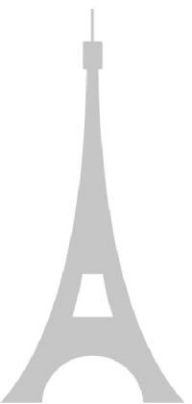




PHYSIOPATHOLOGIE DES REDFLAGS

Dr Nicolas PERON

MIR HEGP



réanimation 2024

PARIS 12-14 JUIN

DÉCLARATION DE LIENS D'INTÉRÊT POTENTIELS



réanimation 2024
PARIS 12-14 JUIN

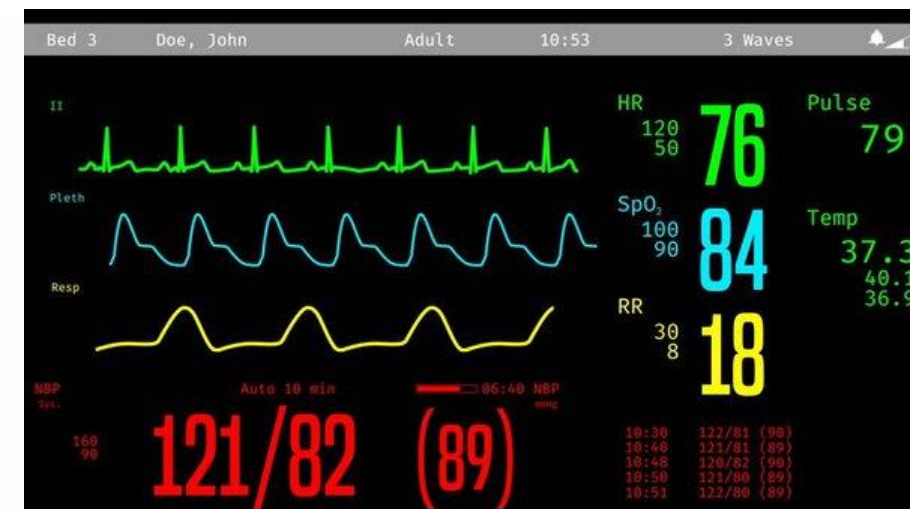
Péron Nicolas, Paris

☒ Je n'ai pas de lien d'intérêt potentiel à déclarer

Introduction



réanimation 2024
PARIS 12-14 JUIN



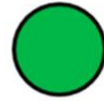
C'est risqué !?



réanimation 2024
PARIS 12-14 JUIN

Type of Potential Safety Events	No. of Studies, Reporting these Events (%)	No. of Patients	No. of Mobilization/ Rehabilitation Sessions	No. of Reported Events (% of Mobilization/ Rehabilitation Sessions)
Fall	27 (57)	5,972	16,342	11 (0.07)
Endotracheal tube removal	28 (58)	6,303	17,148	2 (0.01)
Intravascular catheter event*	31 (65)	6,134	16,397	35 (0.2)
Other catheter or tube removal	25 (52)	4,959	15,761	15 (0.09)
Cardiac arrest	26 (54)	5,830	14,438	4 (0.03)
Hemodynamic changes	33 (69)	6,593	18,083	126 (0.7)
Desaturation [†]	33 (69)	5,753	16,487	78 (0.5)
Other [‡]	32 (67)	6,579	17,132	312 (1.8)

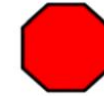
Nydahl, CCM, 2014



Low risk of an adverse event.
Proceed as usual according to each ICU's protocols and procedures.



Potential risk and consequences of an adverse event are higher than green, but may be outweighed by the potential benefits of mobilization.
The precautions or contraindications should be clarified prior to any mobilization episode. If mobilized, consideration should be given to doing so gradually and cautiously.



Significant potential risk or consequences of an adverse event.
Active mobilization should not occur unless specifically authorized by the treating intensive care specialist in consultation with the senior physical therapist and senior nursing staff.

- Le risque d'évènement indésirable est rare (1-3%)
- Quels sont les risques potentiels ?

