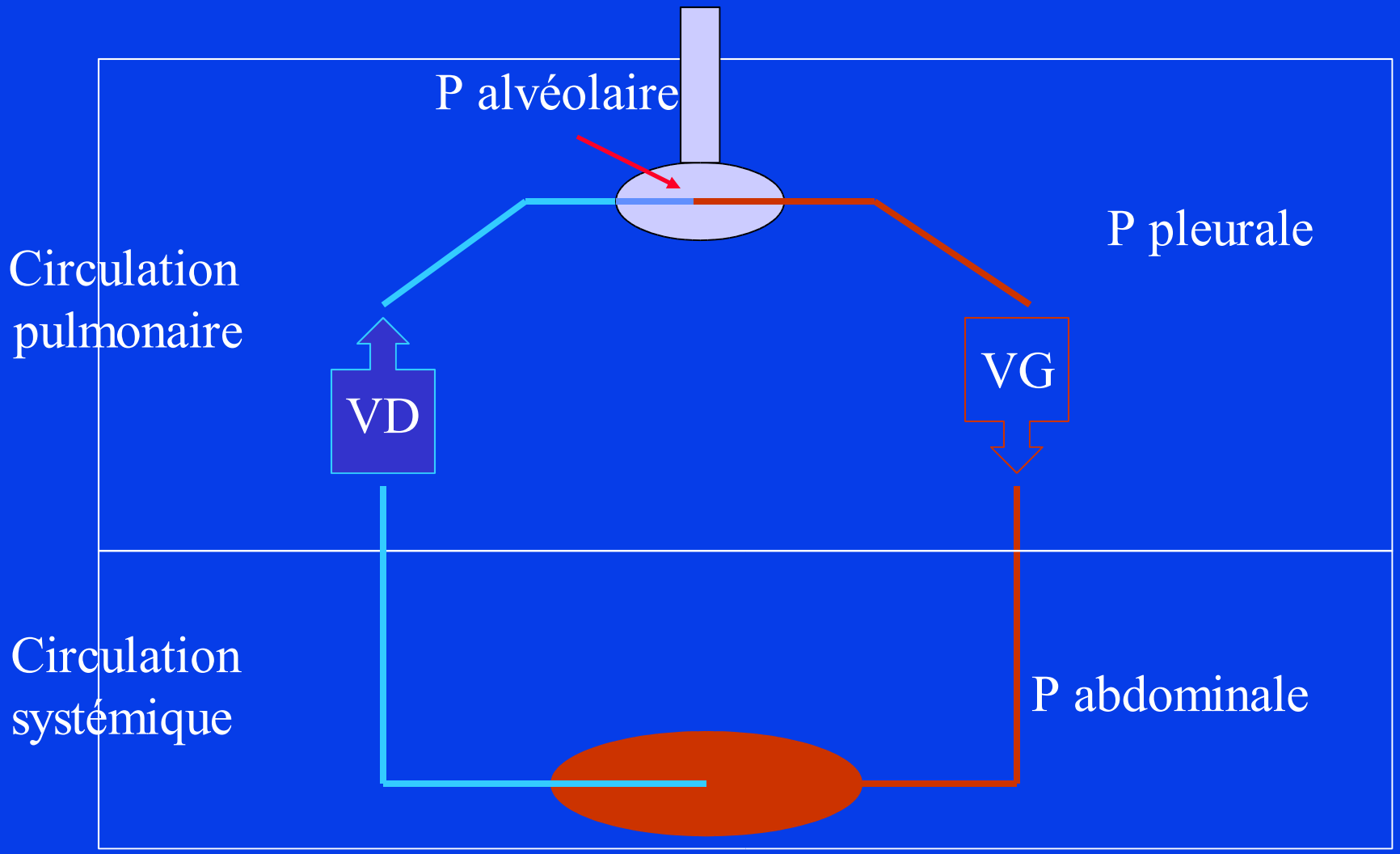
INTERACTIONS CARDIORESPIRATOIRES

Antoine Vieillard-Baron

Hôpital Ambroise Paré, Boulogne, France

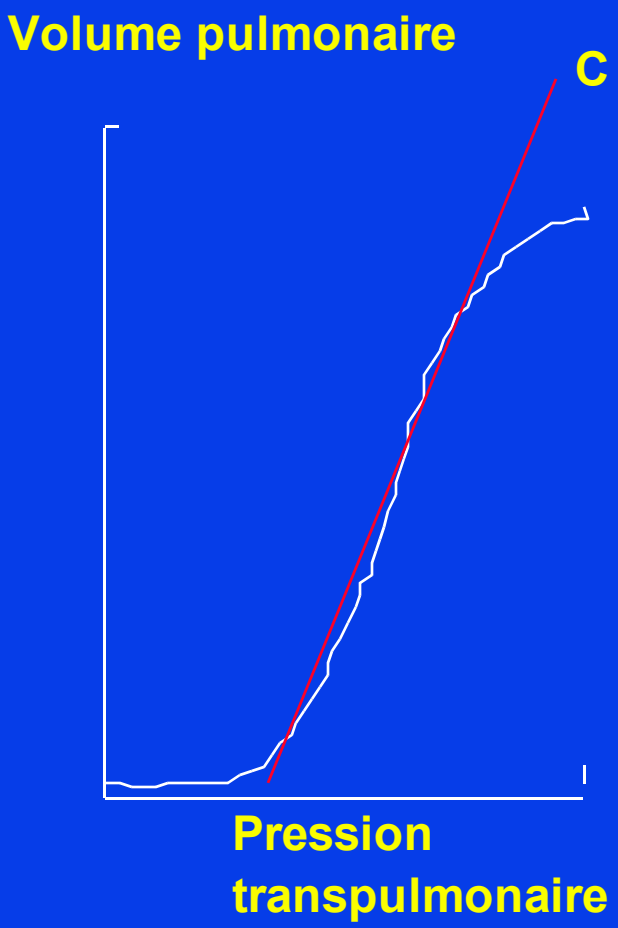
SCHEMA DE LA CIRCULATION



PRESSION TRANSPULMONAIRE

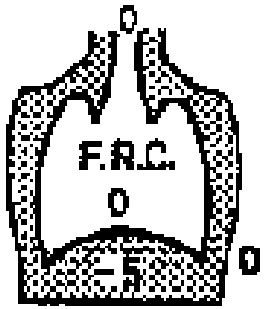
PTP = Palv - Ppl

C = ∆V / ∆PTP

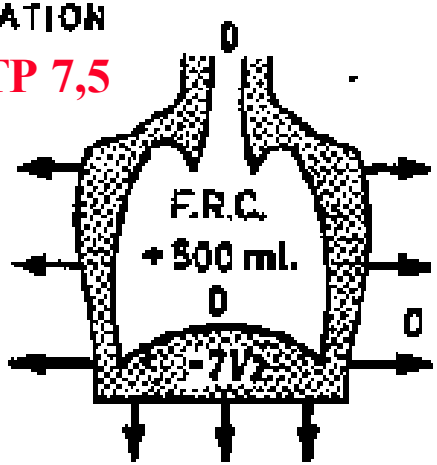


SPONTANEOUS RESPIRATION

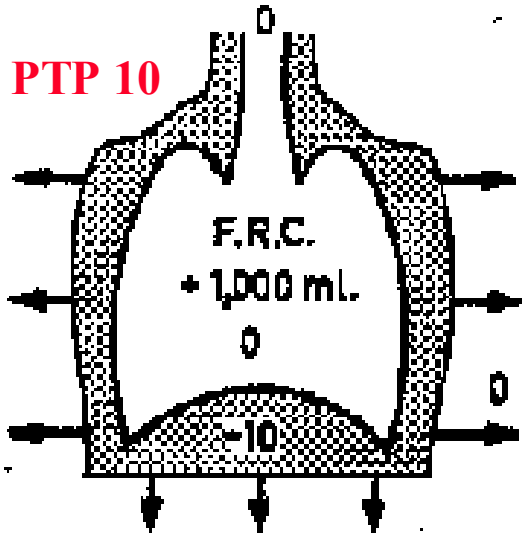
PTP 5



PTP 7,5

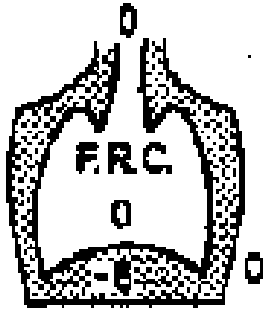


PTP 10



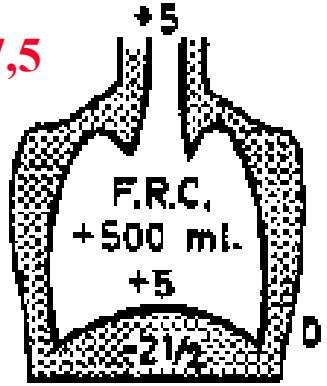
INTERMITTENT POSITIVE PRESSURE VENTILATION

PTP 5

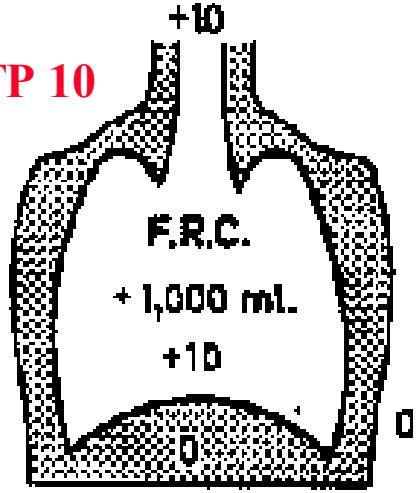


Figures denote pressure relative to atmosphere (cm H_2O)

