



# Trigger e appropriatezza trasfusionale

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**Congresso Nazionale SIdEM**

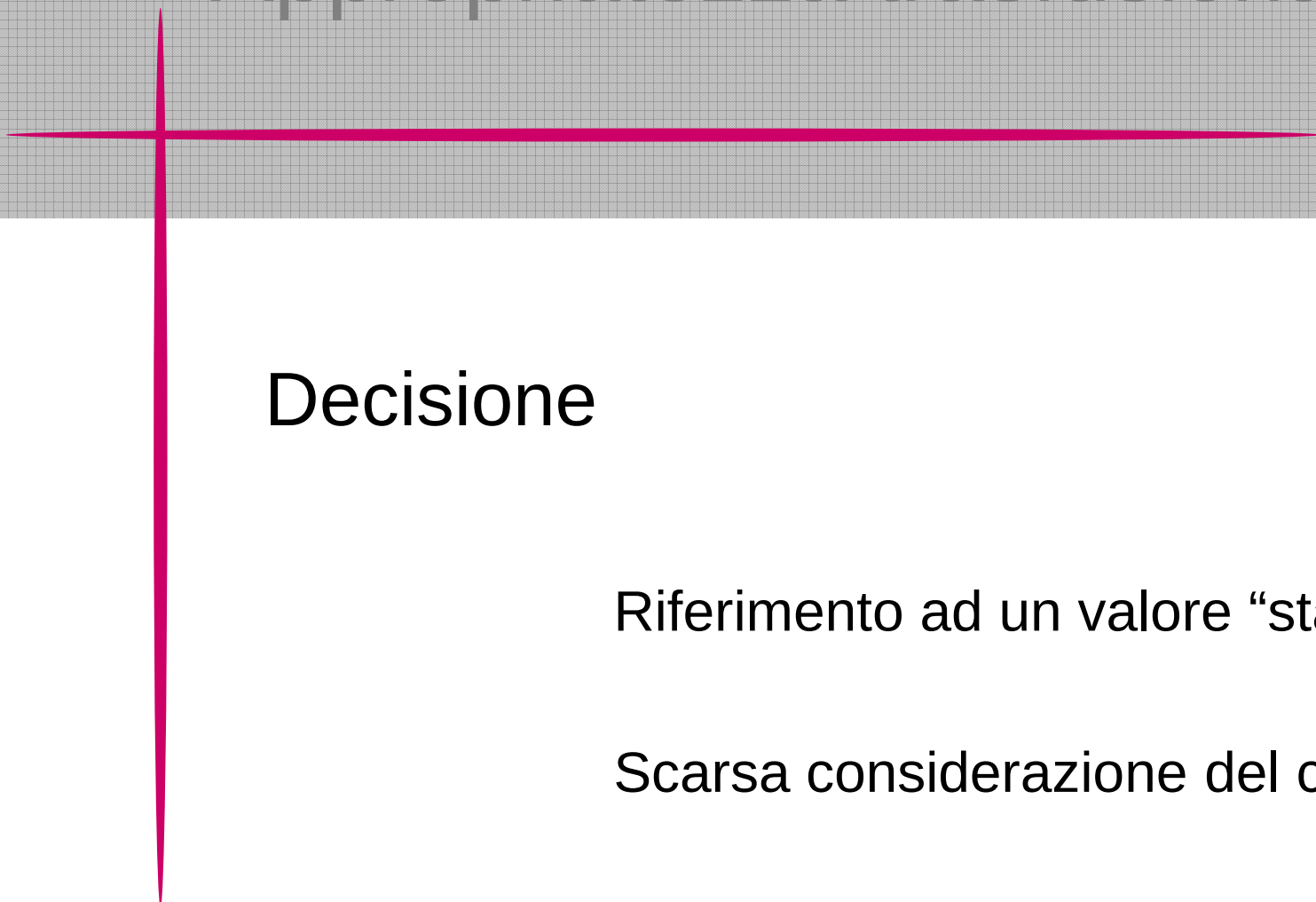
TORINO , 9-11 Novembre 2011

# Appropriatezza

È come un abito elegante



# Appropriatezza trasfusionale



## Decisione

Riferimento ad un valore “standard”