PARIS 12-14 JUI

4S Algorithm for Cardiac Arrest:

- Système Cardio-vasculaire (État hémodynamique):**
 - MAP ≤ 65
 - Below target perfusion
 - Spinal precautions
 - Intracranial pressure > 20 mmHg
 - and/or
 - Arterial blood gas
 - in d
- Système respiratoire:**
 - Percutaneous oxygen saturation
 - bleeding
- Métabolique Et Neurologique:**
 - Greater than level
 - Mode HF or
 - Surgical
 - Unstable/unstabilized major fracture
 - Pelvic
 - Spinal
 - Lower limb long bone
 - Large open surgical wound
 - Chest/sternum^a
 - Abdomen^a
 - Transvenous or epicardial pacemaker:
 - Dependent rhythm
 - Uncontrolled seizures
- Other Indicators:**
 - Femoral IABP
 - ECMO:
 - 5 or subclavian (not single bicaval dual
 - ulae)
 - 0 bpm
 - ic stenosis
 - ongoing chest pain and/or
 - dynamic EKG changes)

Legend:

- Green Circle: Good/Target
- Red Octagon: Bad/Not Target
- Yellow Triangle: Caution/Borderline

Une évidence



réanimation 2024
PARIS 12-14 JUIN

Surgical		
Unstable/unstabilized major fracture Pelvic Spinal Lower limb long bone		
Large open surgical wound Chest/sternum ^a Abdomen ^a		
Known uncontrolled active bleeding		

Intracranial pressure		
Active management of intracranial hypertension, with ICP not in desired range		
Spinal precautions (pre-clearance or fixation)		
Uncontrolled seizures		

Transvenous or epicardial pacemaker:		
Dependent rhythm		
Stable underlying rhythm		
Prone positioning ^d		

Level of consciousness		
Patient drowsy, calm or restless (e.g., RASS -1 to +1)		
Patient lightly sedated or agitated (e.g., RASS -2 or +2)		
Patient unrousable or deeply sedated (e.g., RASS <-2)		
Patient very agitated or combative (e.g., RASS >+2)		



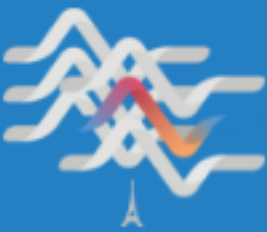
CARDIAQUE ET HÉMODYNAMIQUE



réanimation 2024

PARIS 12-14 JUIN

Mobilisation ≈ Effort

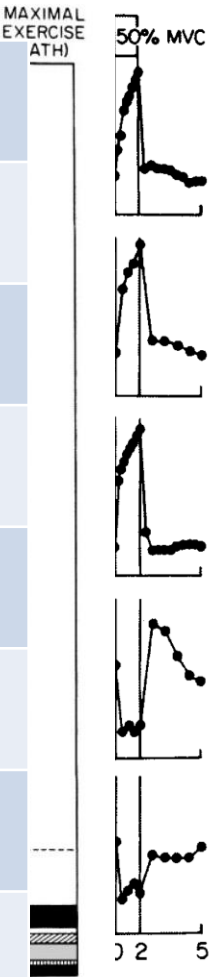


réanimation 2024
PARIS 12-14 JUIN

↘ Paro

↗ extr
0

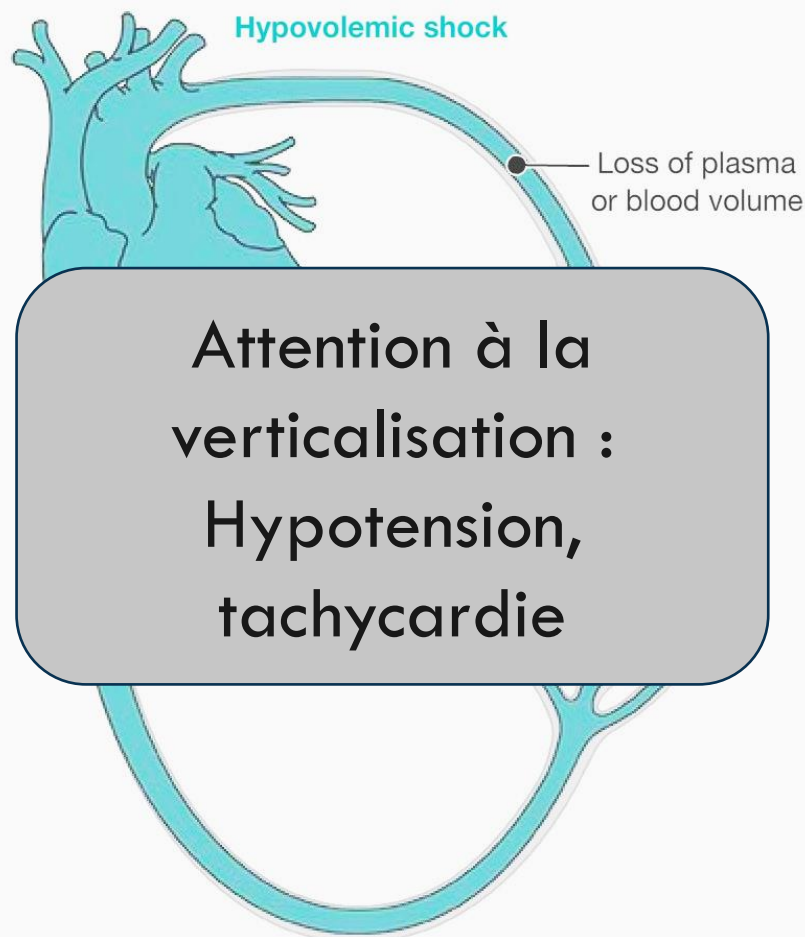
Fréquence cardiaque	↗
Volume d'éjection systolique (inotropisme, chronotropisme)	↗
Débit cardiaque ($Q_c = FC \times VES$)	↗↗
Pression artérielle systolique	↗
Pression artérielle diastolique	→
Pression artérielle moyenne	→↗
Résistance vasculaire périphérique	↘
% débit sanguin vers les muscles actifs	↗



