

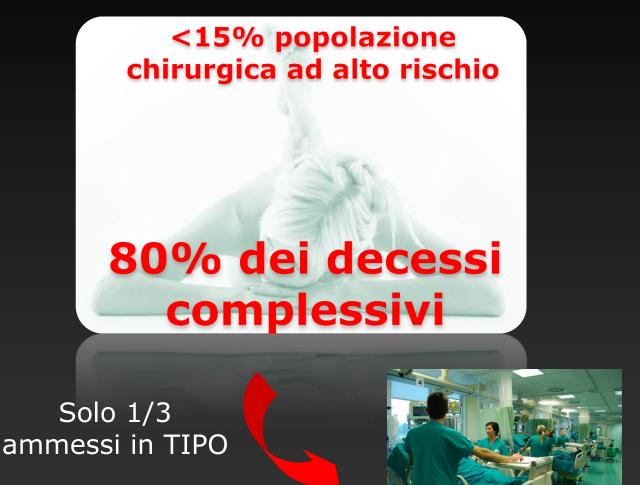


Il monitoraggio emodinamico in Urgenza/Emergenza

F.L. Lorini -Bergamo

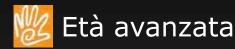


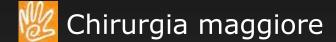
Il paziente ad alto rischio





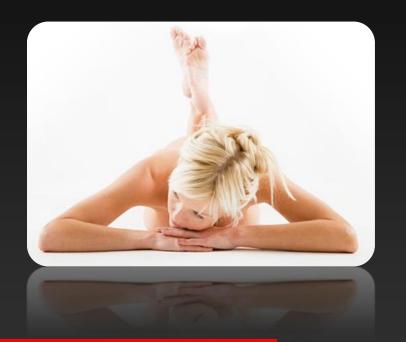
Il paziente ad alto rischio











Rischio individuale di mortalità >5%

Procedure associate a mortalità >5%



Cosa deve fare il monitoraggio emodinamico

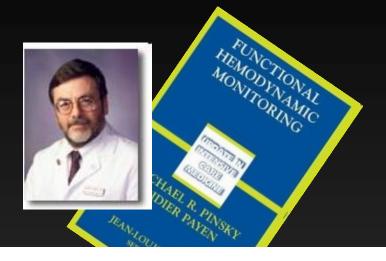
Nessun sistema di monitoraggio emodinamico, semplice o sofisticato che sia, è in grado di migliorare l'outcome se non accoppiato a uno o più trattamenti che siano in grado essi stessi di migliorare l'outcome

rapido-semplice-continuo





Michael Pinsky dixit.....



Le verità del monitoraggio emodinamico

Tachycardia is never a good thing.

Hypotension is always pathologic.

There is no such thing as normal cardiac output.

Central venous pressure is only elevated in disease.

Peripheral edema is of cosmetic concern.



Hemodynamics

- Heme=Blood
- Dynamus=Movement
- Hemodynamic= The movement of Blood

Quick Definitions

| Cardiac Output (CO) 4-8 liters/min | Volume of blood ejected each min during Ventr. contractions | | |
|--|---|--|--|
| Cardiac Index (CI) 2.5-4 liters/min | CO/BSA | | |
| Stroke volume (SV) 60-130ml | Volume of blood ejected during ventricular systole | | |
| Ejection Fraction (EF) 50-75% | Percentage of blood pumped out of the LV durring systole | | |
| Systemic Vascular Resistance(SVR) | The resistance in the systemic vasculature | | |

800-1500 Dynes/sec/cm-5

Factors Affecting Blood Pressure

Quick Definitions

| Preload | Volume returning to the heart | | |
|---------------|--|--|--|
| Contractility | Force of contraction | | |
| Afterload | Resistance the heart must push against | | |