Scarsa considerazione del contesto

## linee guida

- Hb come parametro di riferimento
- ampio range decisionale

Ampia variabilità di indicazione

Hb < 6 g/dl

6,3

8,0

9,8

Hb > 10 g/dl

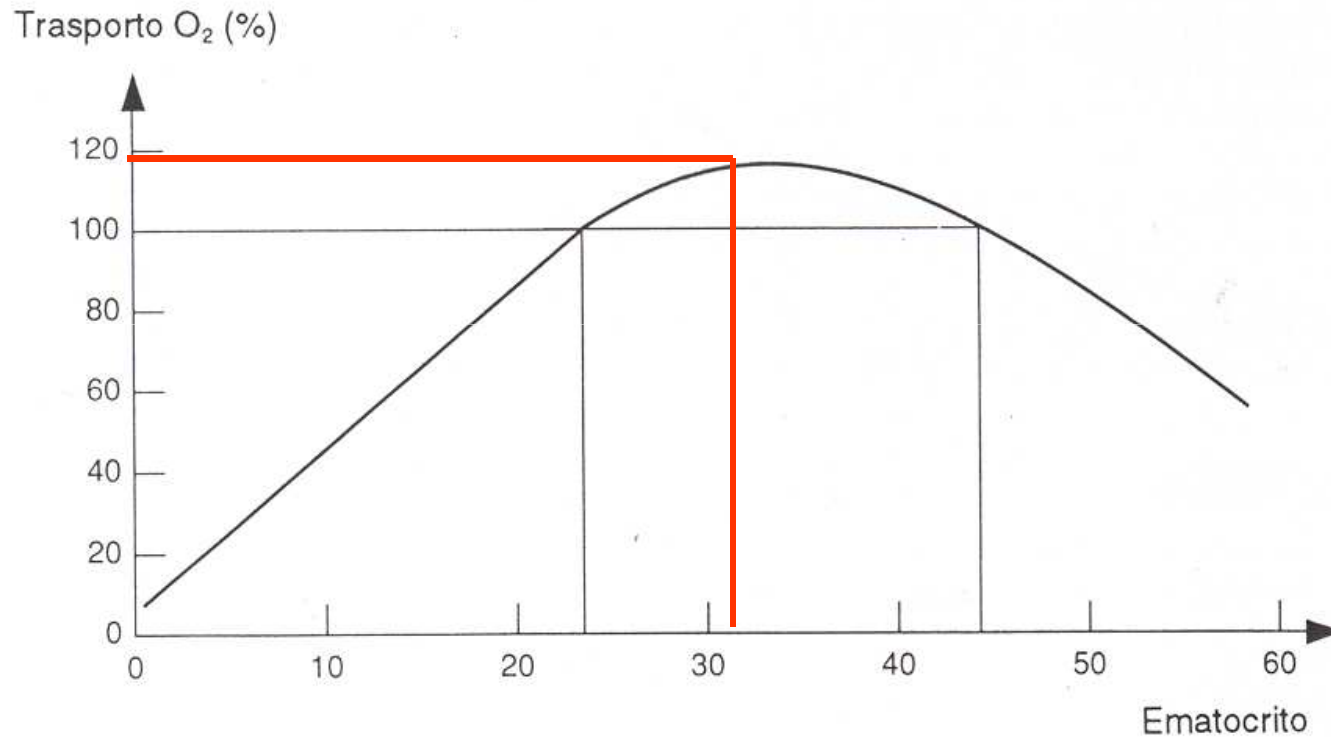
tra 6 e 10 g/dl di Hb  
devono essere riconosciute le condizioni soggettive  
di adattamento ossiforetico alle esigenze metaboliche

Perioperative Red Cell Transfusion.  
NIH Consensus Development Conference Statement, 1988.

..... *to increase **oxygen-carrying capacity** in anemic patients*

# “optimal hemoglobin”

[Hb] alla quale si ottiene la massima espressione della funzione ( $DO_2$ )  
e si evitano gli effetti negativi di un contenuto troppo basso o troppo alto



La  $DO_2$  massima si ottiene a 30% di Ht e si riduce per ulteriori diluizioni

# “emoglobina minimamente accettabile”

Czer LSC, Shoemaker WC. Optimal hematocrit value in critically ill Postoperative patients. *Surg Gynecol Obstet* 1978; 147: 363-8

Alcuni pazienti possono tollerare valori di Hb molto bassi (< 5 g/dl) quando possiedono meccanismi compensatori efficaci

Viele MK, Weiskopf RB: What can we learn about the need for transfusion from patients who refuse blood? The experience with Jehovah's Witnesses. *Transfusion* 1994; 34:396-401

I meccanismi energetici e quelli di compenso sono in grado di garantire un rapporto  $DO_2/VO_2$  adeguato

## Intraoperative Management of Extreme Hemodilution in a Patient with a Severed Axillary Artery

JianQiang Dai, MS,\* WeiFeng Tu, PhD,† Zheng Yang, MD,† and RiHui Lin, MS†

We present a case of extreme hemodilution in which appropriately crossmatched blood was not available. A 53-year-old man was admitted to our hospital because of hemorrhagic shock due to multiple stab wounds. His blood type was B, Rh negative, and his intravascular fluid volume was maintained with balanced salt solution and plasma substitutes, i.e., hydroxyethyl starch. His hemoglobin reached a nadir of 0.7 g/dL and hematocrit 2.2% before being transfused. No evidence of cardiac ischemia was noted and he was discharged in good condition. Extreme hemodilution can be successfully managed by maintaining a normal blood volume, 100% oxygen, and the use of plasma substitutes. (Anesth Analg 2010;111:1204–6)



