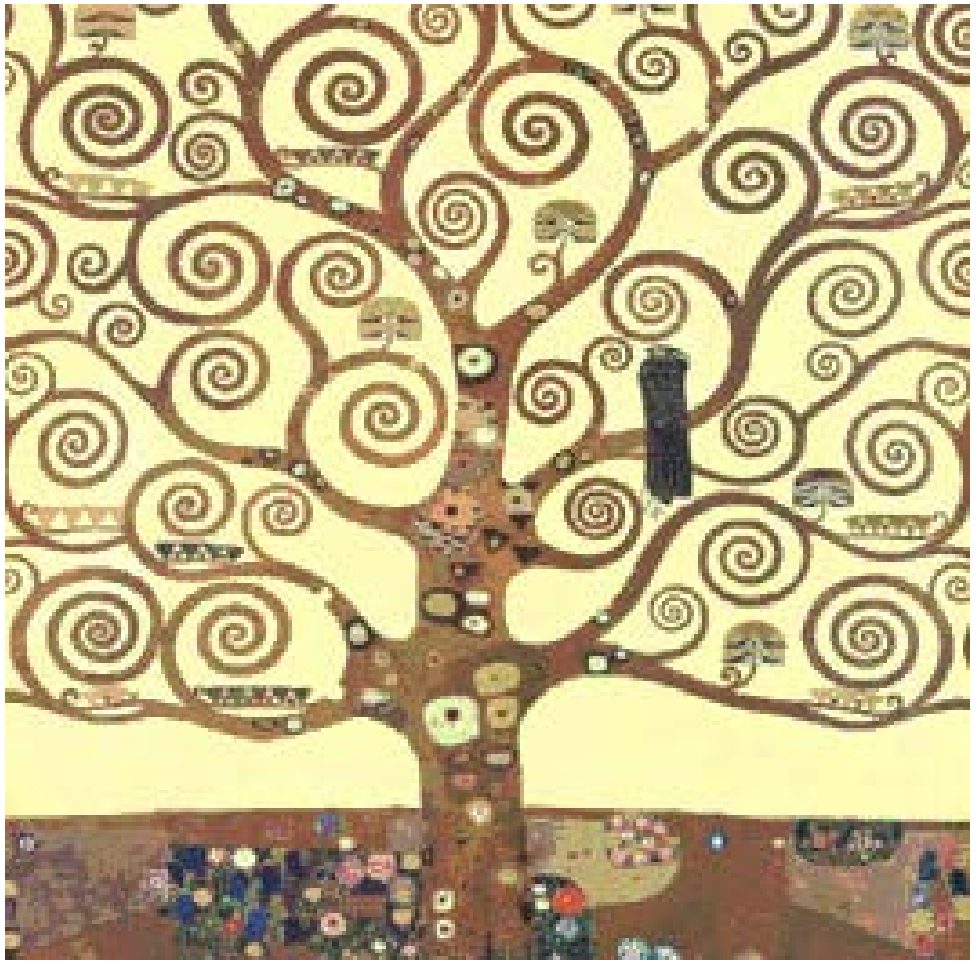
PBM in Terapia Intensiva

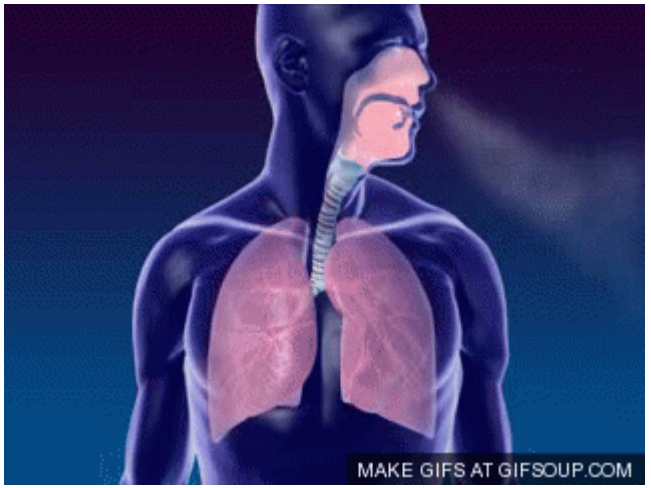


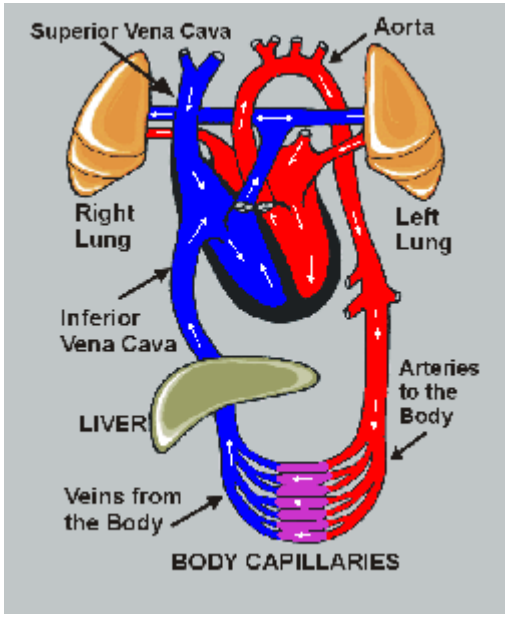
Legnano

18 febbraio 2018

D. Radrizzani

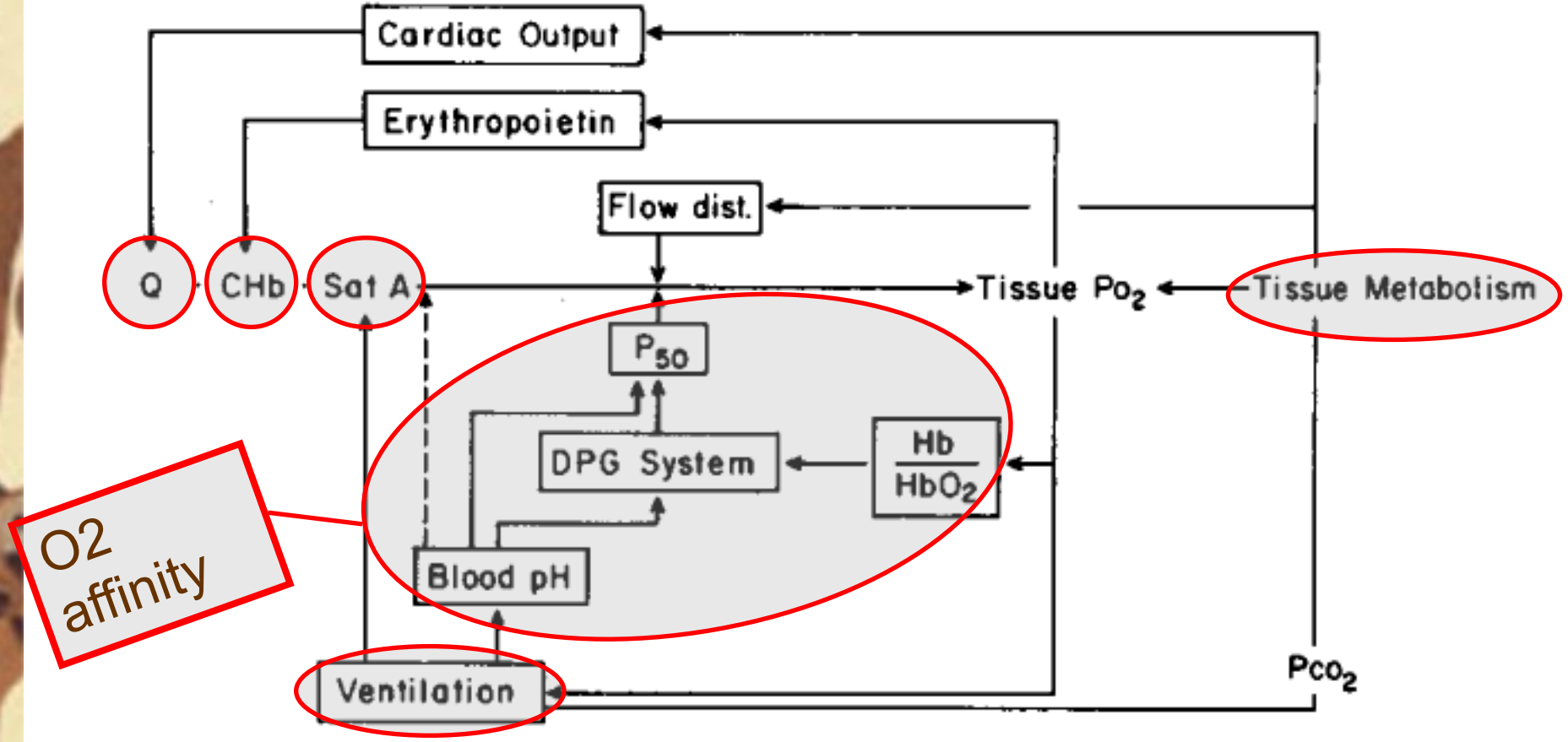
Intensivist's essentials





- Intensive care efforts are made to maintain adequate ventilation and cardiac output
- To ensure O_2 to all tissues and hence guarantee energy metabolism and preserve life

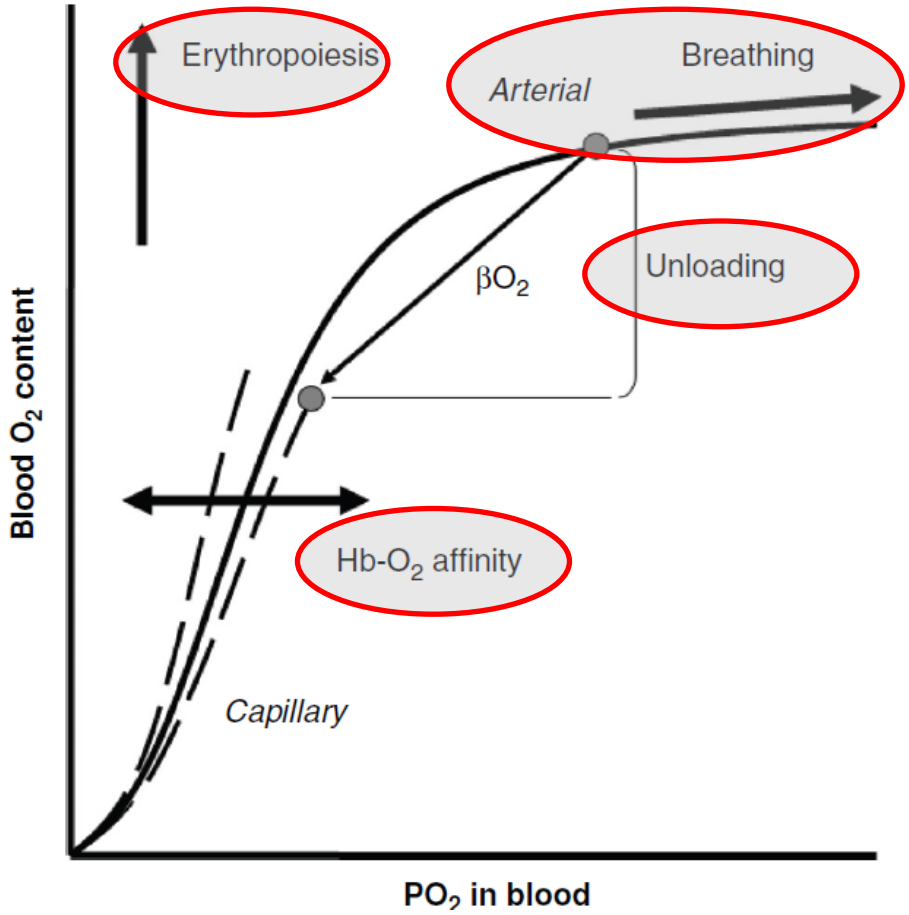
Tissue O2 supply and its regulation



Clement A NEJM 1972

Factors that modify O_2 transport by hemoglobin in blood

- Hb-O2 affinity is the link between alveolar PO2 and tissue O2supply.
- The upper part of the O2-dissociation curve reflects arterial O2-loading
  - ventilation increases alveolar and arterial Po2. Consequently, arterial SO2 and O2 content increase.
- Erythropoiesis accounts for long-term adjustments of O2-capacity by increasing total Hb and its concentration in blood.
  - Augmented ventilation (seconds) and erythropoiesis (days) increase the amount of O2 loaded during passage of blood through the alveola
- Blood flow determines the amount of O2 delivered to the periphery per unit of time.