Aspetti fisiopatologici

Le classi di rischio

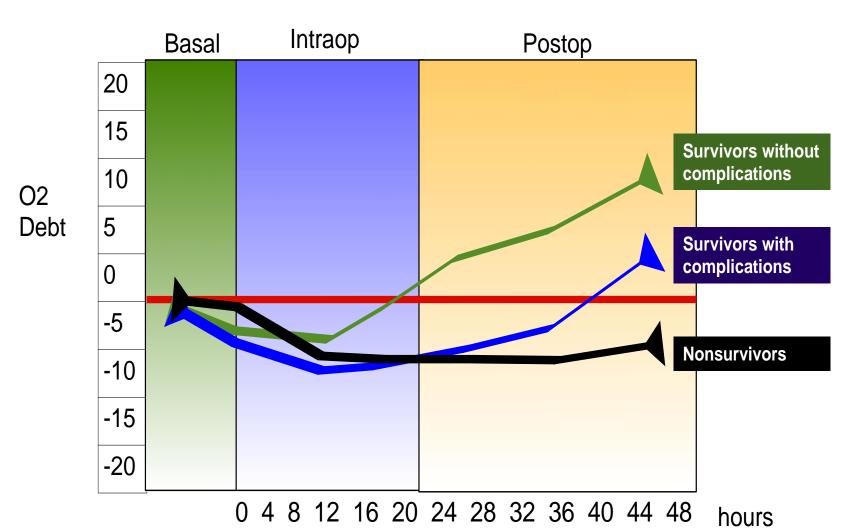
Quali indicatori

What we Know

Role of oxygen debt in the development of organ failure sepsis, and death in high-risk surgical patients

WC Shoemaker, PL Appel and HB Kram

Chest 1992;102;208-215 DOI 10.1378/chest.102.1.208



Markers of energy failure

- Oxygen debt concept
- Venous oxygen saturation
- Lactate and acidosis
- Venous/tissue PCO₂

Indeed, the mammalian cells respond to energy failure by

- Increased glycolysis (Lactate and acidosis)
- Oxygen conformance (| Protein synthesis)

both are short term lasting mechanisms



Secondary mitochondrial dysfunction



Necrosis



Apoptosis

"Ideal" monitoring needs

Cardiac Output

Tissue Oxygenation

Detect mechanism of disease

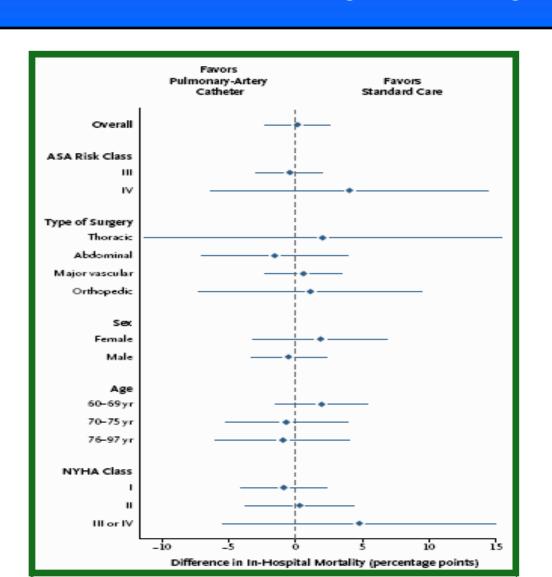


The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 JANUARY 2, 2003

VOL.348 NO.1

A RCT of the Use of PAC in High Risk Surgical Patients



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A RCT of the Use of PAC in High Risk Surgical Patients

Conclusions: We found no benefit to therapy directed by pulmonary-artery catheter over standard care in elderly, high-risk surgical pts

.....many physicians still erroneously believe that the PAOP is useful in assessing a patient's intravascular volume.

This factor together with the incorrect interpretation of the PAOP may largely explain the excess mortality associated with the use of the PAC.