[Hb] non è l'unico responsabile del trasporto di  $O_2$

[Hb] non è l'indicatore discriminante  
per una decisione trasfusionale

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esiste qualche altro fattore che influenza  
la resa del sistema  $DO_2 / VO_2$   
e distingue la tolleranza a differenti livelli di anemia  
rendendola una caratteristica soggettiva

Practice Guidelines for Perioperative Blood  
Transfusion and Adjuvant Therapies.  
An Updated report by the American Society of Anesthesiologists  
Task Force on Perioperative Blood Transfusion  
*Anesthesiology 2006; 105: 198-208.*

## **Raccomandazioni**

### **- Indicazioni alla trasfusione**

Hb < 6 g/dl , frequently justify RBC transfusion  
Hb >10 g/dl , RBC transfusion are hardly ever indicated

### **- Monitoraggio delle perdite ematiche**

### **- Monitoraggio di una adeguata perfusione ed ossigenazione degli organi vitali**

## EDITORIAL

*Transfusion Medicine*, 2008, **18**, 209–210

# Intraoperative transfusion, triggers and precision – an oxymoron

N. Soni *Magill Department of Anaesthesia, Chelsea and Westminster Hospital, London SW10 9NH, UK*

The haemoglobin concentration as a trigger works extremely well in situations where blood volume, cardiac output and oxygenation are stable and within normal range for an individual such as preoperatively or in the relatively stable patient in critical care. This is not the case in the acute situation where triggers inevitably reduce safety margins. Normovolaemic anaemia allows a safe functional system in the steady state, but hypotension, hypovolaemia or hypoxia become disastrous far more rapidly with low haemoglobin as the potential for a compensatory increase in oxygen extraction is much reduced. Furthermore, the