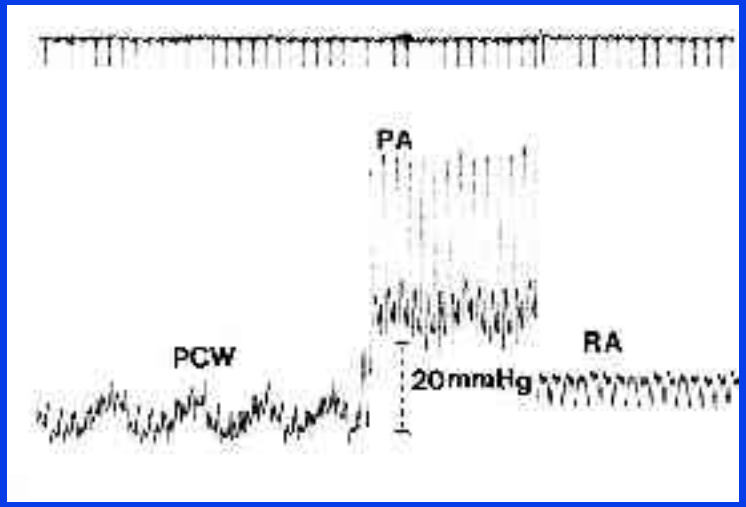
PTP 7,5



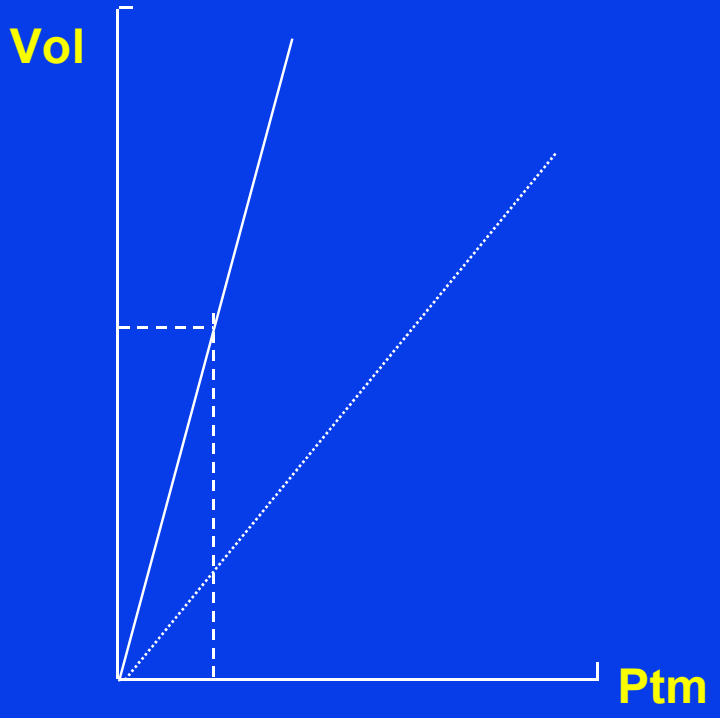
PTP 10



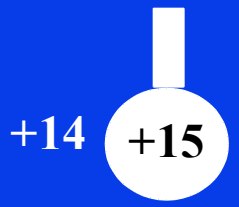
P INTRAVASCULAIRE
P TRANSMURALE

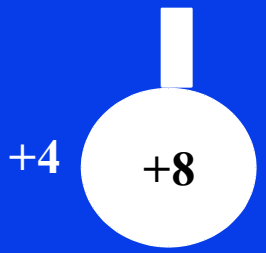


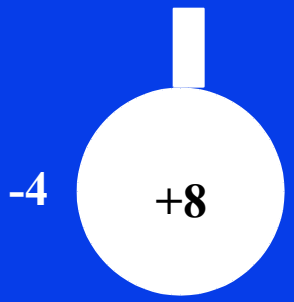
P intravasculaire
=
Pression mesurée par le KT



P transmurale
=
Pression de distension (Pint - Pext)



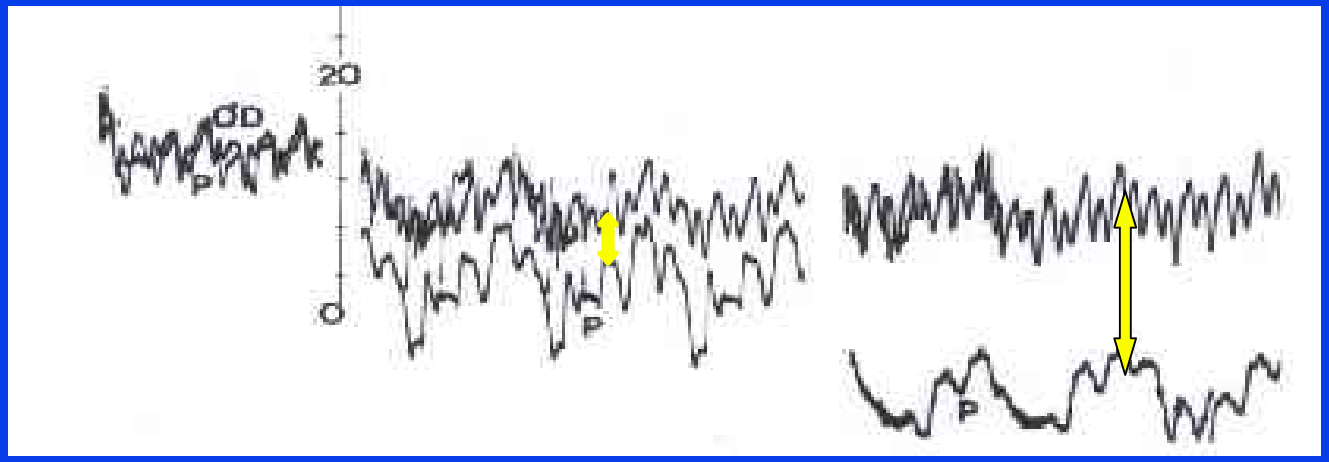




+1

+4

+12




I
30
20
10
0
45
30

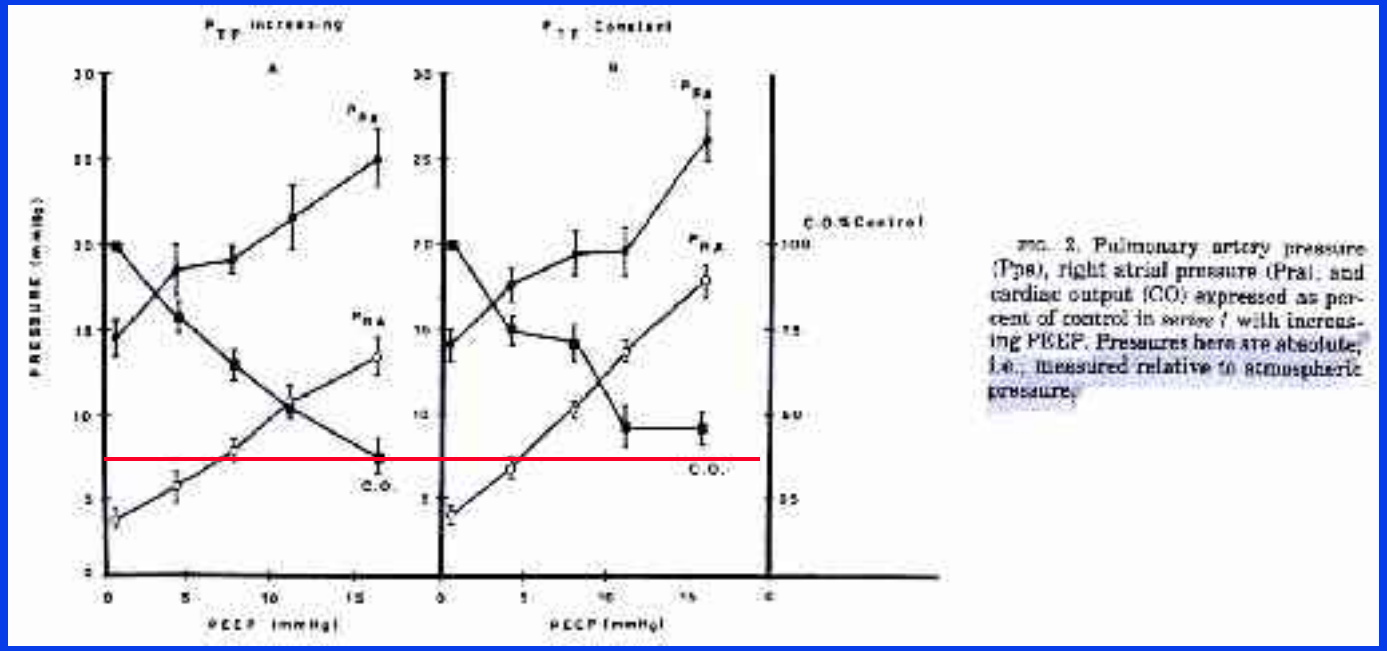


FIG. 2. Pulmonary artery pressure (Ppa), right atrial pressure (Pra), and cardiac output (CO) expressed as percent of control in series I with increasing PEEP. Pressures here are absolute, i.e., measured relative to atmospheric pressure.