Impact of the Pulmonary Artery Catheter in Critically Ill Patients

Meta-analysis of Randomized Clinical Trials

JAMA, October 5, 2005—Vol 294, No. 13

19 DCT

Specific hemodynamic targets

- 6 studies used PCWP as one of the therapeutic goals
- 6 studies used the CI
- 3 studies aimed at DO2
- 4 studies focused on SVR

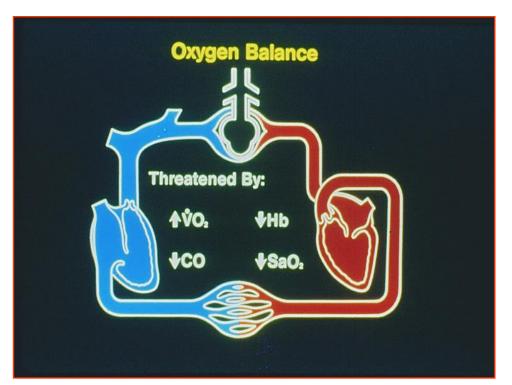
"Ideal" monitoring needs

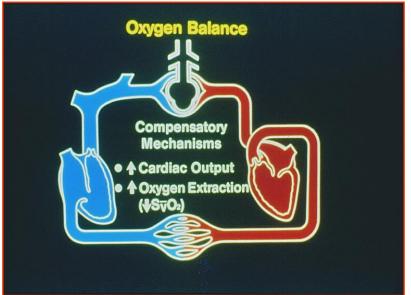
Cardiac Output

Tissue Oxygenation

Detect mechanism of disease





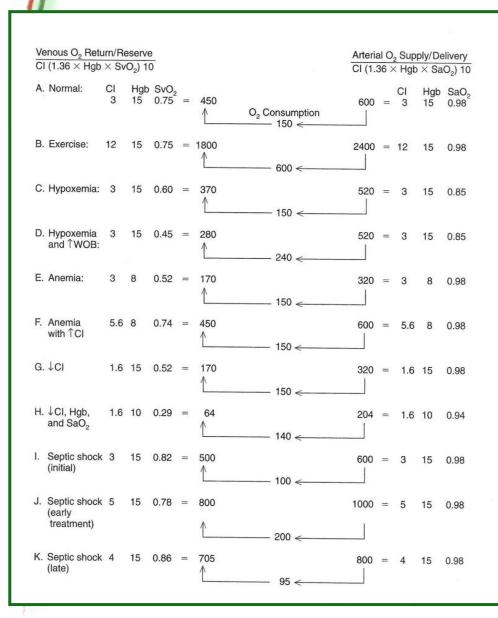


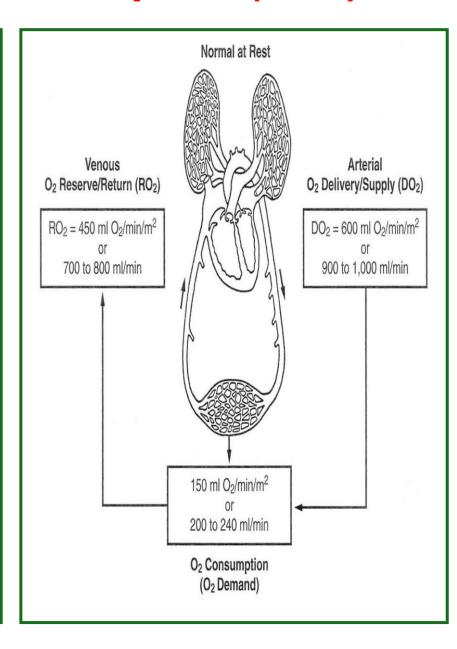
Oxygen Supply

Compensatory Ability

- Cardiac Output Example: 5 I/min x 3 = 15 I/min]-3 Fold Increase
- O₂ Extraction Example: SaO₂ - S_VO₂ 97% - 75% = 22% 97% - 31% = 66%

Factor affect O₂ Consumption (VO₂)