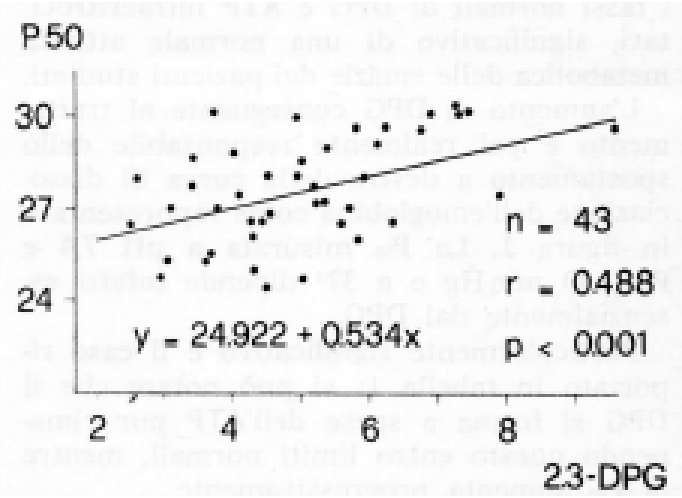


Cessione periferica di ossigeno e nutrizione parenterale totale (TPN)

G. Iapichino - D. Radrizzani
G. Ronchi - M. Solca - F. Bassi
Istituto di Anestesiologia e Rianimazione dell'Università di Milano
(Direttore: Prof. G. Damia)

Min. Anest., 44, 1978

La somministrazione di P durante Nutrizione parenterale totale aumenta significativamente la sintesi di 2,3-DPG intra-eritrocitario mentre l'ATP rimane invariato rispetto ai valori basali
L'aumento di DPG conseguente al trattamento è poi realmente responsabile dello spostamento a destra della curva di dissociazione dell'emoglobina



P	DPG	ATP	P_{50}	HbO_2		a-v
				v	a	
0,9	3,67	1,29	25,6	76,94	98	3,50
1,64	5,86	1,09	29,6	69,27	98	4,79
1,35	6,89	1,05	30,1	68,02	98	4,99

INT SURG 1984; 69:113-116

Restoration of Blood 2,3-Diphosphoglycerate Levels in Multi-Transfused Patients: Effect of Organic and Inorganic Phosphate

GAETANO IAPICHINO, M.D., DANILO RADRIZZANI, M.D., MAURIZIO SOLCA, M.D., MARIA GRAZIA FRANZOSI*, M.D., FRANCO BOBBIO PALLAVICINI, M.D., GIUSEPPE SPINA, M.D., ALBERTO SCHERINI, M.D.

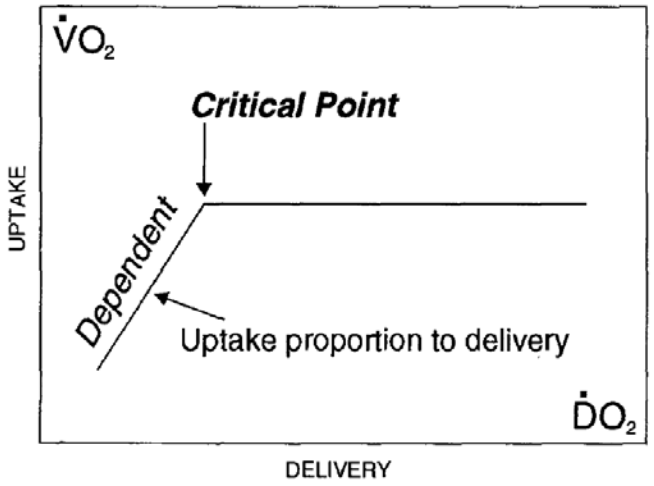
*Intensive Care Unit "E. Vecla", Ospedale Maggiore, and Istituto Anestesiologia e Rianimazione, Milan University, and *Istituto "Mario Negri", Milan, Italy.*

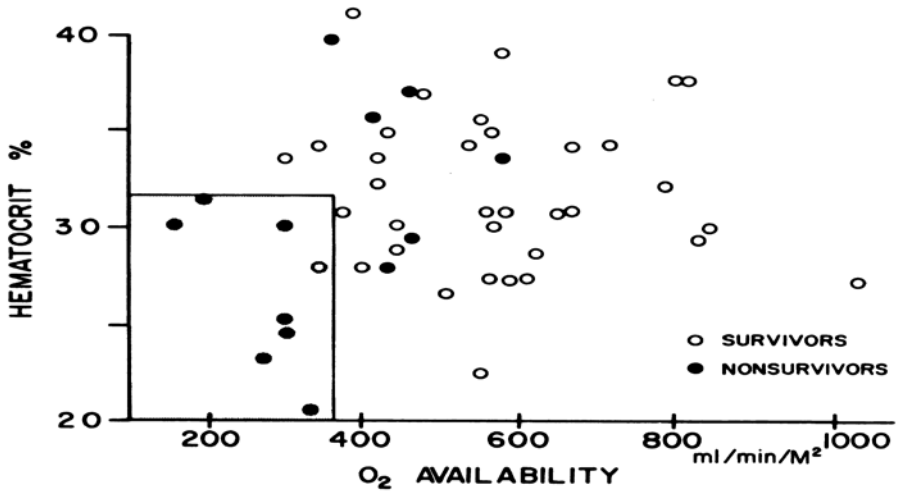
In patients given massive transfusions of ACD stored blood, the DPG returns to normal values within 48-72 h without any treatment.

In our patients, basal DPG was low in absolute value, and even lower if related to the mildly alkalotic blood pH.