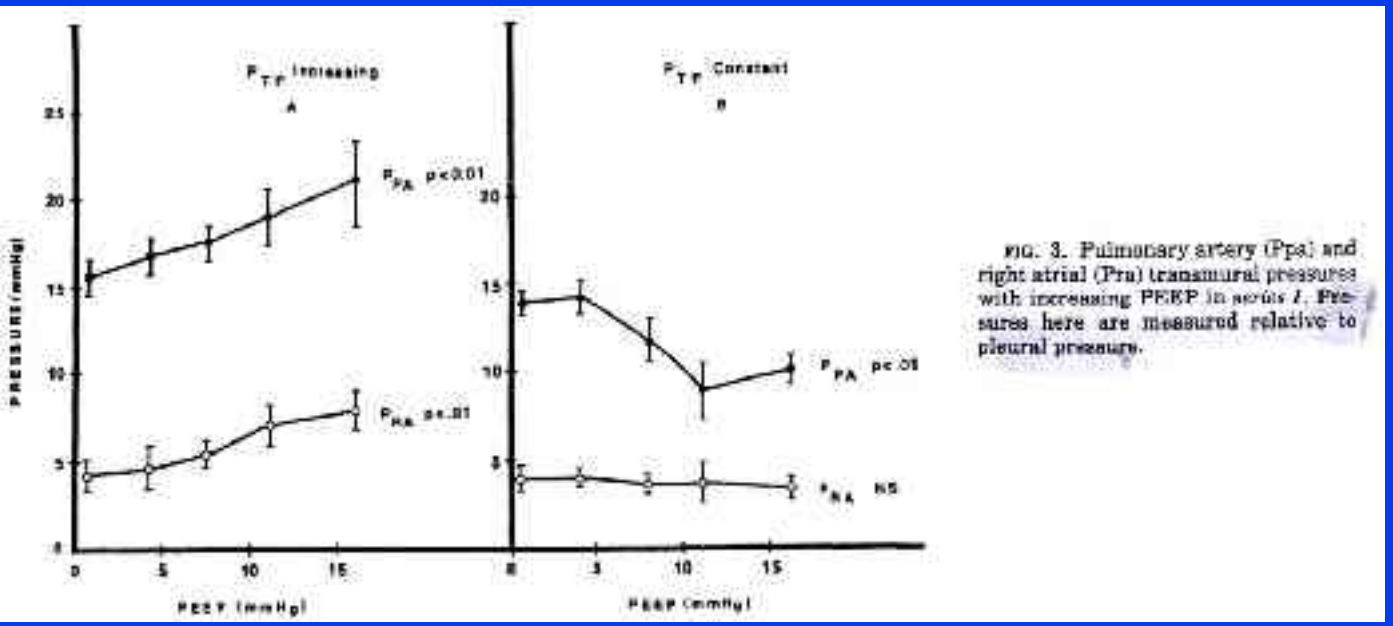


FIG. 3. Pulmonary artery (Ppa) and right atrial (Pra) transmural pressures with increasing PEEP in series I. Pressures here are measured relative to pleural pressure.

Scharf Am J Physiol 1977

PHENOMENES INSPIRATOIRES

- Diminution éjection VD
  - » Par diminution retour veineux systémique
  - » Par augmentation de la postcharge du VD