Hb è un buon indicatore  
in condizioni  
di stabilità emodinamica

modalità di sanguinamento

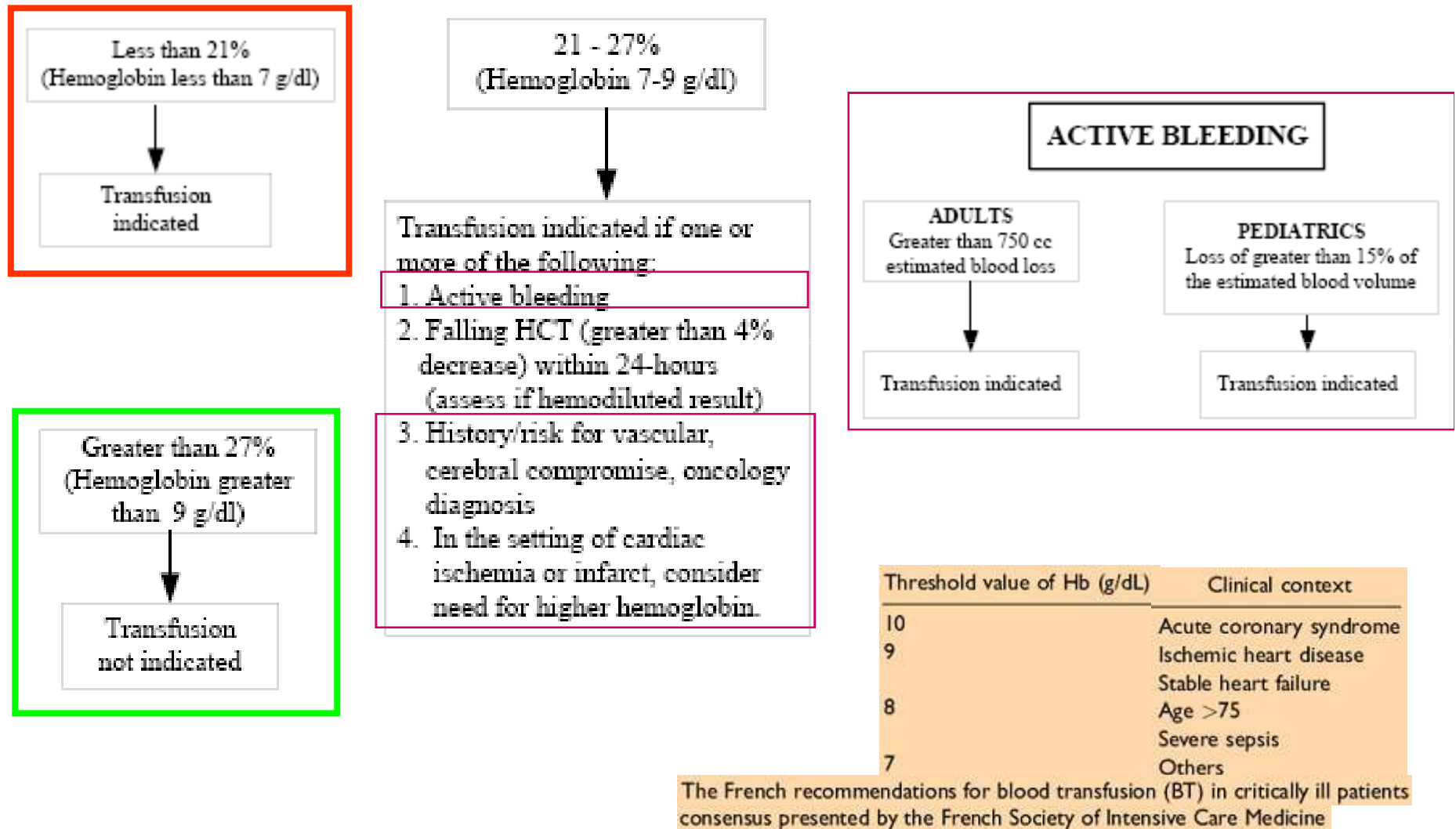
*La statica e il dinamico*

**al letto di reparto**

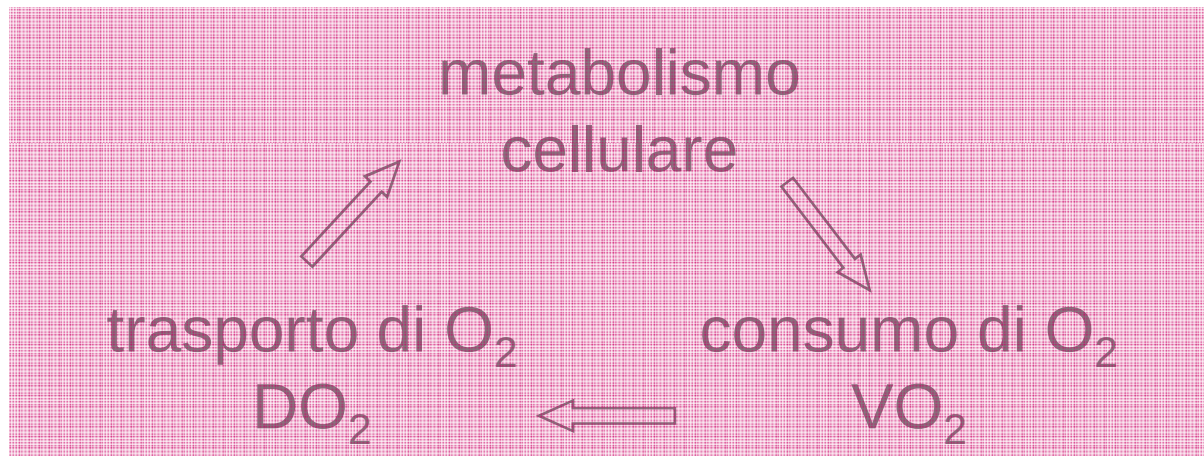
**in sala operatoria**

# Red Cell Transfusion Guidelines

Washington State Clinical Laboratory Advisory Council (CLAC)  
August 2003



# Adeguatezza $DO_2$ / $VO_2$



Le cellule richiedono  $O_2$  per poter svolgere le proprie funzioni

In quantità che dipende dall'intensità di queste funzioni

> attività  
> consumo  $O_2$   
> esigenza di trasporto  $O_2$

livello attività  
cellulare

$VO_2$  e  $DO_2$  sono due fattori  
strettamente correlati tra loro

# Hb lega $O_2$ e lo trasporta ai tessuti

Hb=15 g/100 ml  
100 ml sangue : 20,7 ml  $O_2$   
Vol. ematico 5.000 ml  
**1.035 ml  $O_2$**

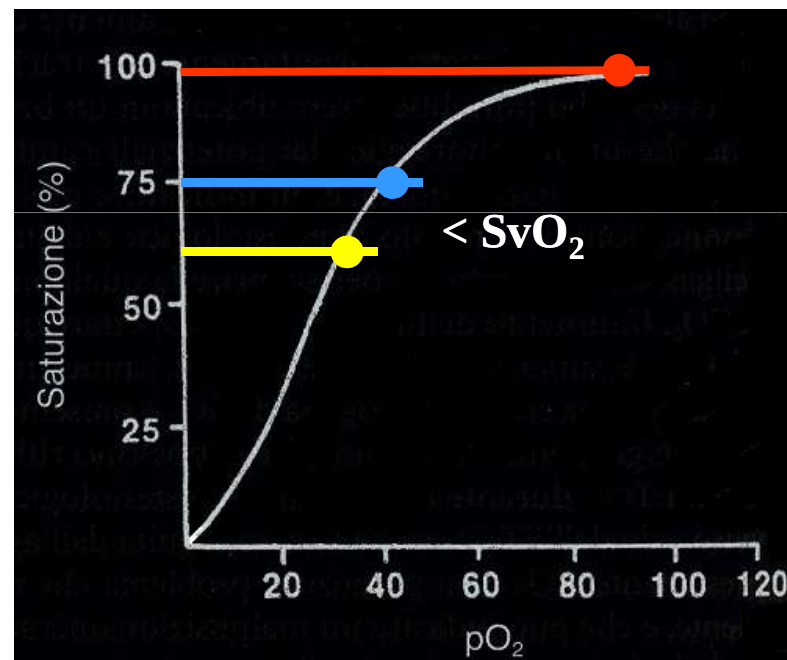
Hb=10 g/100 ml  
100 ml sangue : 13,8 ml  $O_2$   
Vol. ematico 5.000 ml  
**690 ml  $O_2$**