Les états de choc



réanimation 2024
PARIS 12-14 JUIN



↘ Retour veineux
↘ Précharge
↘ VES

↗ FC
↗ RVP
Redistribution
perfusion

Bradycardia:

Requiring pharmacological treatment (e.g., isoprenaline) or awaiting emergency pacemaker insertion



Any stable tachyarrhythmia:

Ventricular rate >150 bpm



Ventricular rate 120 to 150 bpm



Any tachyarrhythmia with ventricular rate < 120 bpm



MAP^b:

Below target range and causing symptoms



Below target range despite support (vasoactive and/or mechanical)



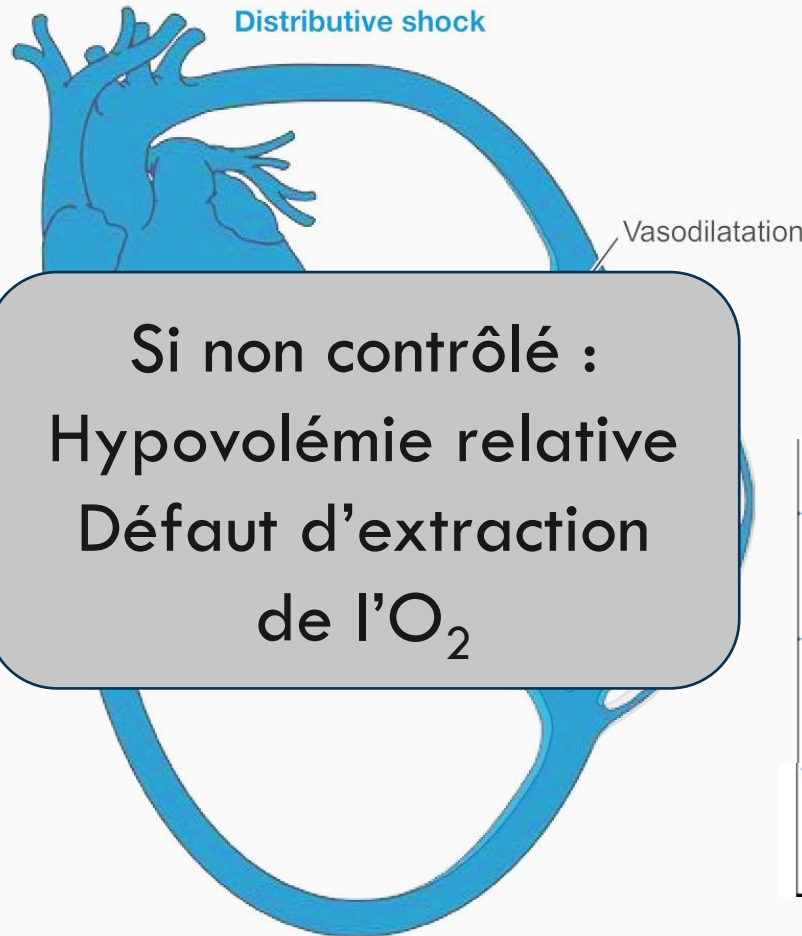
Les états de choc



réanimation 2024
PARIS 12-14 JUIN

Vasoplégie
↳ Retour veineux
↳ Précharge
↳ VES

↗ FC
↳ RVP
Hypoxie tissulaire



Any stable tachyarrhythmia:

Ventricular rate >150 bpm



Ventricular rate 120 to 150 bpm



Any tachyarrhythmia with ventricular rate < 120 bpm



MAP^b:

Below target range and causing symptoms



Below target range despite support (vasoactive and/or mechanical)



Greater than lower limit of target range on high level support



Les états de choc



réanimation 2024
PARIS 12-14 JUIN

Type de choc	Débit cardiaque	Retour veineux	Résistance vasculaire systémique
Hypovolémique	↘	↘	↗
Distributif (septique)	↗ ou ↘	↘	↘
Obstructif (embolie pulmonaire)	↘	↗	→
Cardiogénique	↘	↗	↗ ou ↘

- Crise hypertensive : Risque majoration par stimulation sympathique

- Effort, douleur, inconfort

Intravenous antihypertensive therapy for hypertensive emergency ^a		
--	---	---



- Insuffisance coronarienne :

- Inadéquation entre les besoins myocardiques en O_2 à l'effort et la capacité

Known or suspected severe aortic stenosis		
Cardiac ischemia (defined as ongoing chest pain and/or dynamic EKG changes)		



- Rétrécissement aortique serré **symptomatique** :

- Diminution débit cardiaque, syncope

A large, stylized graphic on the left side of the image. It features a light blue pulse line (resembling an ECG) that winds through the frame. Overlaid on this pulse line are several light blue, stylized hands, some of which are holding or supporting the pulse line. The hands are depicted with simple, rounded fingers and palms. The entire graphic is set against a solid blue background.

RESPIRATOIRE

A small, stylized graphic of the Eiffel Tower, rendered in a light blue color, located in the bottom left corner of the image.

réanimation 2024

PARIS 12-14 JUIN

Effort et verticalisation



réanimation 2024
PARIS 12-14 JUIN

Variable	Rest	Mid-Exercise	Maximum Exercise
O ₂ Consumption (ml·min ⁻¹)	250	2,000	4,000
CO ₂ Output (ml·min ⁻¹)	200	1,950	4,500
Ventilation (l·min ⁻¹)	6	60	150
Systemic blood pressure (mm Hg)	110/70	180/75	230/80
Pulmonary artery systolic pressure (mm Hg)	25	28	35
Arterial PO ₂ (mm Hg)	90	90	89
Arterial PCO ₂ (mm Hg)	40	39	31
pH	7.4	7.39	7.10