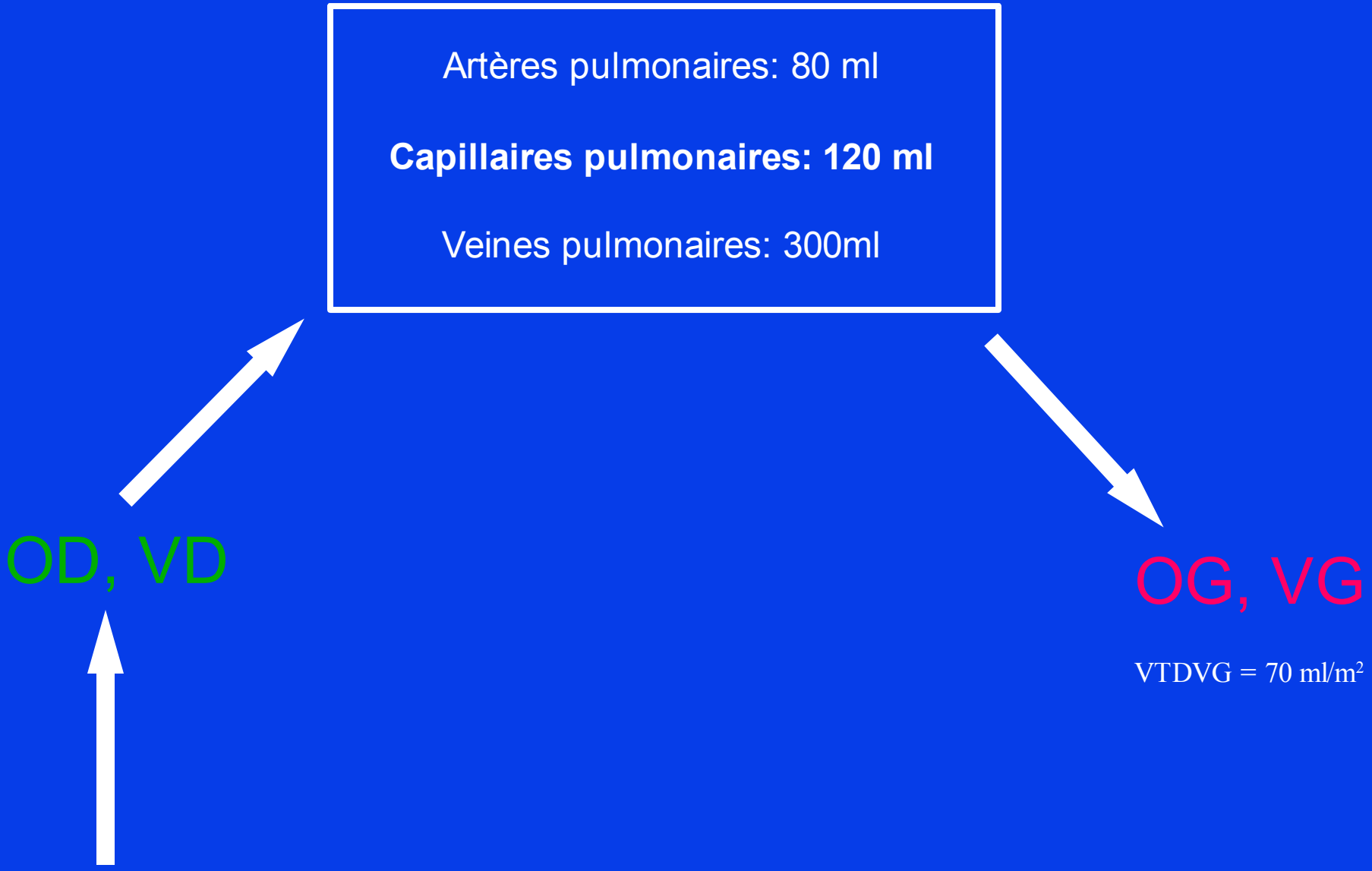
  => dDown

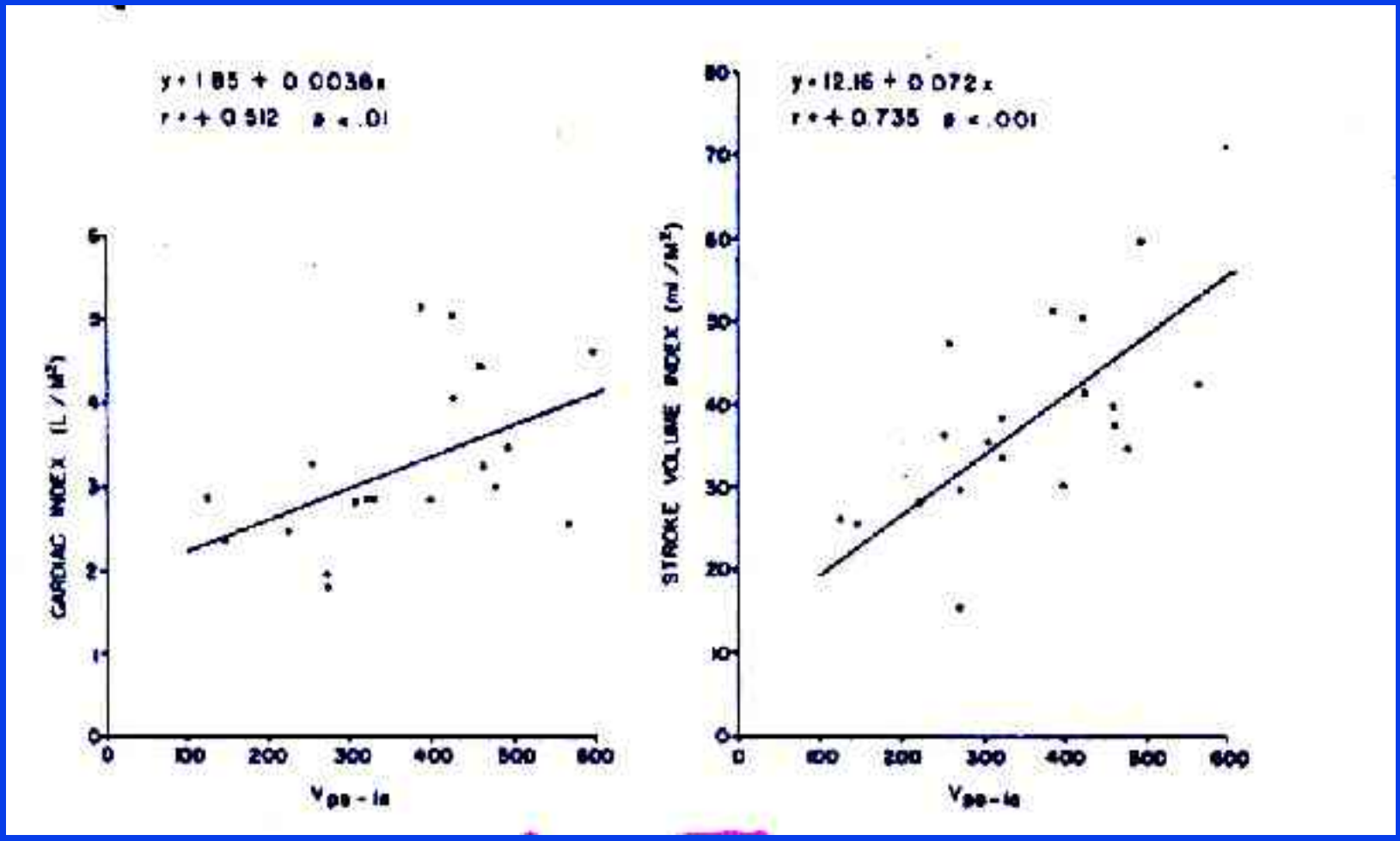
- Augmentation éjection VG
  - » Par augmentation précharge VG

  => dUp

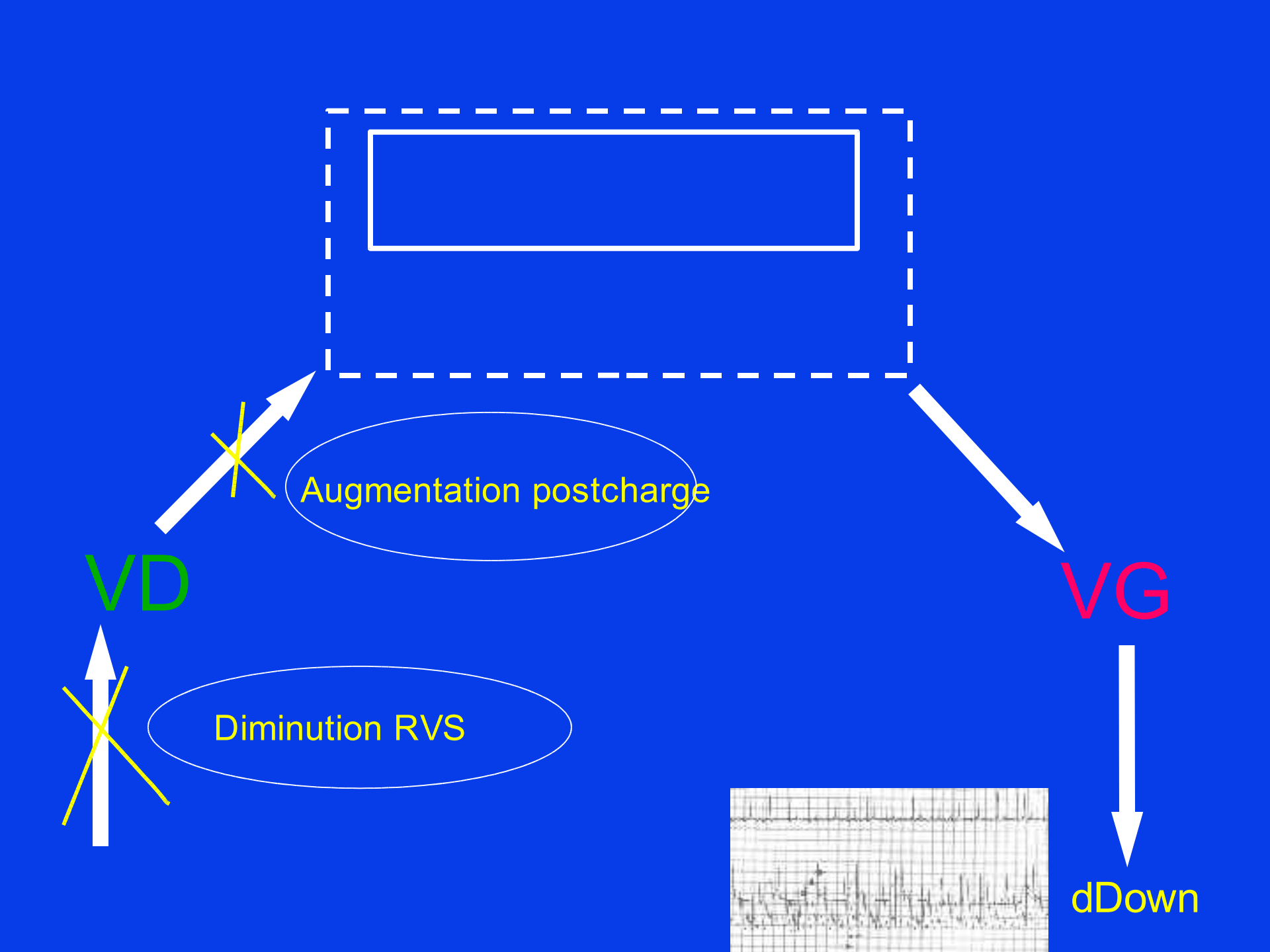
DIMINUTION INSPIRATOIRE DE L'EJECTION DU VD

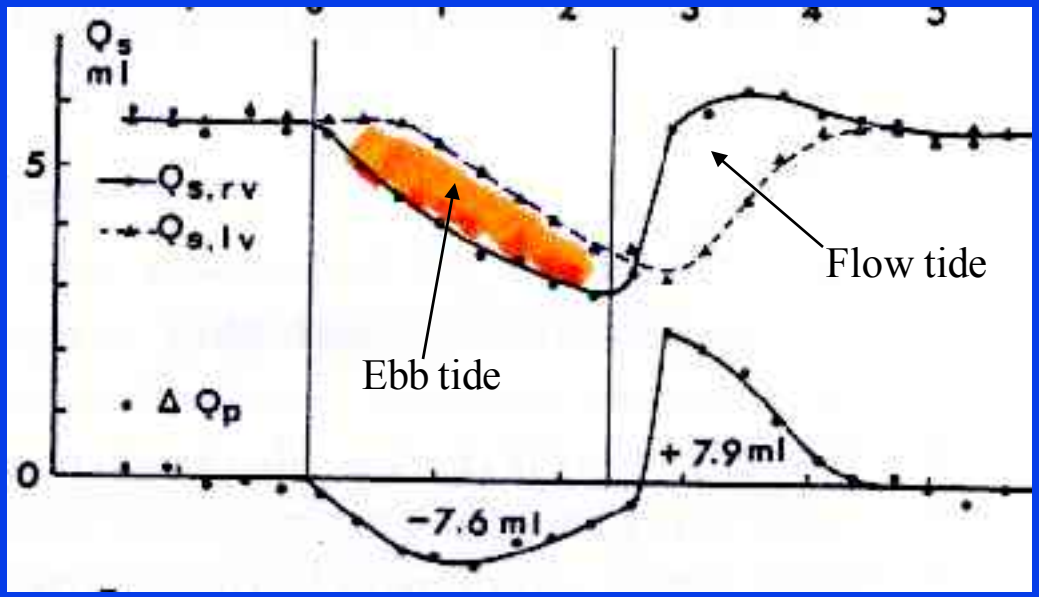
dDown


Artères pulmonaires: 80 ml
Capillaires pulmonaires: 120 ml
Veines pulmonaires: 300ml
OD, VD
OG, VG
VTDVG = 70 ml/m²