Hb=6 g/100 ml  
100 ml sangue : 8,3 ml  $O_2$   
Vol. ematico 5.000 ml  
**414 ml  $O_2$**

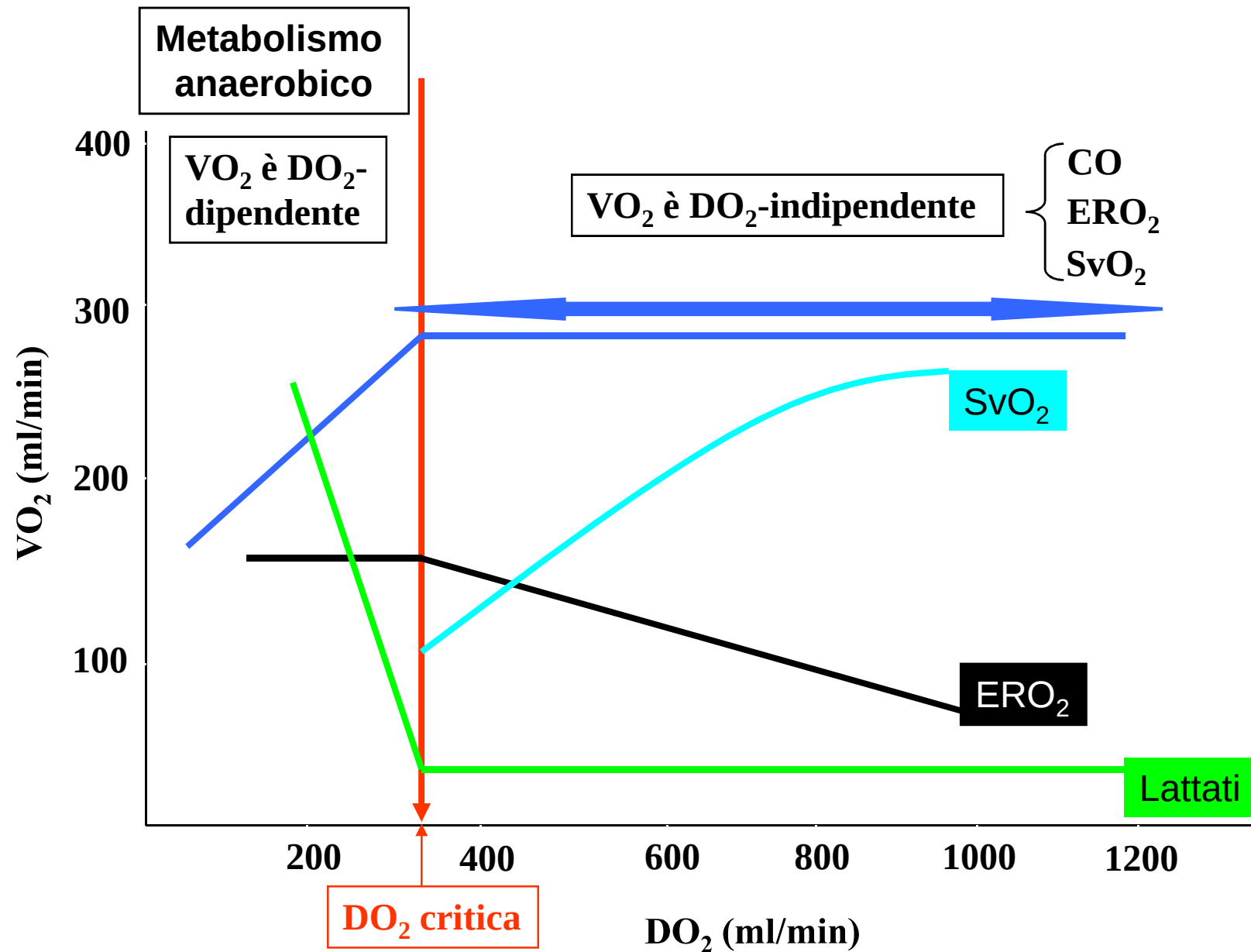
1g Hb = 1,38 ml  $O_2$

a riposo  
 **$VO_2$  250 ml/min**

# Adattamento della SvO<sub>2</sub> alle esigenze di VO<sub>2</sub>



$$> ERO_2 = VO_2 / DO_2$$





DO<sub>2</sub> critica

## Deficit di perfusione tissutale

### Segni di sofferenza d'organo

Tachycardia and hypotension

Increase in total body O<sub>2</sub> extraction (> 50%)