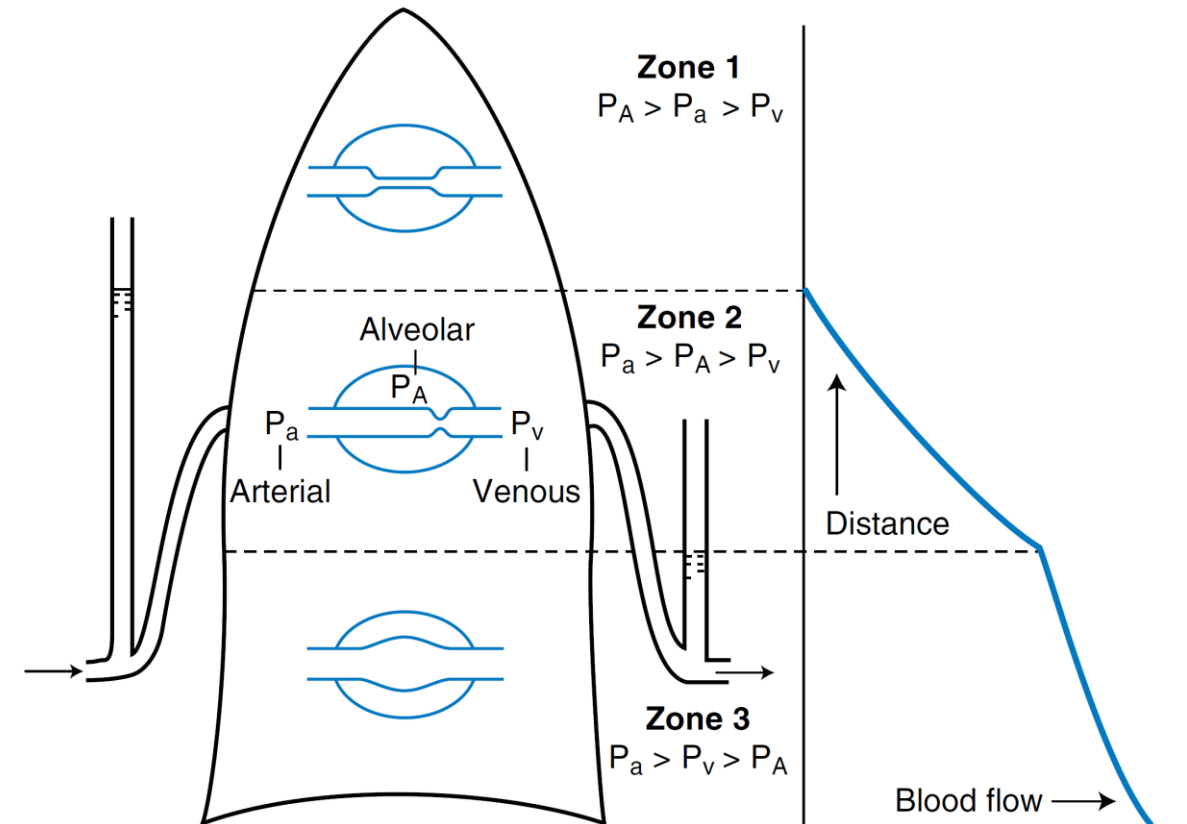
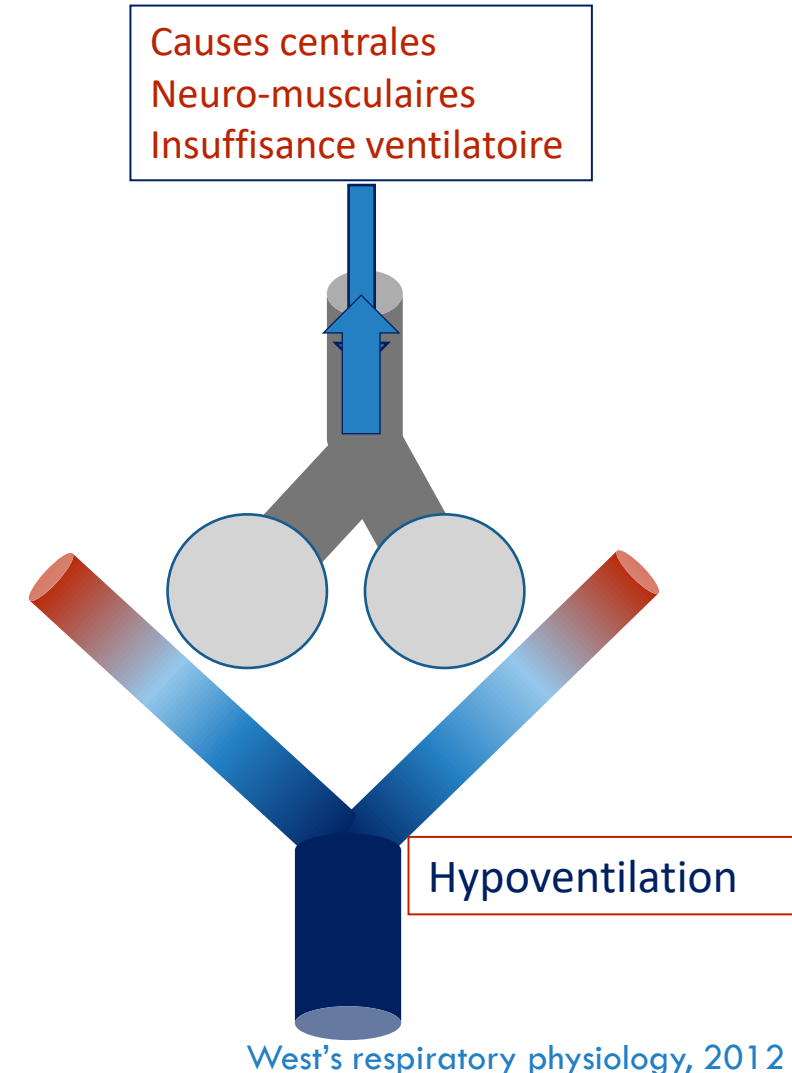