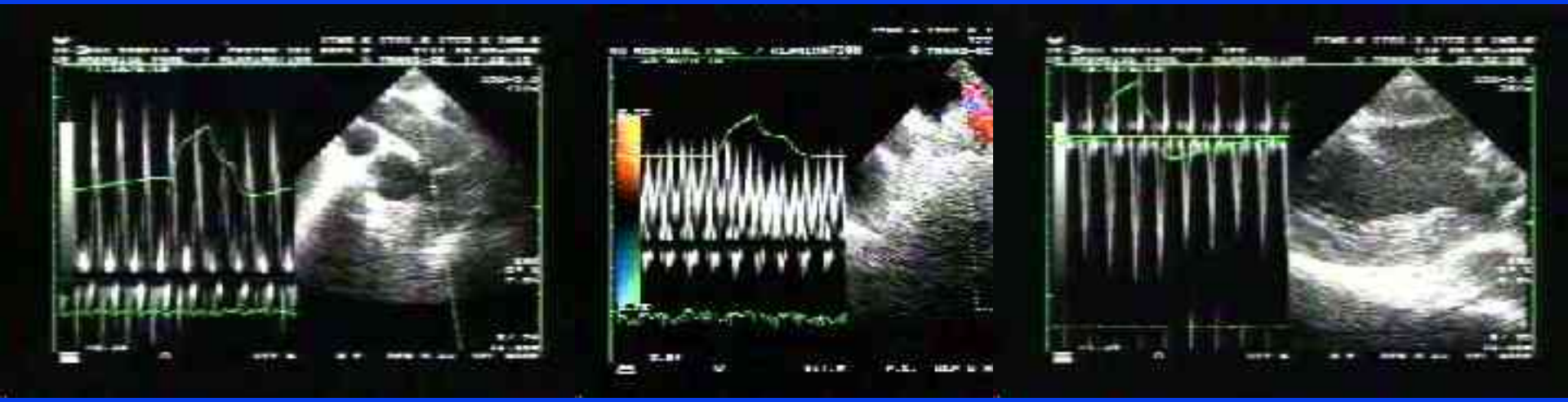


Milnor Circulation 1960


Augmentation postcharge
VD
VG
Diminution RVS
dDown



Vesprille Acta Anaesthesiol Scand 1990



I

MAREE BASSE

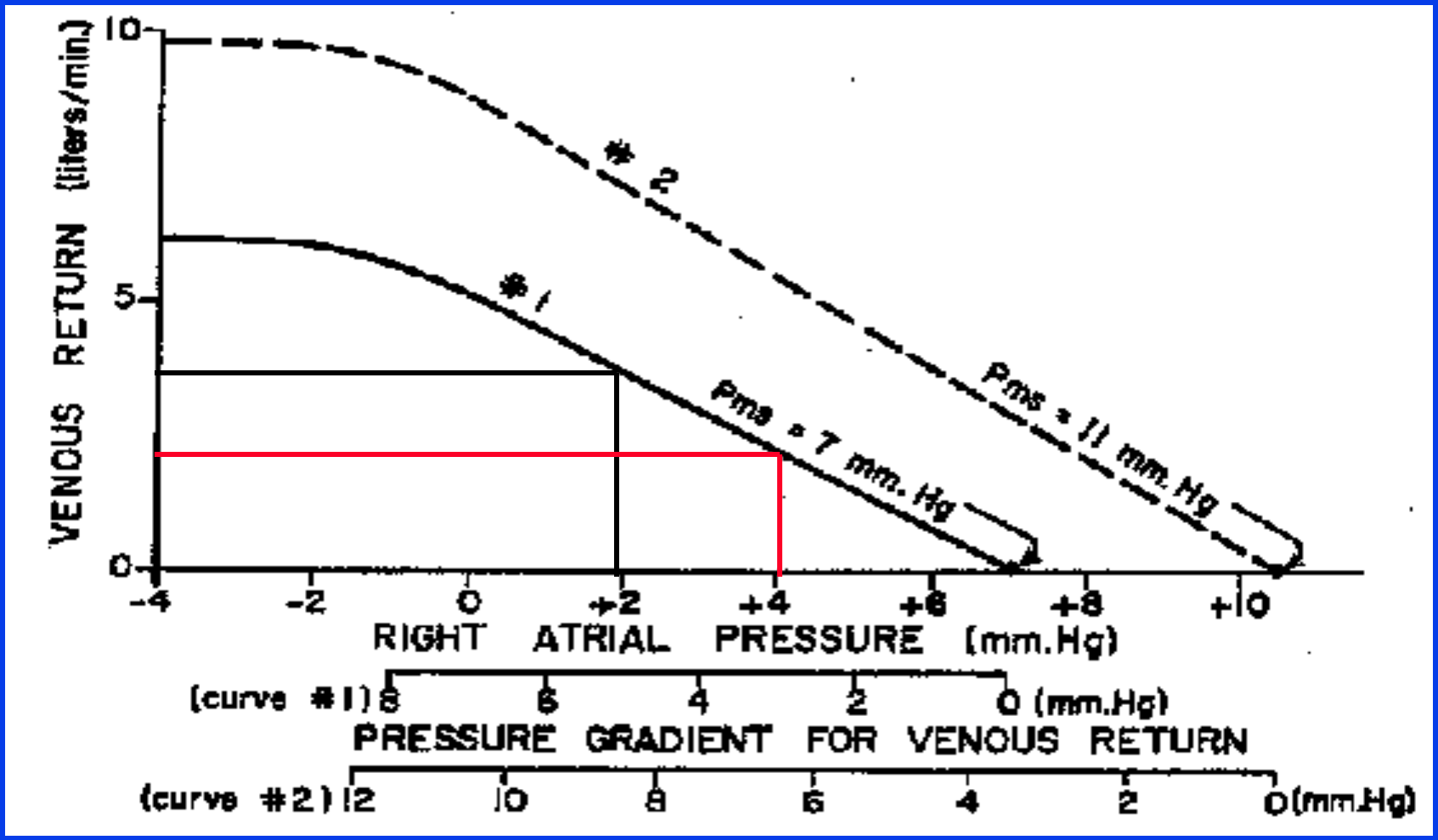
PAR DIMINUTION RETOUR VEINEUX SYSTEMIQUE

RETOUR VEINEUX SYSTÉMIQUE

Pression d'amont: pression moyenne systémique (P_{MS}), déterminée par la volémie et l'élastance du compartiment vasculaire.

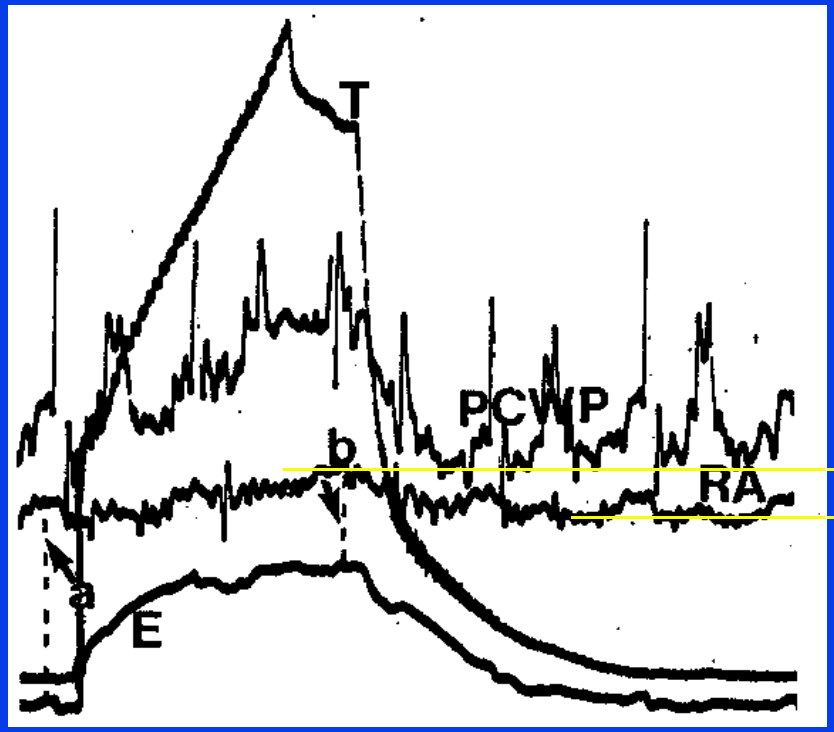
Pression d'aval: pression veineuse centrale (P_{VC})