Decrease in mixed venous O<sub>2</sub> saturation (< 50% to 60%)

Decrease in mixed venous pO<sub>2</sub> (< 32 mmHg)

ST-segment suppression > 0.1 mV in electrocardiogram (ECG)

leads II and/or V<sub>5</sub>

Regional wall motion disturbances in transesophageal echocardiography (TEE)

Può essere il trigger ?

# Trigger trasfusionali fisiologici

segni di inadeguata ossigenazione tissutale  
a vari livelli di Hb determinata da  
condizioni cliniche soggettive

Table 2. Suggested indications for red blood cell (RBC) transfusions, modified according to Marcucci (1) and Spahn et al. (61,62)

| Variable                                                 | Evidence-Based            | Intraoperatively and<br>ICU in a Public/<br>Teaching Hospital | Postoperatively<br>General Ward in a<br>Public/Teaching<br>Hospital |
|----------------------------------------------------------|---------------------------|---------------------------------------------------------------|---------------------------------------------------------------------|
| ● Physiologic transfusion trigger                        |                           |                                                               |                                                                     |
| Relative hypotension <sup>a</sup>                        | Yes                       | Yes                                                           | Yes                                                                 |
| Relative tachycardia <sup>a</sup>                        | Yes                       | Yes                                                           | Yes                                                                 |
| New ST-segment depression<br>>0.1 mV                     | Yes                       | Yes                                                           | Yes                                                                 |
| New ST-segment elevation<br>>0.2 mV                      | Yes                       | Yes                                                           | Yes                                                                 |
| New wall motion abnormality<br>(TEE, TTE)                | Yes                       | Yes                                                           | Yes                                                                 |
| PvO <sub>2</sub> , mm Hg                                 | <25                       | <32                                                           | Nct applicable                                                      |
| Oxygen extraction rate, %                                | >50                       | >40                                                           | Nct applicable                                                      |
| SvO <sub>2</sub> , %                                     | <50                       | <60                                                           | Nct applicable                                                      |
| Decrease in V̇O <sub>2</sub> , %                         | >10-50                    | >10                                                           | Nct applicable                                                      |
| ● Hemoglobin-based transfusion trigger, g/dL             |                           |                                                               |                                                                     |
| In all patients <sup>b</sup>                             | <6                        | 7                                                             | 7-8                                                                 |
| In patients >80 yrs                                      |                           | 7-8                                                           | 8-9                                                                 |
| In patients with severe CAD or CHF                       |                           | 8                                                             | 8-9                                                                 |
| In patients with Sao <sub>2</sub> < 90%                  |                           | 8-9                                                           | 9                                                                   |
| In patients with fever/hypermetabolism                   |                           | 7-8                                                           | 8-9                                                                 |
| ● Possible future transfusion trigger: P300 latency (47) |                           |                                                               |                                                                     |
|                                                          | Prolongation of ≥20 msecs |                                                               |                                                                     |