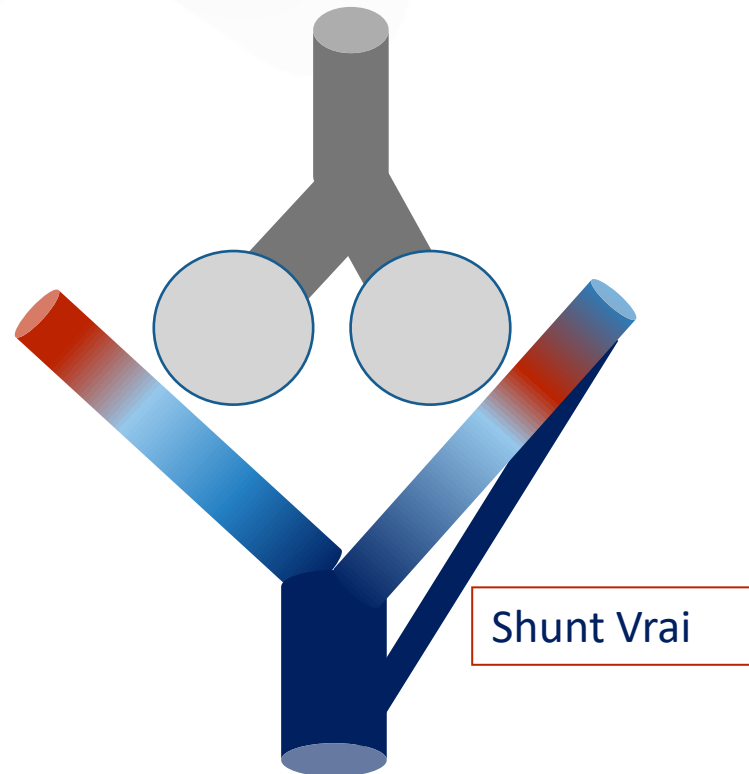
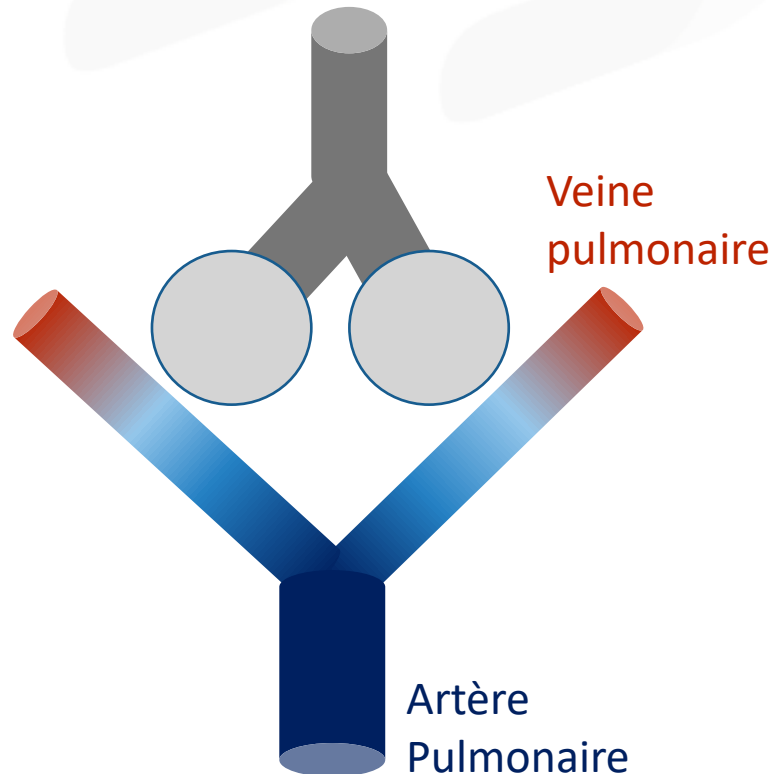