Gradient de pression: $P_{amont} - P_{aval}$

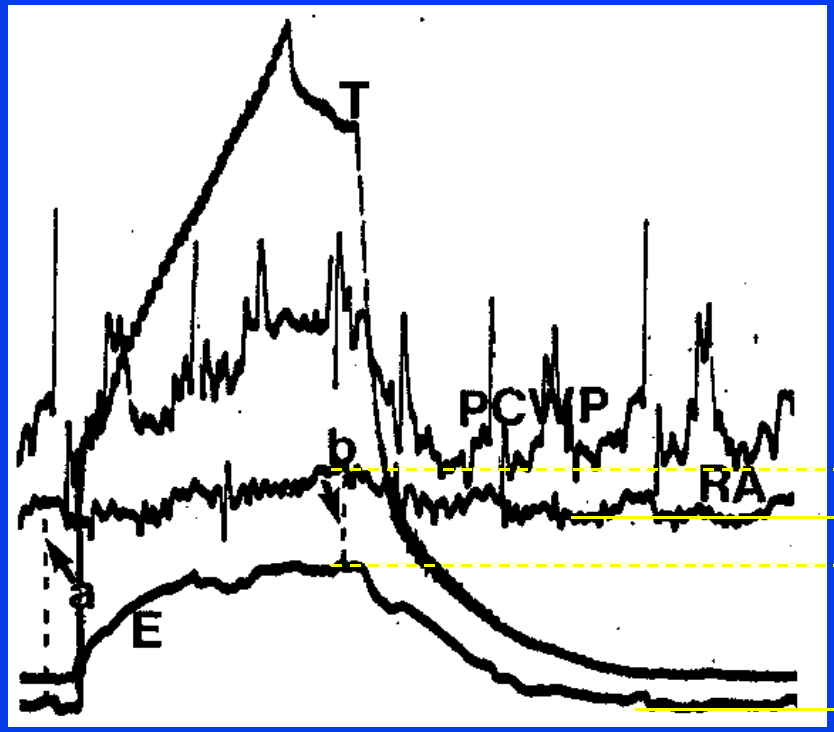


Guyton Physiol Rev 1955

L'élévation de la pression dans les voies aériennes se transmet à la cavité pleurale et entraîne une élévation de la P_{OD} intravasculaire



L'élévation de la pression dans les voies aériennes se transmet à la cavité pleurale et entraîne une réduction de la pression transmurale de l'OD

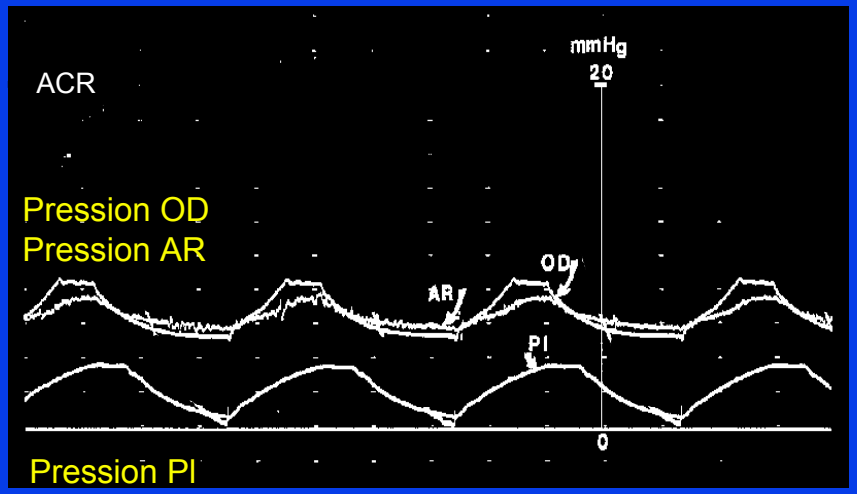


B' < B

B'

B

L'augmentation de la pression pleurale ne modifie pas le gradient favorable au retour veineux (PSM - P_{OD}).



L'augmentation de pression pleurale diminue le retour veineux par diminution de conductance. Zone collabable? Fessler AJRCCM 1991

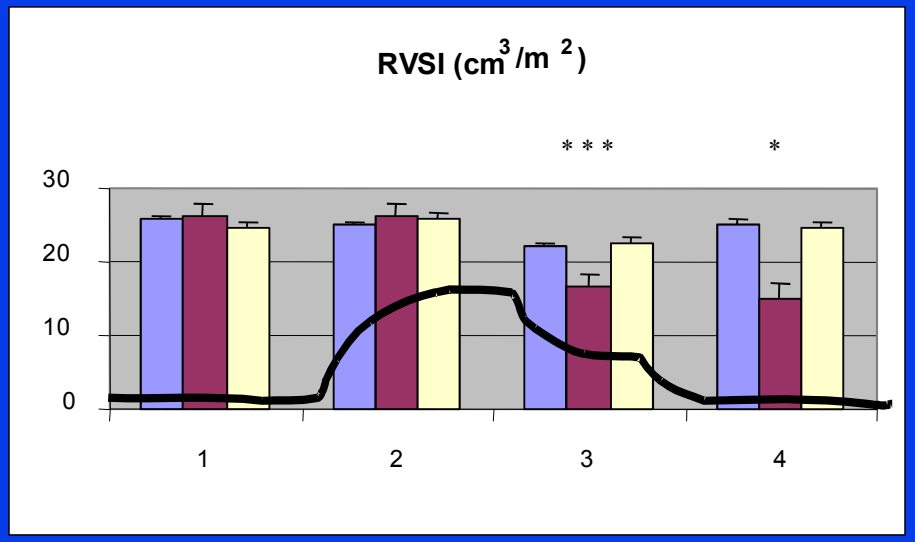
L'augmentation de la pression intra-thoracique lors de l'insufflation entraîne une diminution de la pression transmurale de la VCS qui devient plus faible que sa pression de fermeture