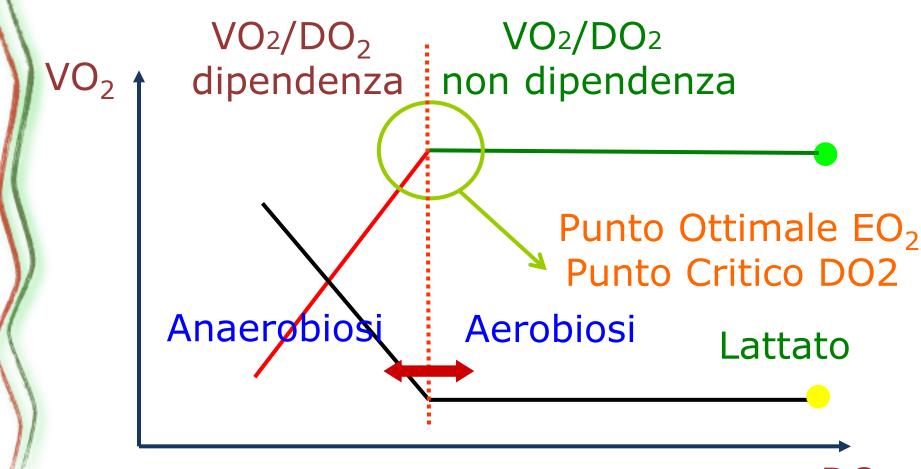
Key points

- La chirurgia maggiore determina un >> delle richieste metaboliche
- La ridotta ossigenazione tissutale può causare insufficienza d' organo e morte
- Durante le fasi intra- e post-operatoria i pz. contraggono un debito d'ossigeno le cui entità e durata correlano con l'incidenza di complicanze e con la mortalità
- L'incremento del CO, del VO₂ e del DO₂ rappresentano meccanismi di compenso fisiologici atti a contrastare l'ipossia tissutale