Figure 4.8. Explanation of the uneven distribution of blood flow in the lung, based on the pressures affecting the capillaries. See text for details.

Les atteintes respiratoires



réanimation 2024
PARIS 12-14 JUIN



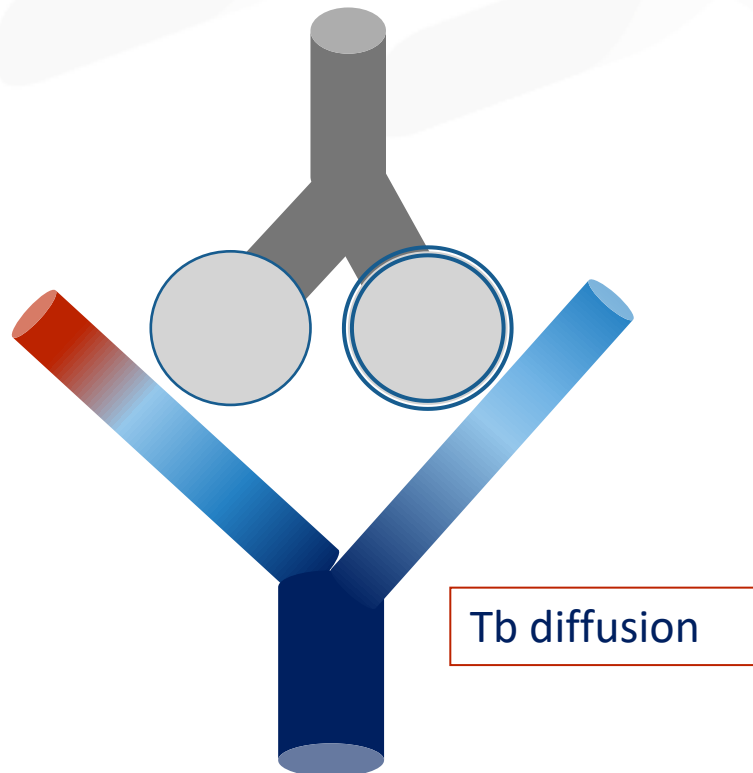
Les atteintes respiratoires



réanimation 2024
PARIS 12-14 JUIN

Altération membrane (PID)
Réduction surface échange
(Emphysème, HTAP)

Effet Shunt

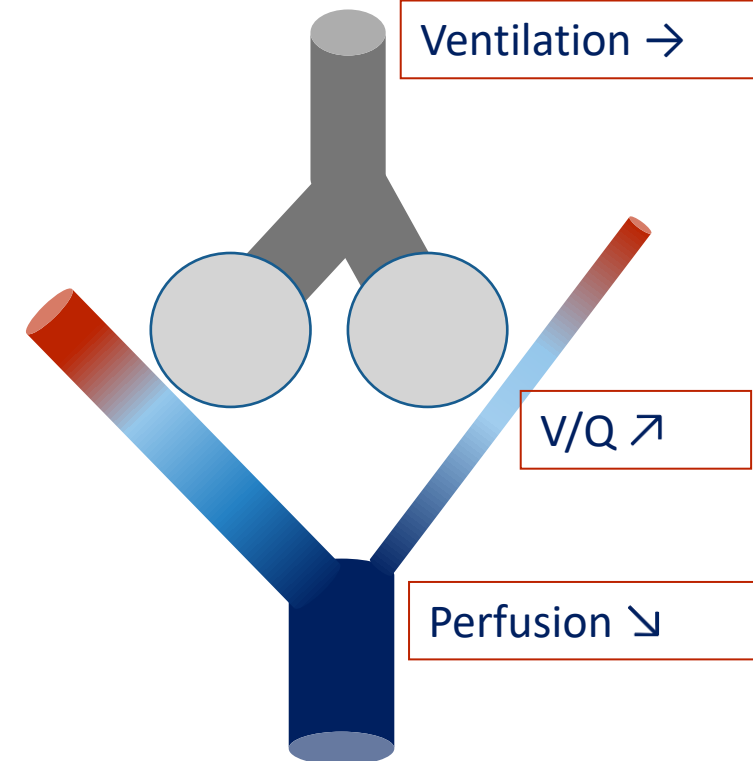


Ventilation $\searrow$

$V/Q \searrow\searrow$

Perfusion $\rightarrow$

Effet espace mort



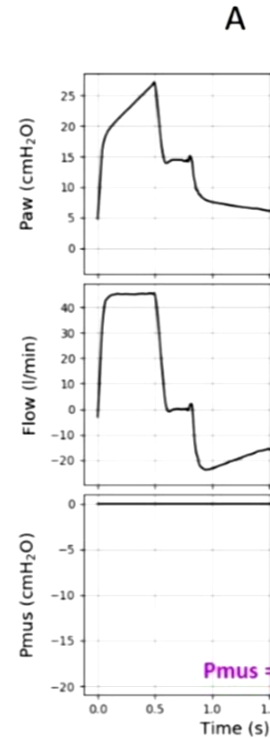
Dans le SDRA



réanimation 2024
PARIS 12-14 JUIN

- Hypoxémie multifactorielle
 - Effet de la PEEP
 - Equilibre instable le plus souvent
- Lors de la mobilisation :
 - Fréquence respiratoire
 - Changement rapport V/Q
 - Travail inspiratoire – P-SILI