Basal
PAS 120 mmHg

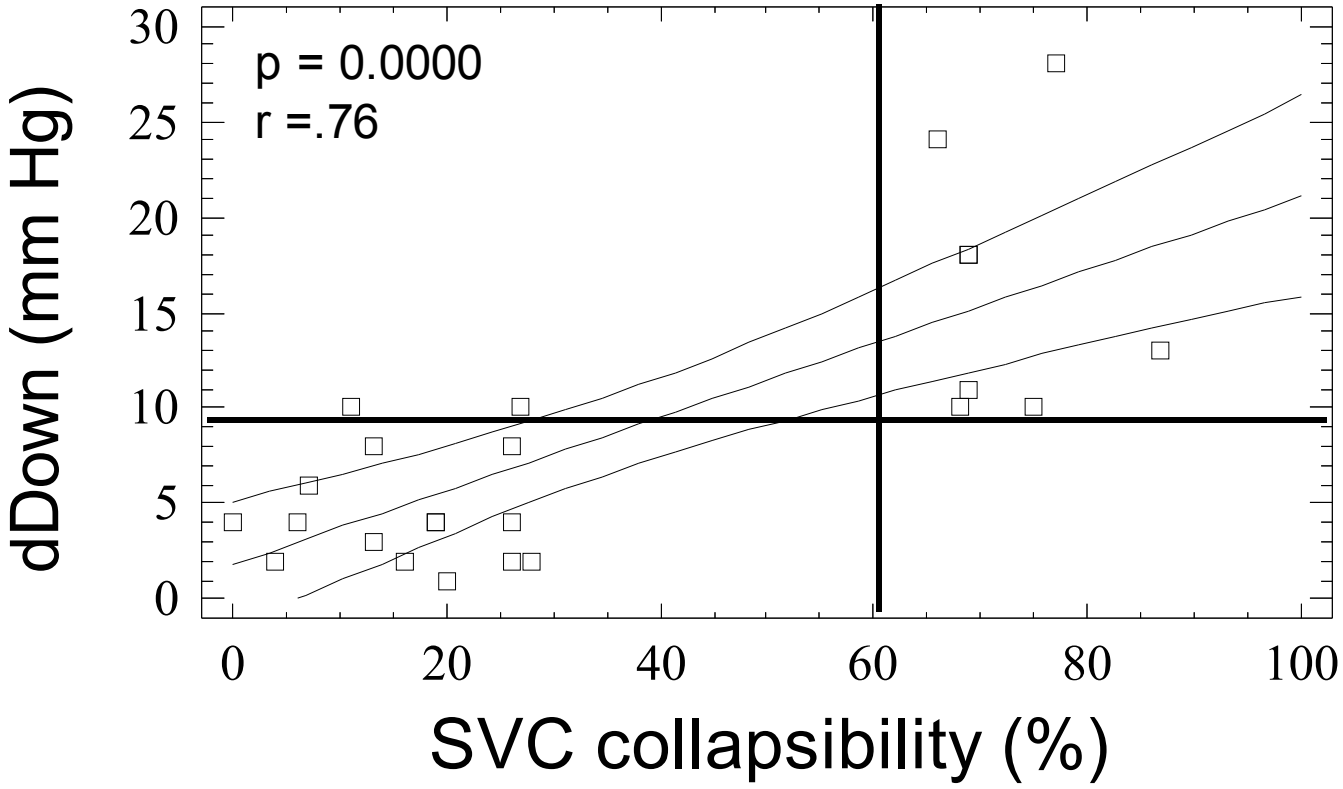
Clampage VCI
PAS 60 mmHg

Vieillard-Baron AJRCCM 2003

N = 22 patients

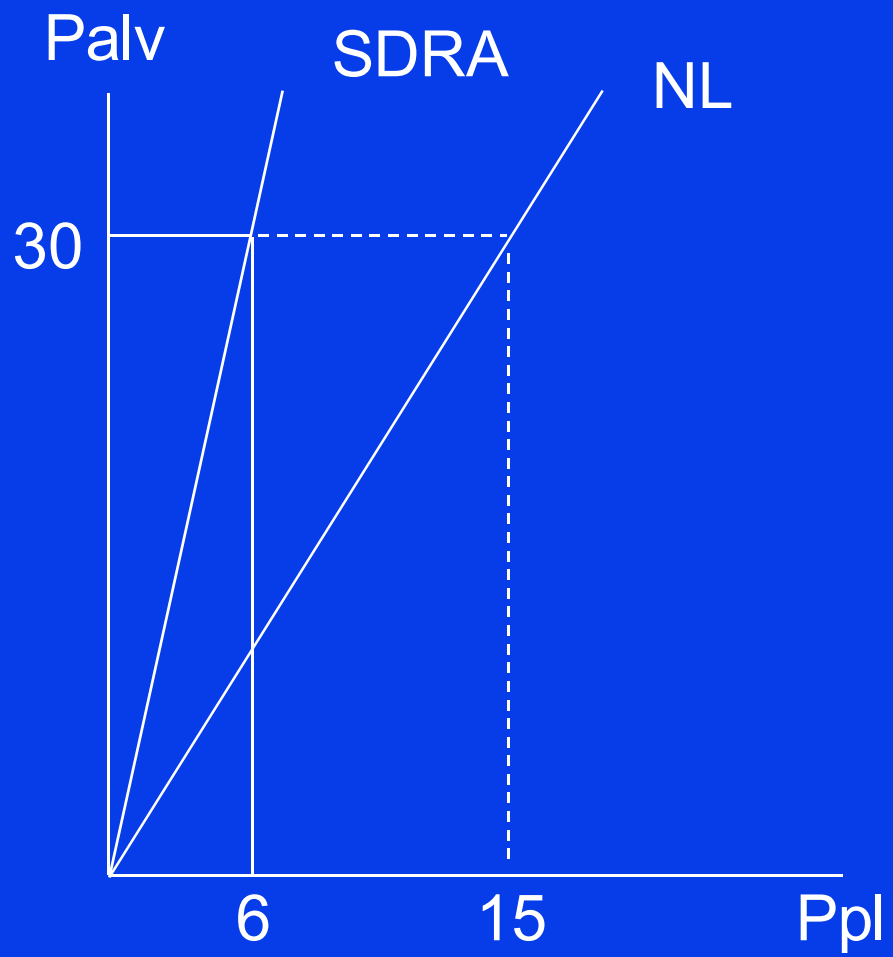


Vieillard-Baron Anesthesiology 2001

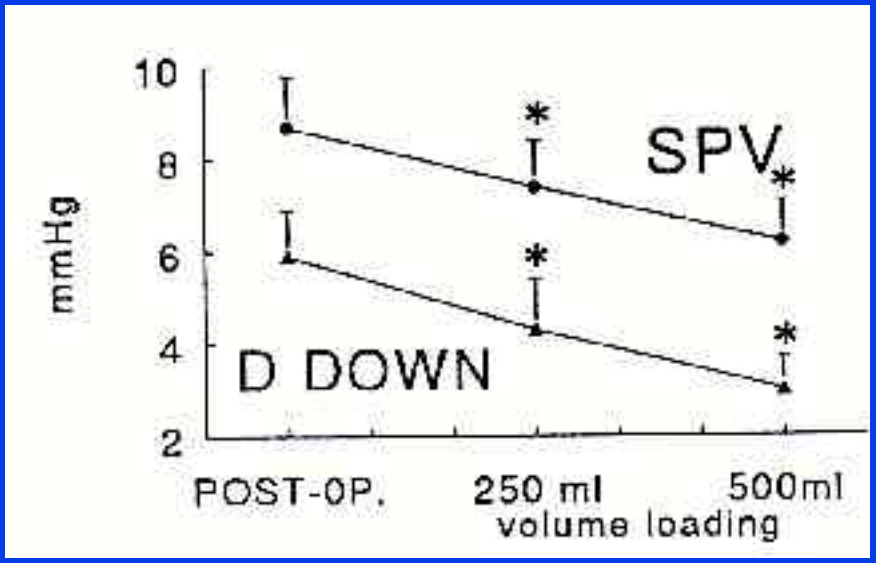


Vieillard-Baron AJRCCM 2003

IMPACT DES CONDITIONS MÉCANIQUES

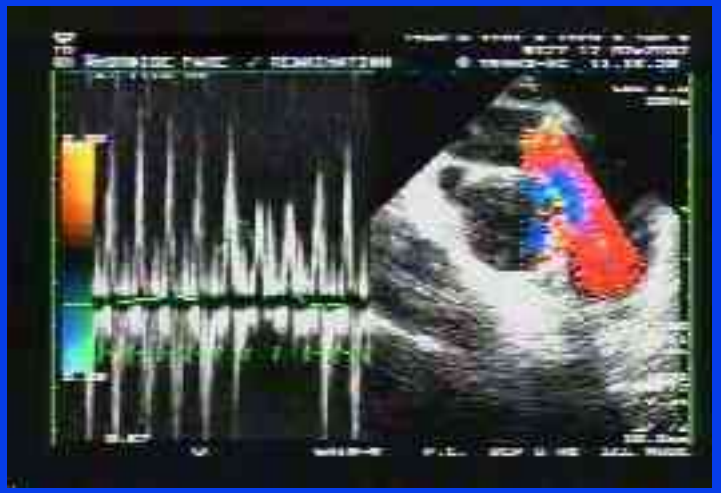


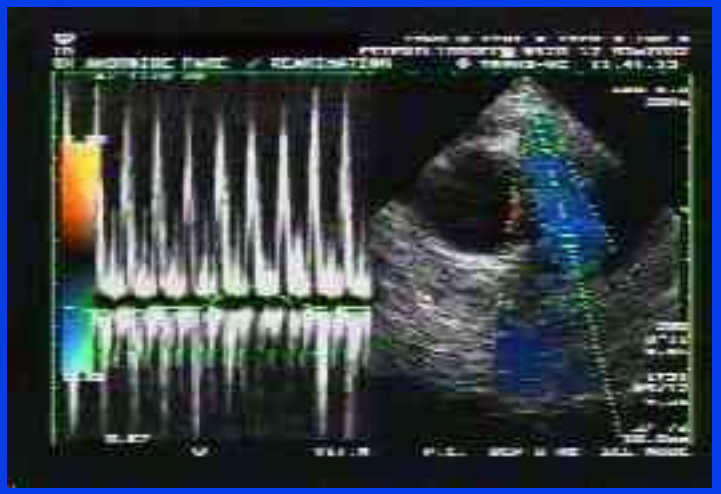
IMPACT DES CONDITIONS HEMODYNAMIQUES



Coriat Anesth Analg 1994