# Fattori che possono Incidere sulla decisione trasfusionale

## Livello di anemia

Pallore

Tachicardia

Ipotensione

Oligoanuria

Dispnea

Sensazione  
di debolezza

Fame d'aria

Difficoltà di  
concentrazione

Età

Cardiopatìa

Cerebropatia

Sat<sub>a</sub>O<sub>2</sub>%

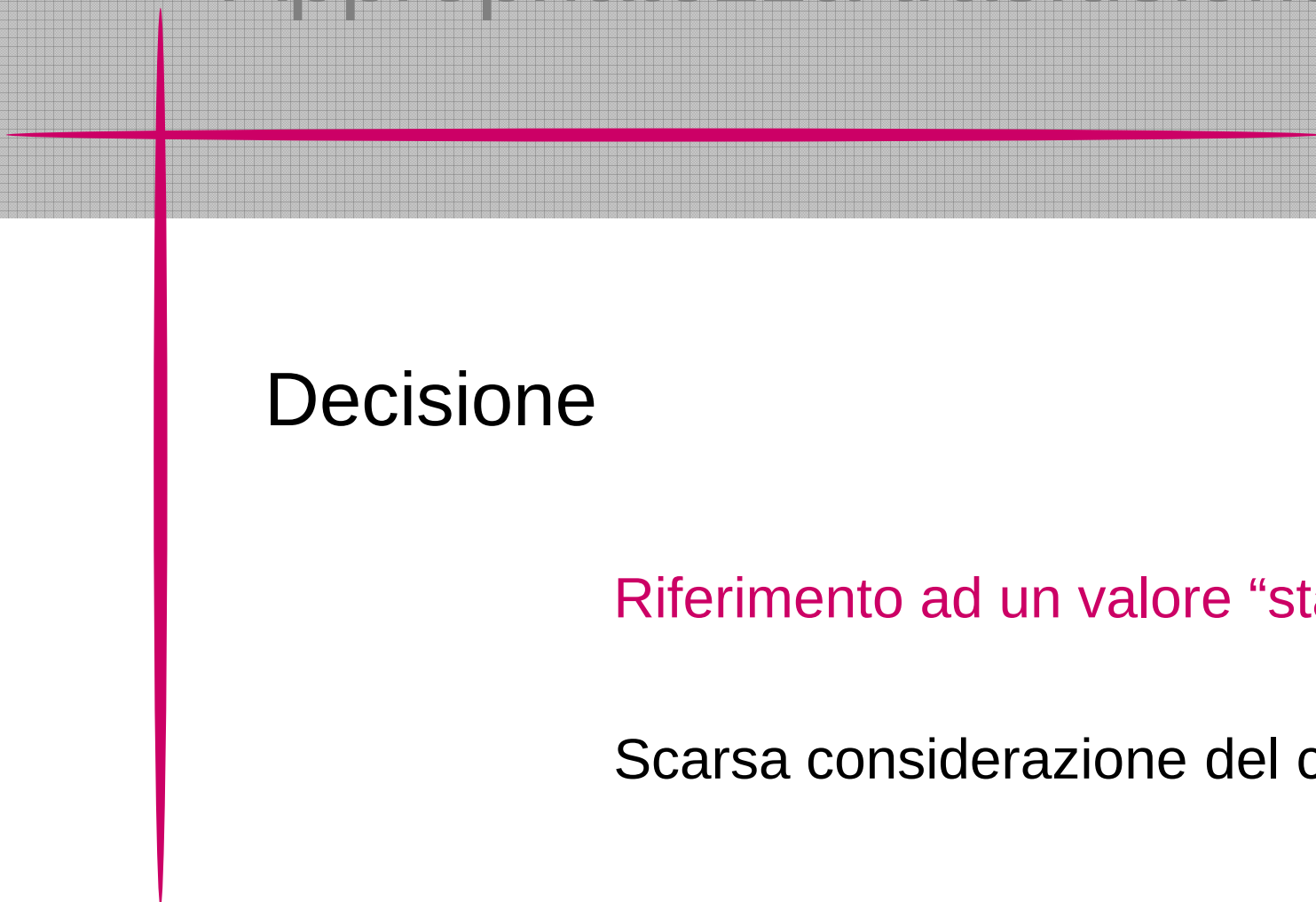
Acidosi

Sat<sub>v</sub>O<sub>2</sub>%

ERO<sub>2</sub>%



# Appropriatezza trasfusionale



## Decisione

Riferimento ad un valore “standard”