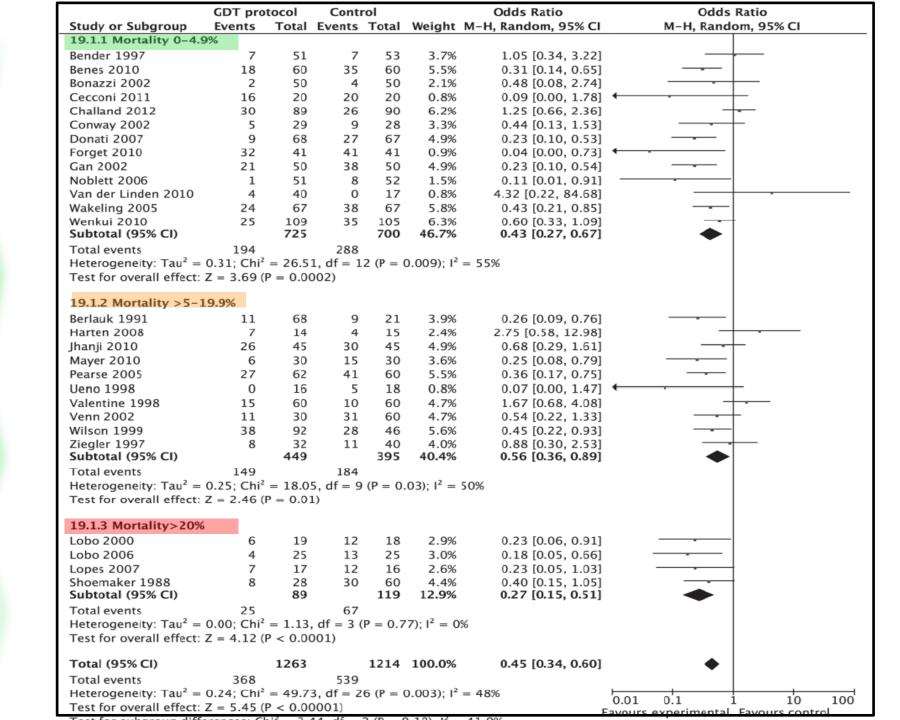


RELAZIONE FISIOLOGICA VO2/DO2

Nell'organismo sano

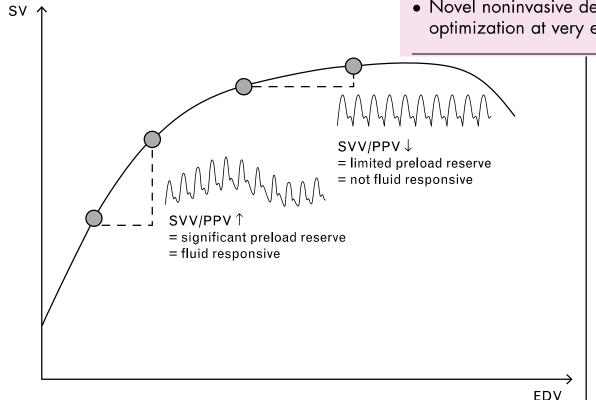


 $DO2 = SV \times HR \times CaO2$



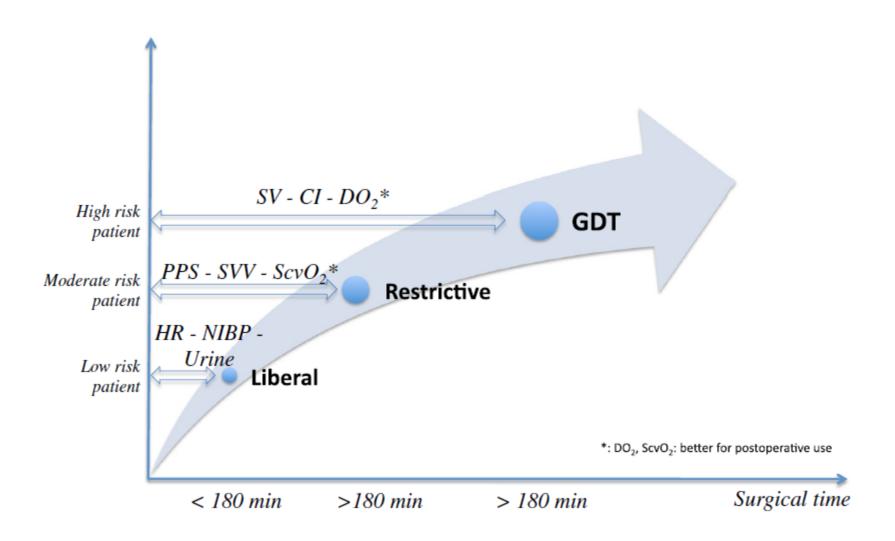
KEY POINTS

- Haemodynamic monitoring can improve outcome if linked to protocols aimed at optimizing oxygen delivery.
- Less-invasive monitoring devices can reliably track changes in cardiac output if used appropriately.
- Novel noninvasive devices allow haemodynamic optimization at very early treatment stages.



Less-invasive approaches to perioperative haemodynamic optimization

Patient risk, monitoring, fluid goal and surgical time

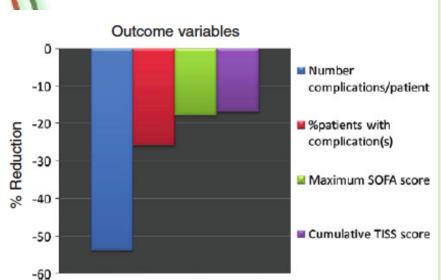


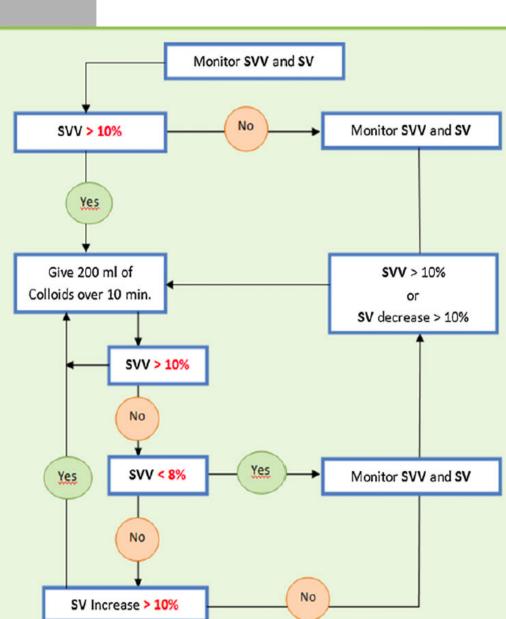
Come si fa l'ottimizzazione emodinamica?