Treatment with FDP significantly and rapidly increased DPG

Oxygen delivery





DO_2 ml.min $^{-1}$ = CaO_2 x 10 x Q

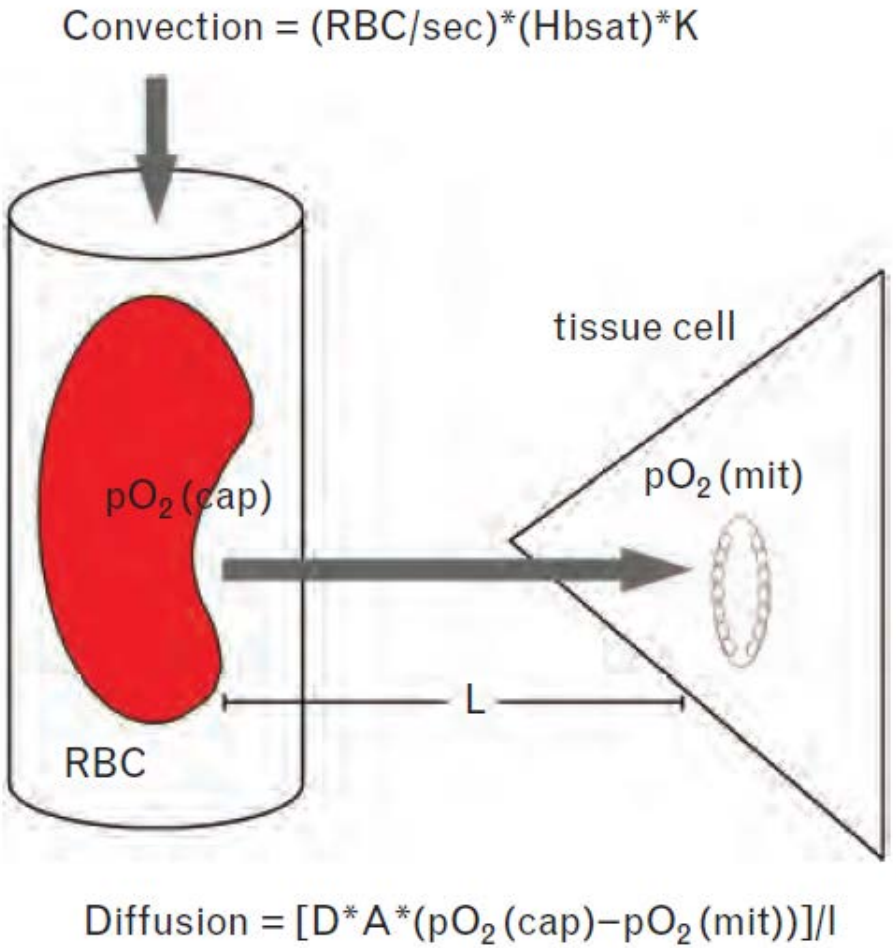
CaO_2 ml.d1^{-1} =

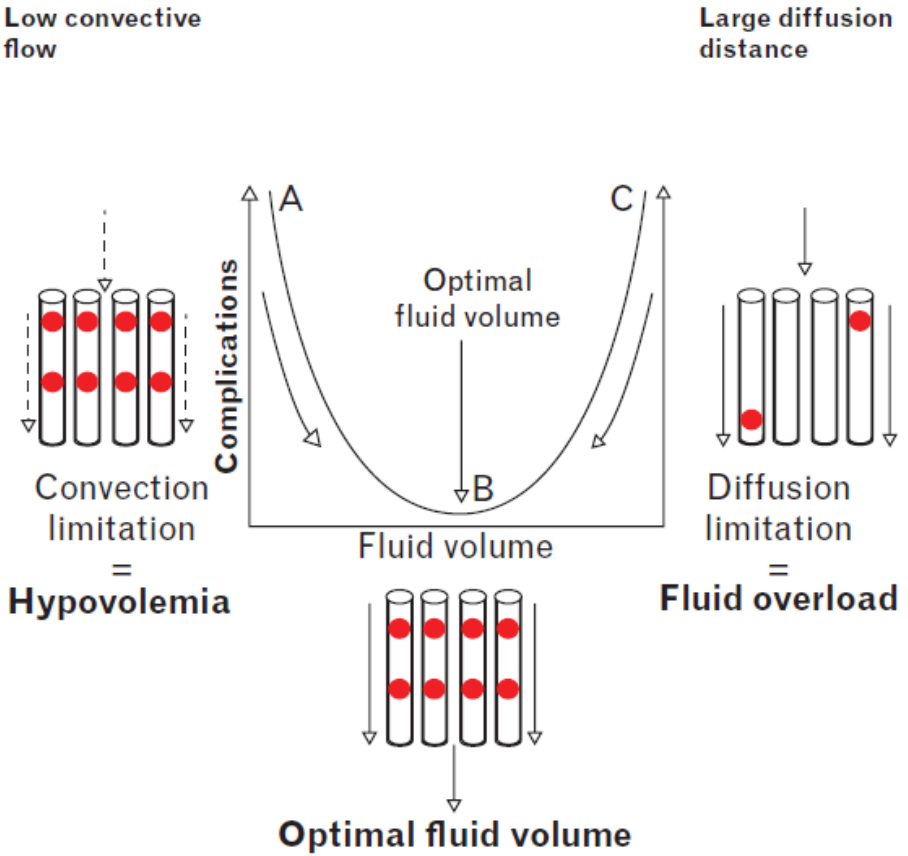
([Hb g.d1^{-1}] x 1.39 ml.g^{-1}x SaO_2 /100) + (PaO_2 x 0.00314) ml.d1^{-1}

•Seven patient died of the height whose hematocrit values were less than 32% and their oxygen availability was less than 375 ml.min $^{-1}$.m^{-2}.

Czer 1978 Surg Gynec Obst.pdf

Functional microcirculatory hemodynamics





Patient (blood) management

Optimizing Hemostasis
Assess coagulation
Goal directed correction
EB plasma and factors

Blood conservation
Surgical hemostasis
Autotransfusion & blood conservation
Assess blood loss
Limit diagnostic blood loss

Improved patient outcome

Patient centered decision making

Managing anemia
Early detection
Minimize O2 consumption
EB drugs to support hematopoiesis
EB RBC's use

