randomizzati per ricevere

> 6 ore di terapia standard
> 6 ore di terapia emodinamica mirata

prima di essere ricoverati in TI

> 6 ore di terapia standard
CVP > 8-12 (espansione volemica)
MAP > 65 (agenti vasoattivi)
Diuresi > 0,5 ml/kg/ora

> 6 ore di terapia emodinamica mirata
CVP > 8-12 (espansione volemica)
MAP > 65 (agenti vasoattivi)
+
ScvO2 > 70%
(trasfusione di GRC ed agenti inotropi)

	standard	Early-Goal
Fluidi (ml)		
tempo 0-6	3500 ± 2400	4980 ± 2980 *
PVC (mmHg)		
tempo 6	11.8 ± 6.8	13.8 ± 4.4 *
GRC (%)		
tempo 0-6	18.5	64.1 *
Vasopressori (%)		
tempo 0-6	30.3	27.4
Inotropi (%)		
tempo 0-6	0.8	13.7 *

* p<0.01

Disfunzione d'organo	standard	Early-Goal
tempo 0	7.3 ± 3.1	7.6 ± 3.1
tempo 6	6.8 ± 3.7	5.9 ± 3.7 *
tempo 7-72hr	6.4 ± 4	5.1 ± 3.9 *

* $p<0.01$

TABLE 3. KAPLAN–MEIER ESTIMATES OF MORTALITY AND CAUSES OF IN-HOSPITAL DEATH.*

VARIABLE	STANDARD THERAPY (N=133)	EARLY GOAL-DIRECTED THERAPY (N=130)	RELATIVE RISK (95% CI)	P VALUE
	no. (%)			
In-hospital mortality†				
All patients	59 (46.5)	38 (30.5)	0.58 (0.38–0.87)	0.009
Patients with severe sepsis	19 (30.0)	9 (14.9)	0.46 (0.21–1.03)	0.06
Patients with septic shock	40 (56.8)	29 (42.3)	0.60 (0.36–0.98)	0.04
				0.07
				0.01
				0.03
Causes of in-hospital death‡				
Sudden cardiovascular collapse	25/119 (21.0)	12/117 (10.3)	—	0.02
Multiorgan failure	26/119 (21.8)	19/117 (16.2)	—	0.27

Mortalità a 28 giorni 49,2 % 33,3 % p=0.01

*CI denotes confidence interval. Dashes indicate that the relative risk is not applicable.

†Percentages were calculated by the Kaplan–Meier product-limit method.

‡The denominators indicate the numbers of patients in each group who completed the initial six-hour study period.

Rivers E et Al: N Eng J Med 345; 1368-1377, 2001

Per conquistare una posizione strategica in guerra avrai bisogno di:

- Un plotone all'alba.
- Una compagnia all'ora di pranzo.
- Un reggimento la sera.
- Un battaglione il giorno dopo.
- Un intero esercito alla fine della settimana

Field Marshal Irwin Rommel. 1942.