Scarsa considerazione del contesto

# Outcome

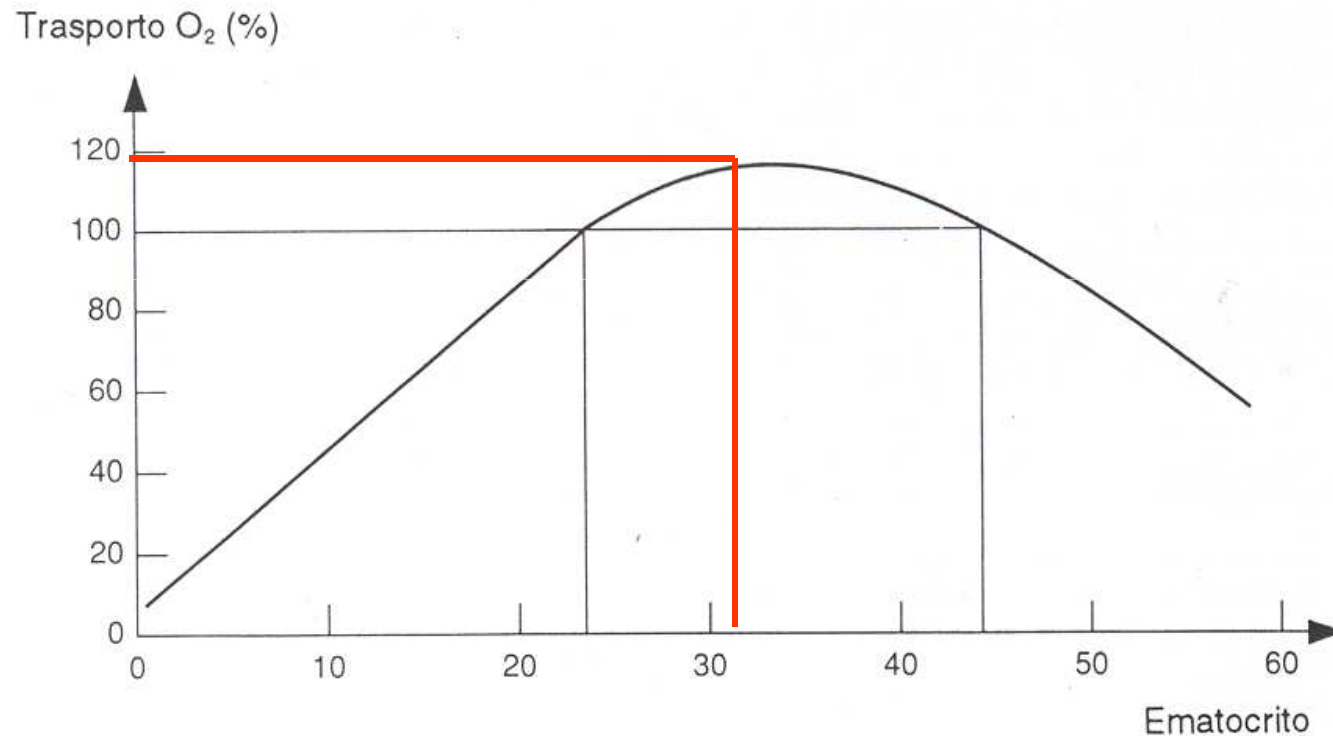
The decision to administer a blood transfusion should, therefore, be based on clinical judgement of the individual's risk/benefit ratio including risks associated with transfusion and anaemia, respectively.

L'appropriatezza è la conferma dell'affidabilità del trigger

Può essere fornita solo successivamente alla trasfusione  
sulla base di un ottenimento di un risultato di miglioramento funzionale

# "optimal hemoglobin"

[Hb] alla quale si ottiene la massima espressione della funzione ( $DO_2$ )  
e si evitano gli effetti negativi di un contenuto troppo basso o troppo alto



La  $DO_2$  massima si ottiene a 30% di Ht e si riduce per ulteriori diluizioni

Stehling L, Zauder HL. Acute normovolemic hemodilution. Transfusion 1991;31:857-68

# Appropriatezza trasfusionale

definizione dei trigger

Adeguatezza del contenuto di Hb  
alle esigenze funzionali

**Hb Target**

# Preoperative anaemia and postoperative outcomes in non-cardiac surgery: a retrospective cohort study

Khaled M Musallam, Hani M Tamim, Toby Richards, Donat R Spahn, Frits R Rosendaal, Aida Habbal, Mohammad Khreiss, Fadi S Dahdaleh, Kaivan Khavandi, Pierre M Sfeir, Assaad Soweid, Jamal J Hoballah, Ali T Taher, Faek R Jamali

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**Methods** We analysed data for patients undergoing major non-cardiac surgery in 2008 from The American College of Surgeons' National Surgical Quality Improvement Program database (a prospective validated outcomes registry from 211 hospitals worldwide in 2008). We obtained anonymised data for 30-day mortality and morbidity (cardiac, respiratory, CNS, urinary tract, wound, sepsis, and venous thromboembolism outcomes), demographics, and preoperative and perioperative risk factors. We used multivariate logistic regression to assess the adjusted and modified (nine predefined risk factor subgroups) effect of anaemia, which was defined as mild (haematocrit concentration  $>29$ – $<39\%$  in men and  $>29$ – $<36\%$  in women) or moderate-to-severe ( $\leq 29\%$  in men and women) on postoperative outcomes.

**Findings** We obtained data for 227 425 patients, of whom 69 229 (30·44%) had preoperative anaemia. After adjustment, postoperative mortality at 30 days was higher in patients with anaemia than in those without anaemia (odds ratio [OR] 1·42, 95% CI 1·31–1·54); this difference was consistent in mild anaemia (1·41, 1·30–1·53) and moderate-to-severe anaemia (1·44, 1·29–1·60). Composite postoperative morbidity at 30 days was also higher in patients with anaemia than in those without anaemia (adjusted OR 1·35, 1·30–1·40), again consistent in patients with mild anaemia (1·31, 1·26–1·36) and moderate-to-severe anaemia (1·56, 1·47–1·66). When compared with patients without anaemia or a defined risk factor, patients with anaemia and most risk factors had a higher adjusted OR for 30-day mortality and morbidity than did patients with either anaemia or the risk factor alone.

**Interpretation** Preoperative anaemia, even to a mild degree, is independently associated with an increased risk of 30-day morbidity and mortality in patients undergoing major non-cardiac surgery.



l'adeguatezza  
dei target

*è eleganza*