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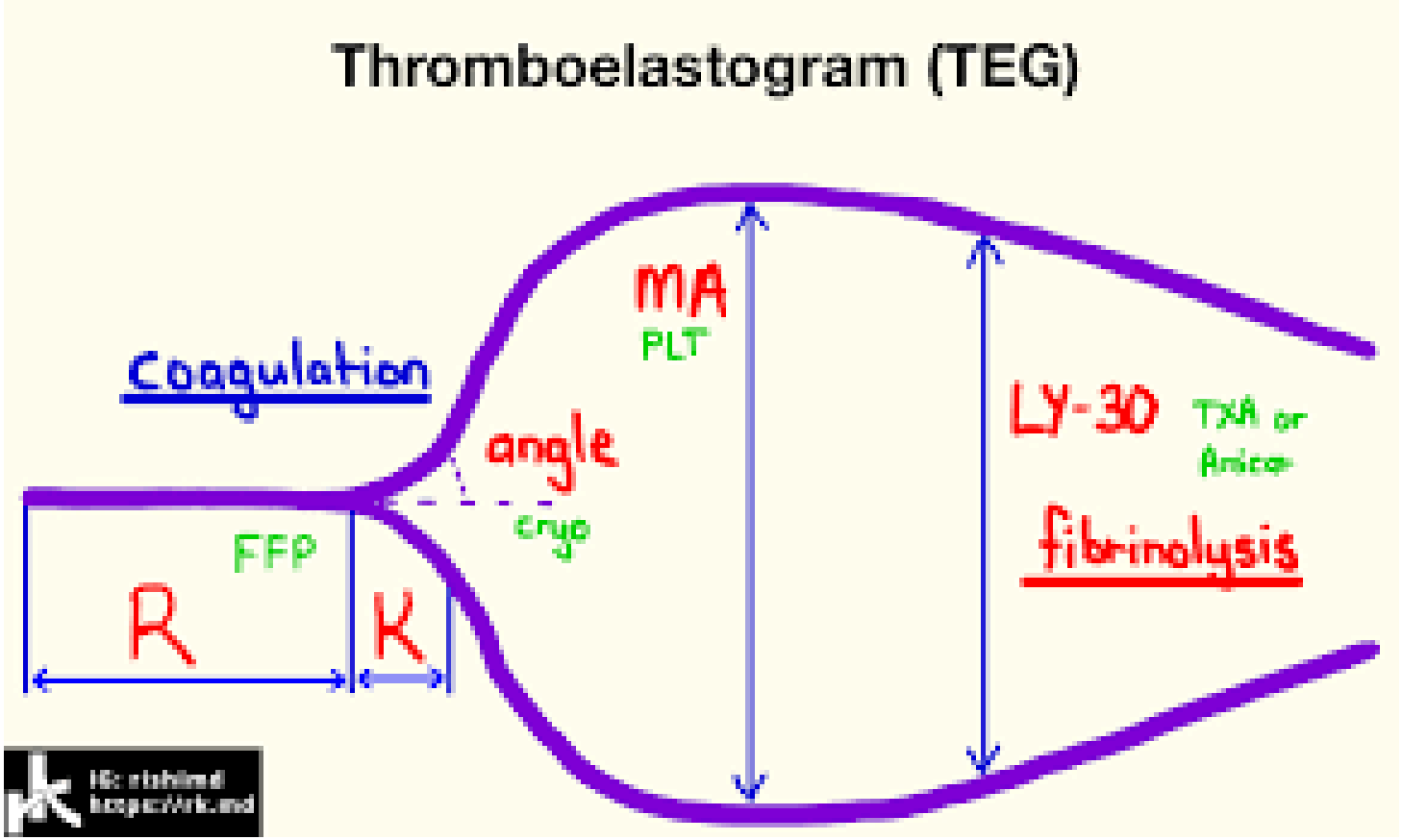

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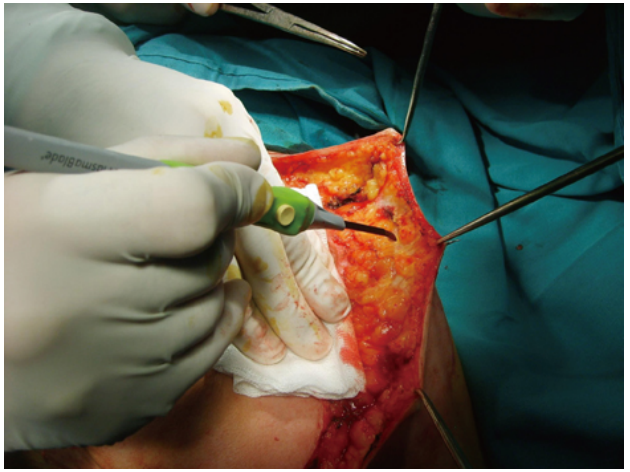
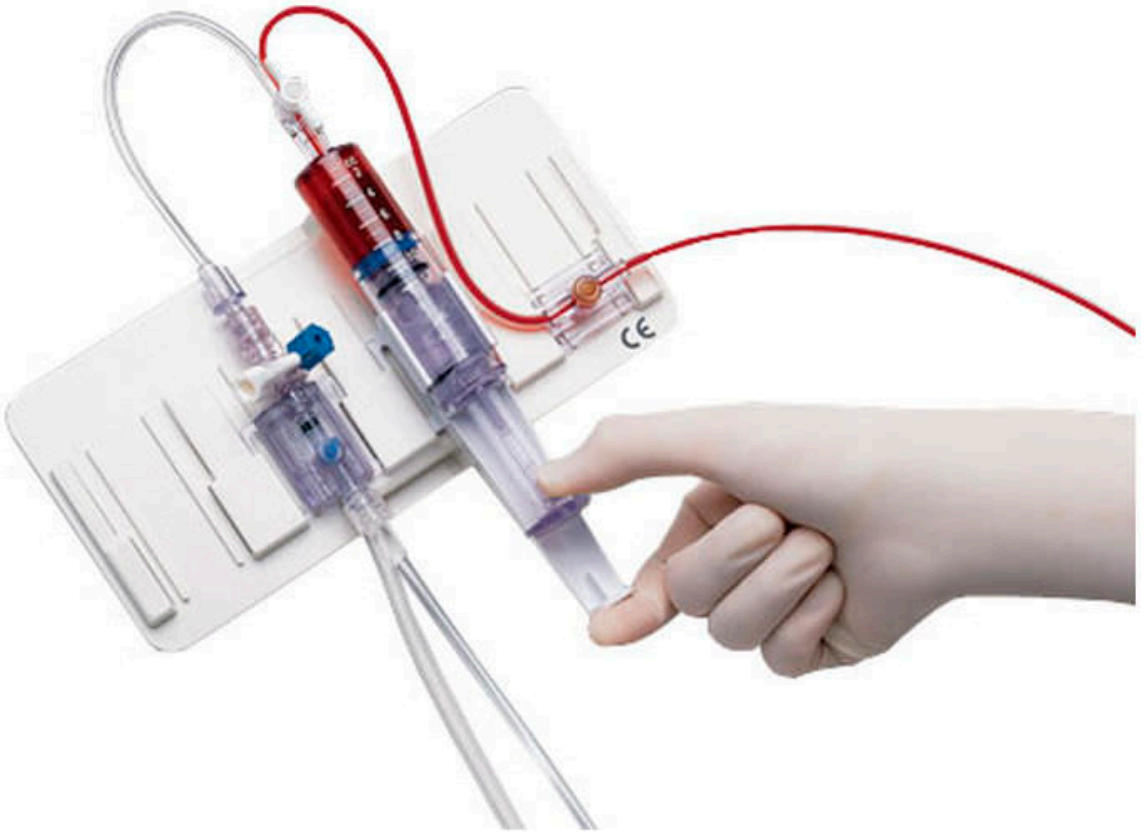