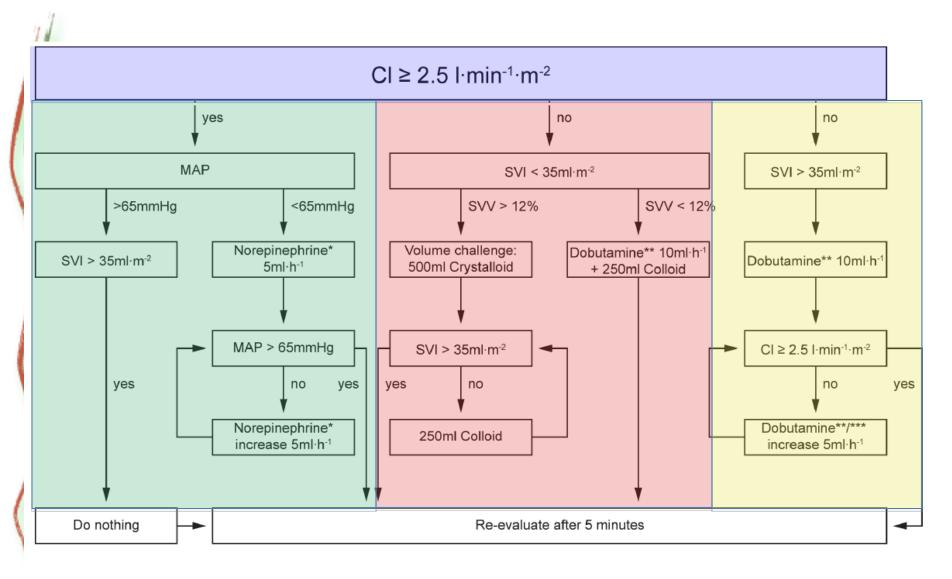
ORIGINAL RESEARCH

Goal-directed intraoperative volume and its variation in a prospective randomized m

Thomas W. L. Scheeren · Christoph Wiesena Herwig Gerlach · Gernot Marx



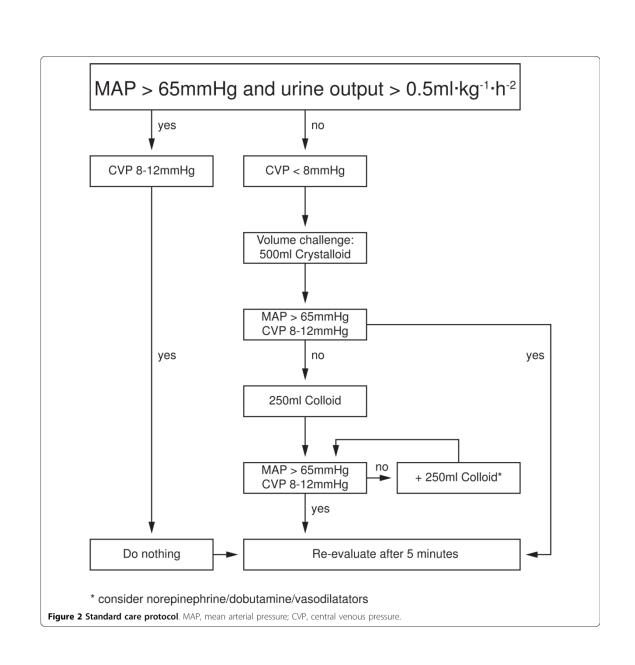




^{* =} Norepinephrine 1mg/50ml

^{** =} Dobutamine 50mg/50ml

^{*** =} consider other inotropes/vasodilatators



Caso clinico

- > Pz. di 62 anni
- Cardiomiopatia dilatativa In lista per trapianto cardiaco
- > Frattura di femore pertrocanterica