Respiratory parameters			
Fraction of inspired oxygen			
≤ 0.6		●	●
> 0.6		▲	▲
Percutaneous oxygen saturation			
$\geq 90\%$		●	●
$< 90\%^b$		▲	■
Respiratory rate			
≤ 30 bpm		●	●
> 30 bpm		▲	▲
Ventilation			
Mode HFOV		▲	■
PEEP			
≤ 10 cmH ₂ O		●	●
> 10 cmH ₂ O		▲	▲
Ventilator dysynchrony ^c		▲	▲

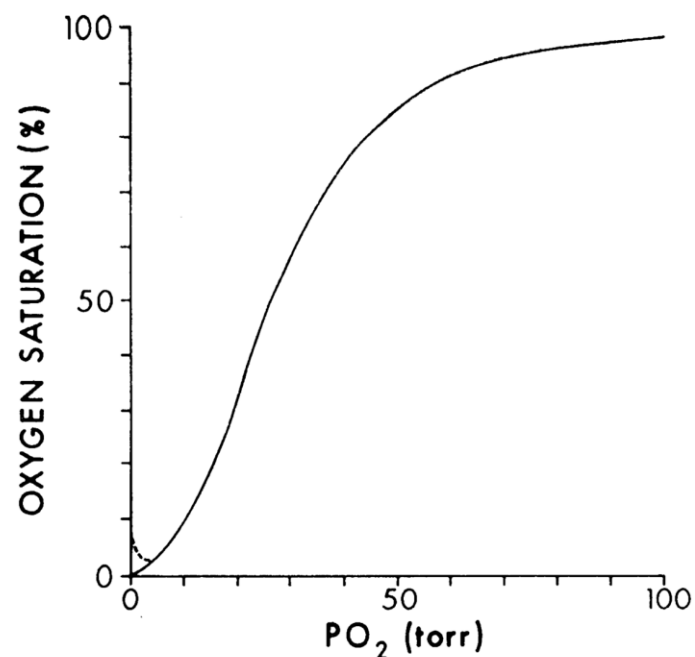


Courbe de dissociation de l'Hb



réanimation 2024
PARIS 12-14 JUIN

PaO ₂ (mmHg)	30	37,5	45	52,5	60	67,5	82,5	104	>127
SaO ₂ (%)	57,4	71,4	80,7	86,8	90,7	93,2	96,2	98,2	>99



Percutaneous oxygen saturation

≥ 90%

< 90%^b

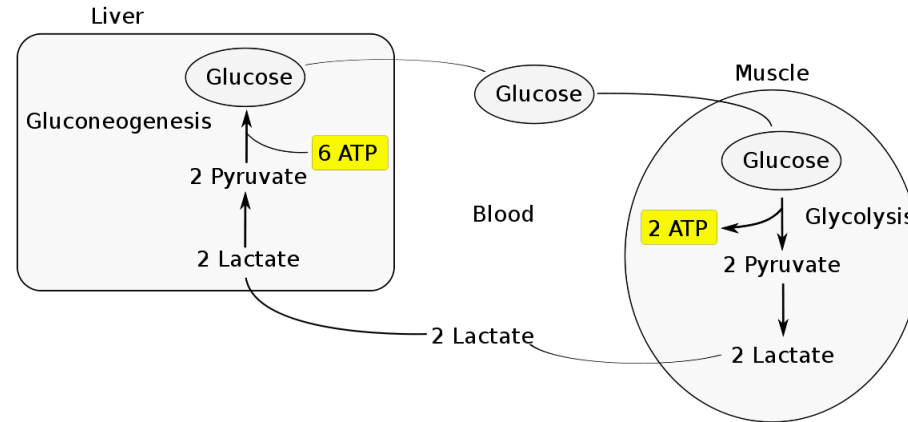


Shock of any cause with lactate $>4\text{mmol/L}$



Hypoxémie

Défaut
d'extraction
d' O_2



Bas débit
cardiaque

Production
musculaire
anaérobie

- La majorité des situations de réanimation ne sont pas des **Red Flags**.
- Il faut porter une attention particulière aux patients :
 - Dont la stabilité hémodynamique est incertaine
 - Dont la stabilité respiratoire est incertaine
- Comprendre les mécanismes physiopathologiques
 - Pour prévenir les évènements indésirables d'une mobilisation précoce
 - Et parfois s'abstenir