Surgical hemostasis

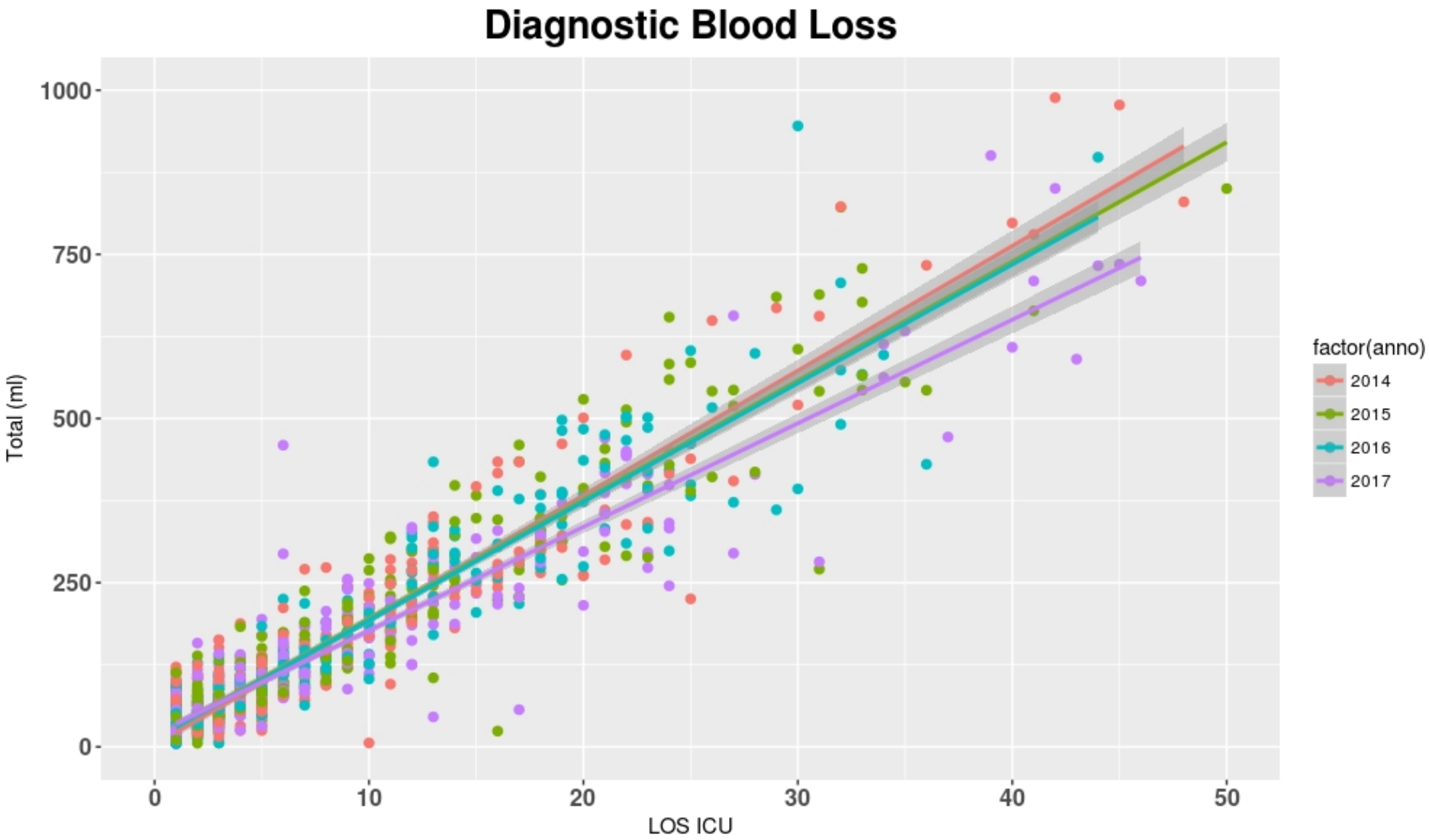
Quantify loss

Autotransfusion

Diagnostic blood loss



- closed circuit blood sampling

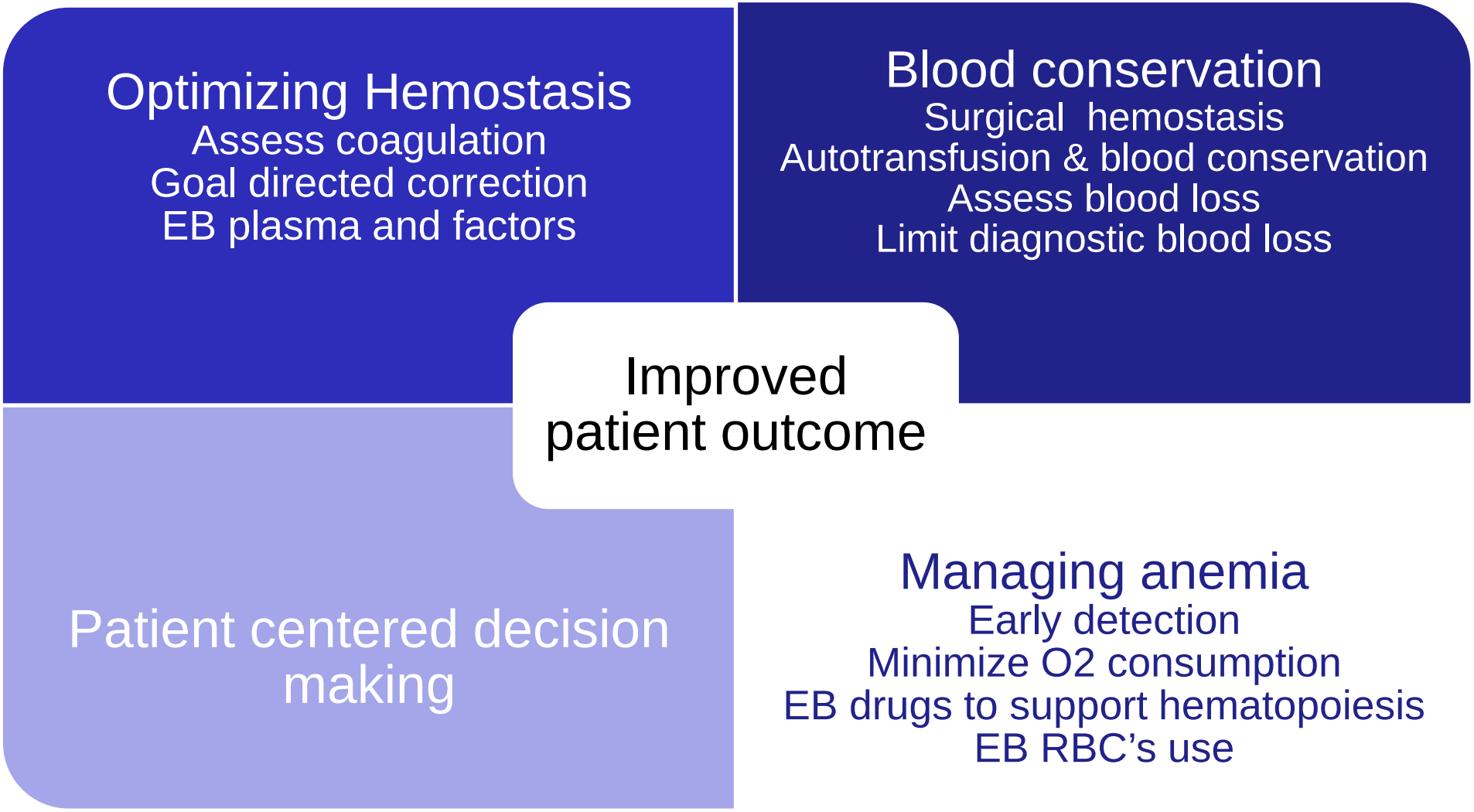


1346 patients

47185 samples (35 per patient)