> PA: 105/65 mmHg

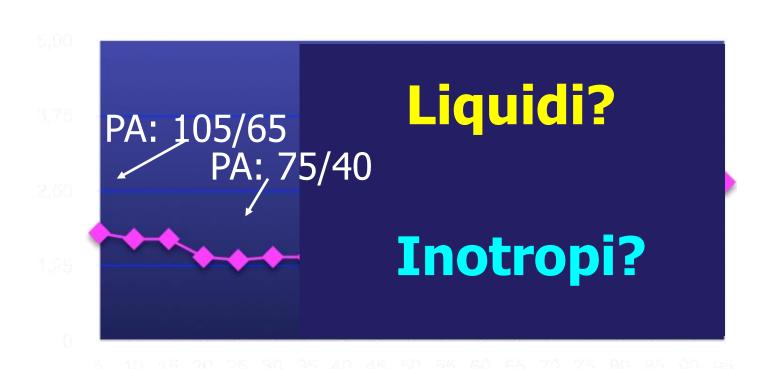
> FC: 78

> FE: 20%

EGA: pH 7.32, $PaCO_{2}$ 45, PaO_{2} 68, BE -2.4, SaO_{2} 94%

Monitoraggio CO

Waveform derivated monitoring



Liquidi?

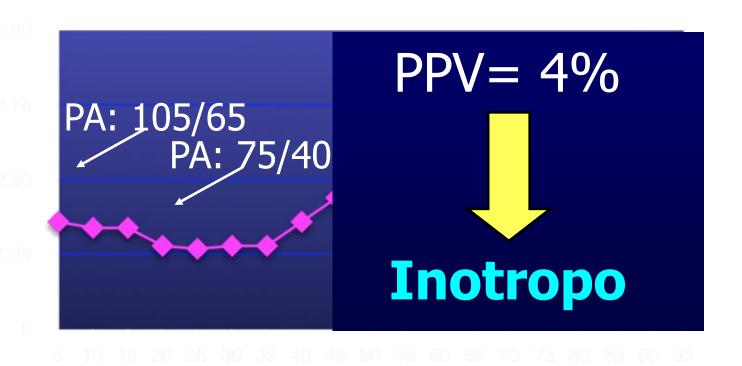
Preload?