203 l (151 ml per patient)

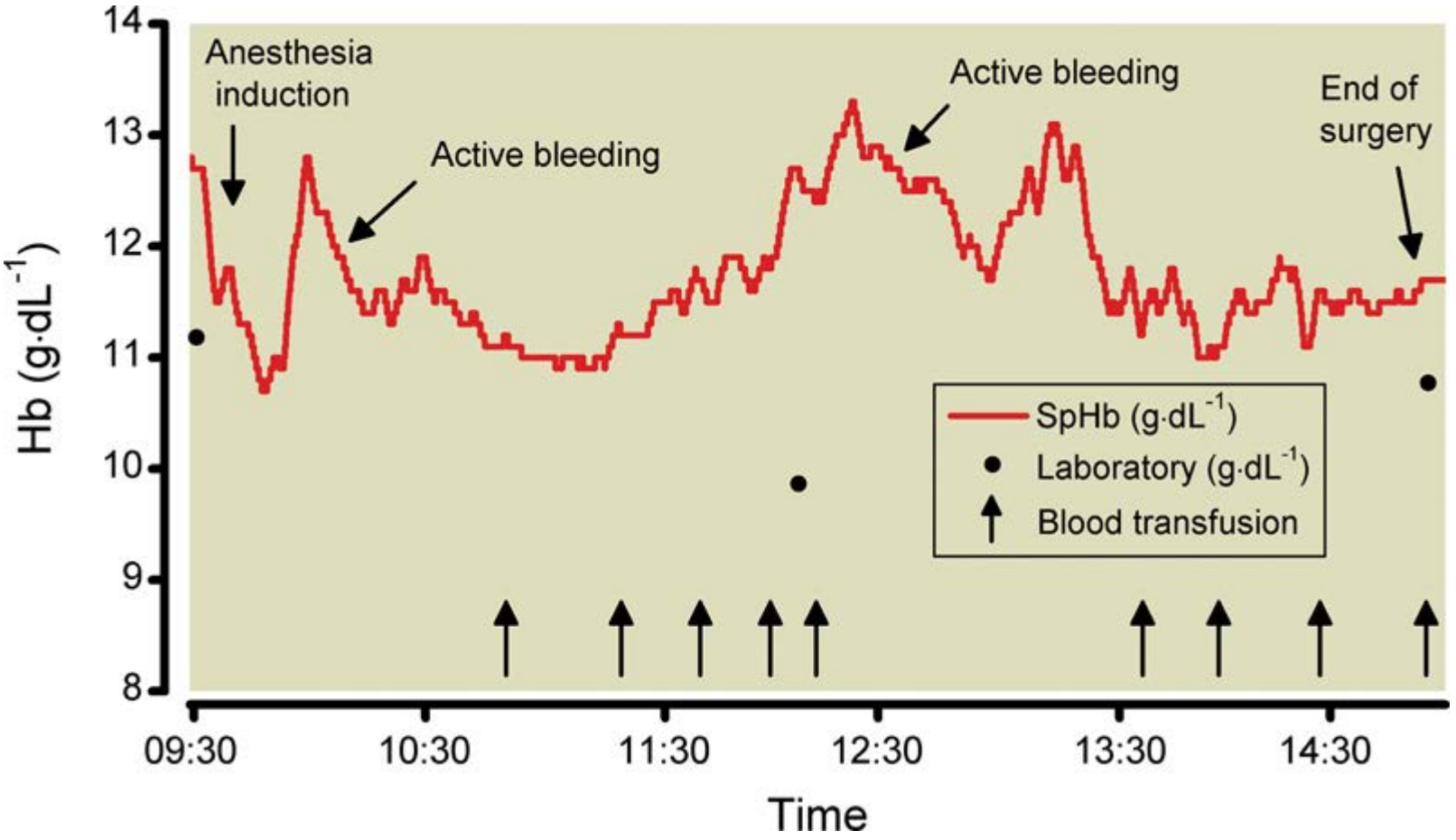
Patient (blood) management



Comparison of the Accuracy of Noninvasive Hemoglobin Monitoring by Spectrophotometry (SpHb) and HemoCue® with Automated Laboratory Hemoglobin Measurement