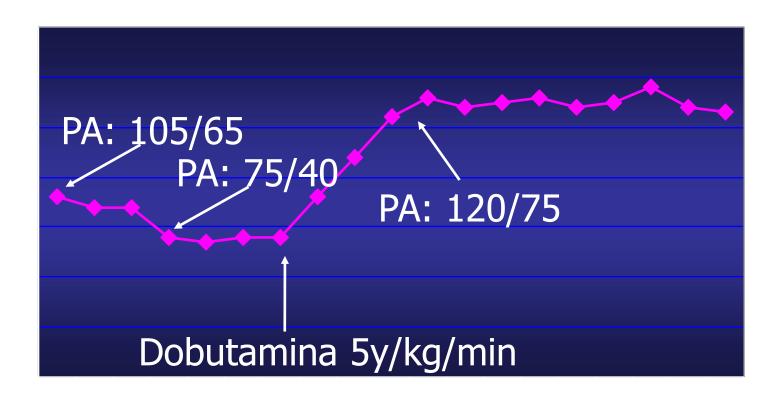
PVC = 8 mmHg

SPV

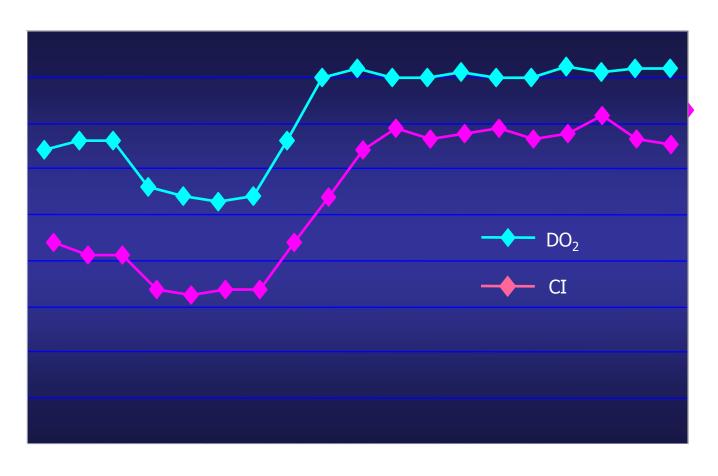
PPV

SVV





Trasporto di ossigeno (DO₂)



Hemodynamics Continuous Livello 5 PAC Livello 4 PeV Livello 3 GC Livello 2 PVC Livello 1 PA

DIAGNOSI ECHO intermittent



Key points

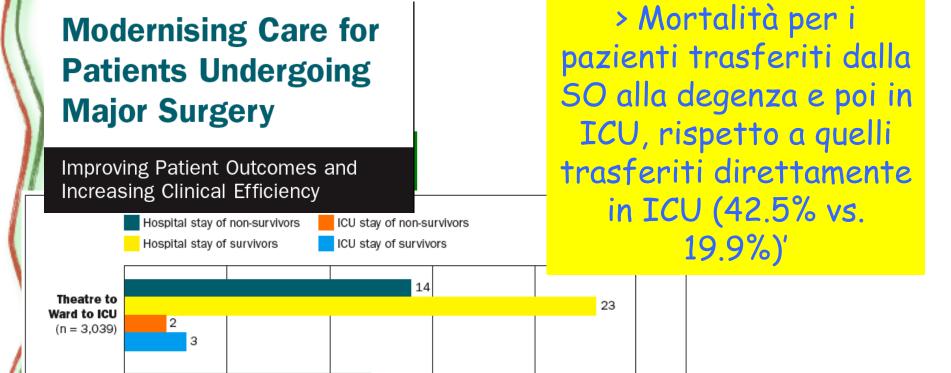
- Nella quasi totalità dei casi, oggetto dell' ottimizzazione sono quei parametri correlati al trasporto di ossigeno tissutale (CI, O₂ER, SvO₂, ScvO₂, DO₂, VO₂)
- ☐ Spesso l'obiettivo è il raggiungimento di valori sopranormali
- Qualunque sia la variabile in gioco, lo schema dell' ottimizzazione è comune a tutti gli studi:
 Ottimizzazione della volemia con infusione di fluidi A volemia ottimizzata e obiettivo non raggiunto, utilizzo

farmaci inotropi, vasopressori, vasodilatatori

<u>....</u>

di

Post-OP: Percorso protetto



Days

Direct to ICU

(n = 58.061)

Situazione alla dimissione

N=425 pazienti dimessi al primo episodio di ricovero Criteri alla dimissione e reale attribuzione in USC

| USC | DEG | TSI | TI |
|---------|-------------|-----|----|
| Criteri | | 1 | |
| DEG | 313 | 6 | B" |
| TSI | (32 , ", | 50 | 4 |
| TI | 5 | 3 | 12 |

| | Expected | | | | |
|-----------|-----------|--------|-----------|-------|--------|
| Agreement | Agreement | Kappa | Std. Err. | Z | Prob>Z |
| 88.24% | 64.80% | 0.6658 | 0.0402 | 16.56 | 0.0000 |

Situazione alla dimissione

N=50 pazienti dimessi al primo episodio di ricovero con criteri non concordanti

40 in luogo inappropriato 10 troppo protetti

gruppo A gruppo B

GRUPPO A : Indice di rientro in area Cr 10 volte lo std Indice di mortalità 6 volte lo std

Conclusioni

- 1. Le emergenze/Urgenze rappresentano il vero paziente ad alto rischio
- 2. Il monitoraggio emodinamico deve essere precoce ed avanzato
- 3. E' necessario scegliere Target Terapeutici ben definiti
- 4. Il percorso necessita di una "protezione "nel post-operatorio