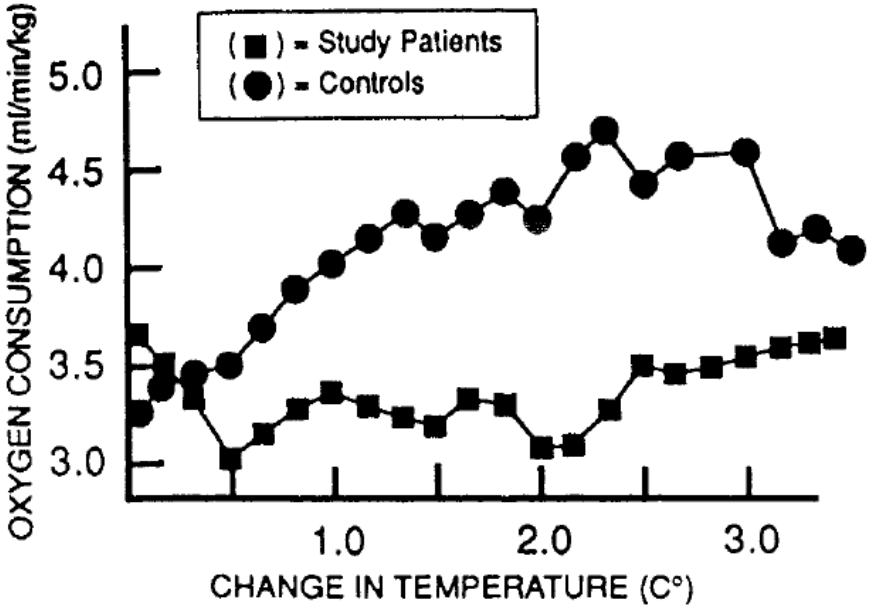
Lionel Lamhaut, M.D.,* Roxana Apriotesei, M.D.,† Xavier Combes, M.D., Ph.D.,* Marc Lejay, M.D.,† Pierre Carli, M.D.,‡ Benoît Vivien, M.D., Ph.D.*

Anesthesiology 2011; 115:548–54



Oxygen consumption

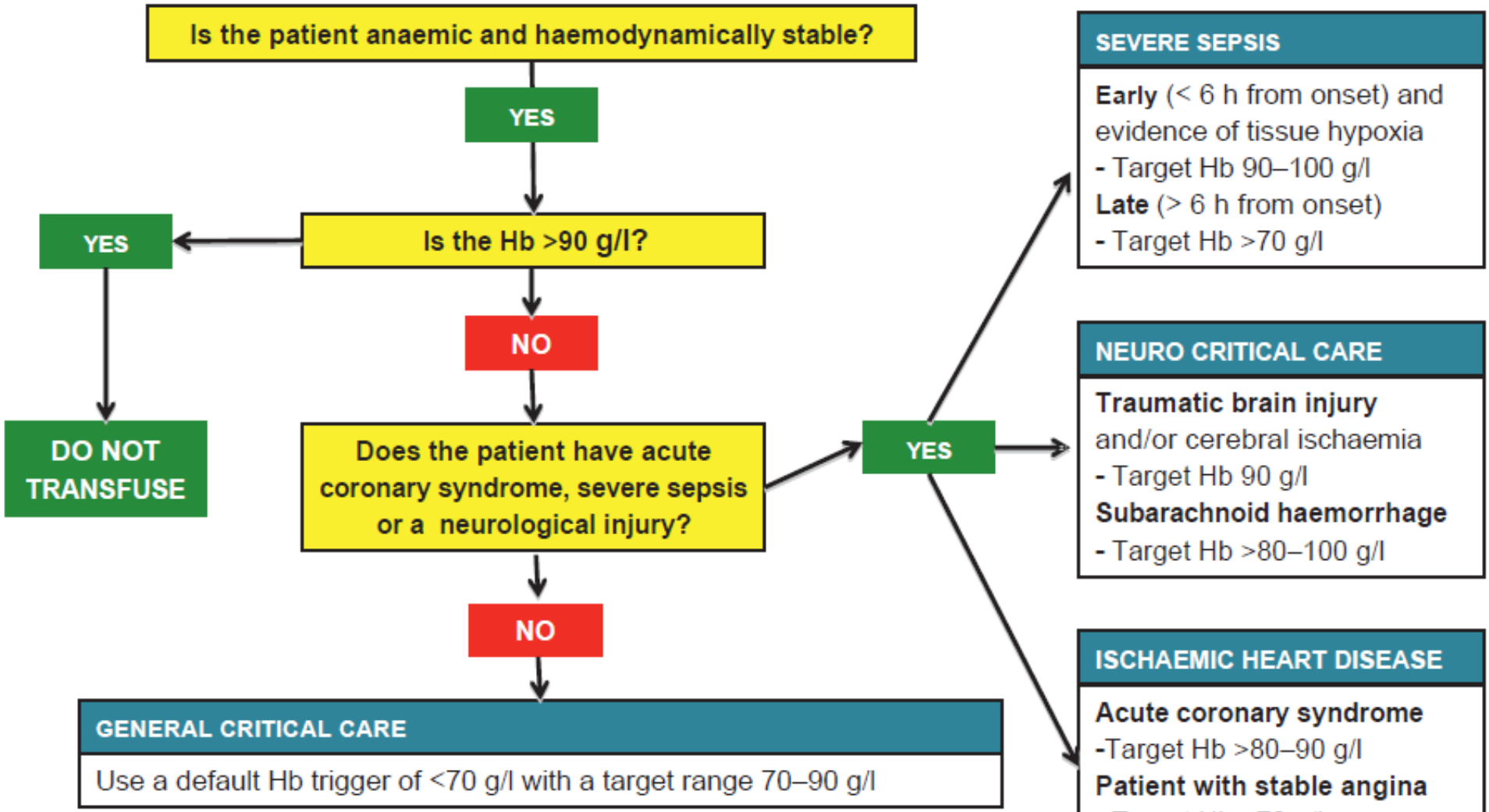
- In impending respiratory failure, up to 25% of O_2 consumption can be related to the work of breathing.
- Each degree rise in temperature increases O_2 consumption of 13%, shivering add to this
- Activity and nursing
- Drugs



Biochemical characteristics of anaemia in the critically ill.

	Change	Comment
Serum iron	Decreased	Similar to chronic disease
Iron binding capacity	Decreased	
Ferritin	Increased	Acute phase protein
Transferrin	Decreased	
Soluble transferrin receptor	Normal	Increase represents iron deficiency or new erythropoiesis
B12 and folate	Normal	
[Erythropoietin]	Slight increase	Inappropriately low for severity of anaemia, related to renal impairment and inflammation

It appears on balance that a combination of iron supplementation and erythropoietin therapy can modestly decrease transfusion requirements negligible when a transfusion trigger of 70 g/l is used. No difference in patient outcomes has been demonstrated, except for a possible decrease in mortality among trauma patients



Danilo Radrizzani Anestesia e Rianimazione Legnano

Take home message

- O_2 delivery below 500 ml min^{-1} m^{-2} limits O_2 uptake
- Optimize hemostasis
  - Assess coagulation and correct when indicated
- Conserve blood
  - Surgical hemostasis, quantitative evaluation, autotrasfusion, limit diagnostic
- Manage anemia
  - Detect it early, minimize O2 consumpion, modify trigger to transfusion according to the patient


Thanks for the attention