IC 2,5 l/min/m²





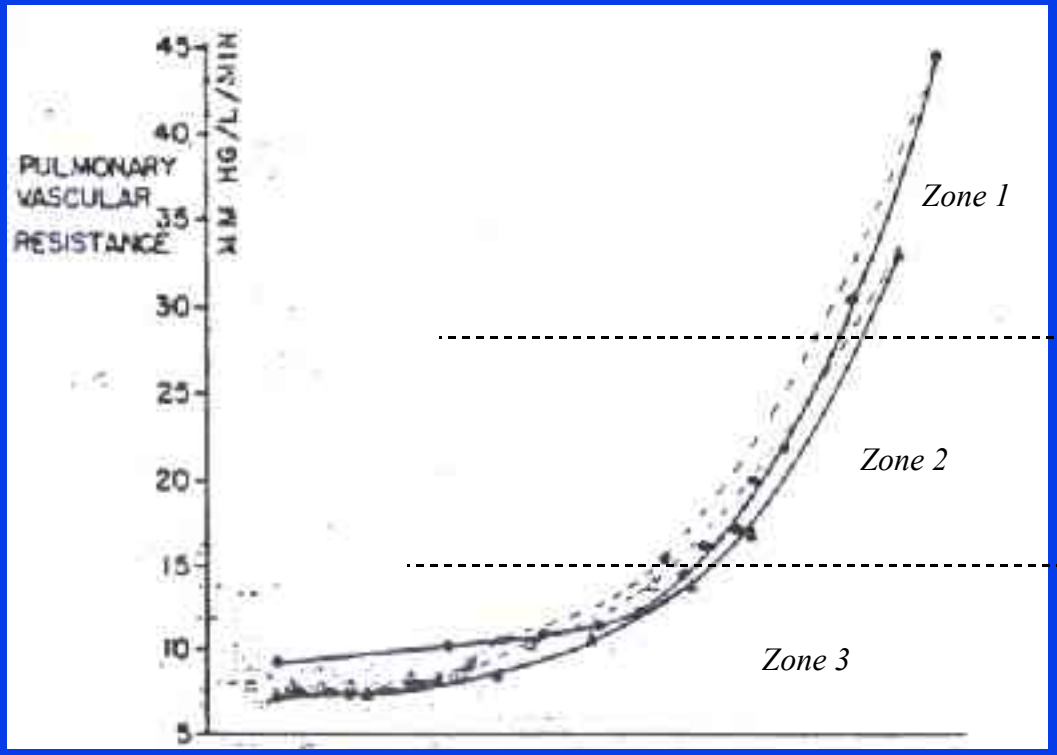
IC 4,5 l/min/m²

II

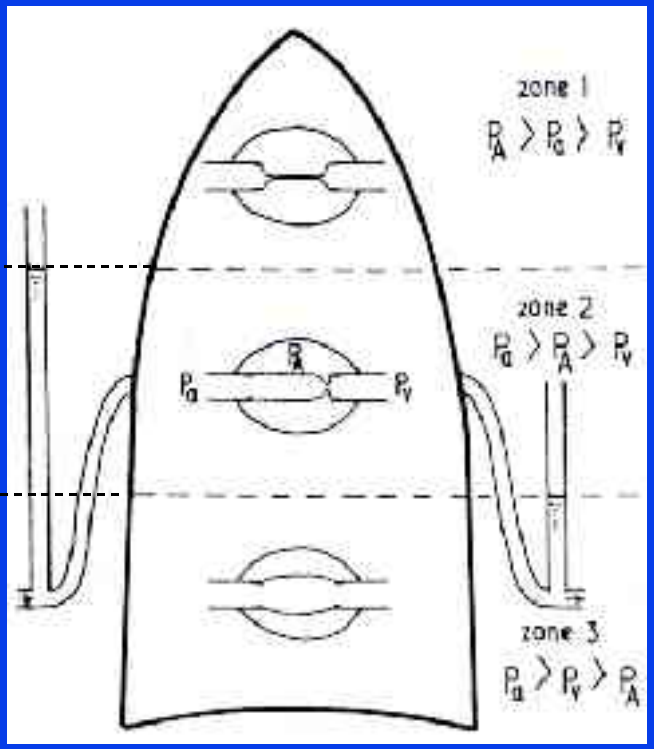
MAREE BASSE

PAR AUGMENTATION DE LA POSTCHARGE VD

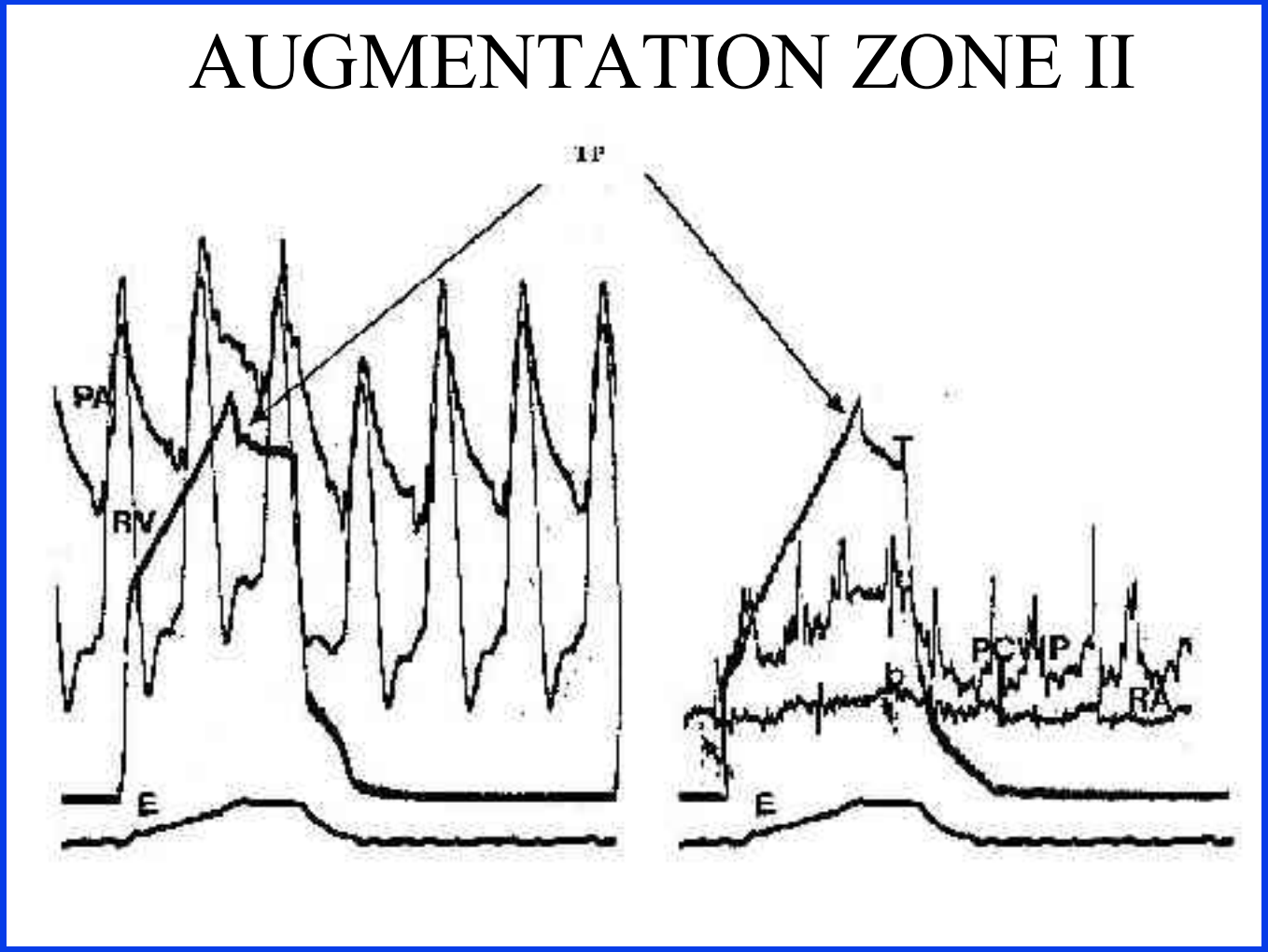
Whittenberger JAP 1960

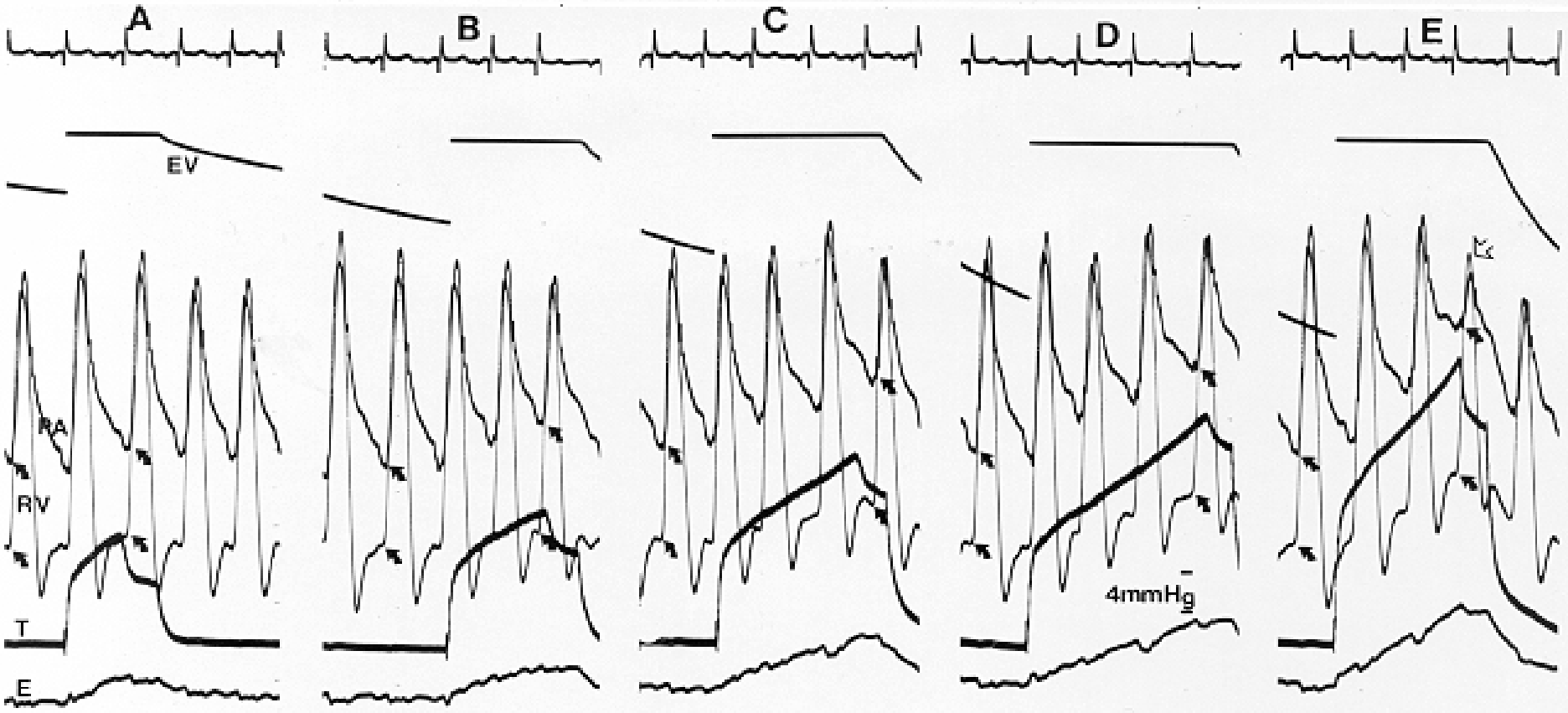


West JAP 1964



LA PRESSION TRANSPULMONAIRE AGIT SUR LA CIRCULATION PULMONAIRE





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9/14

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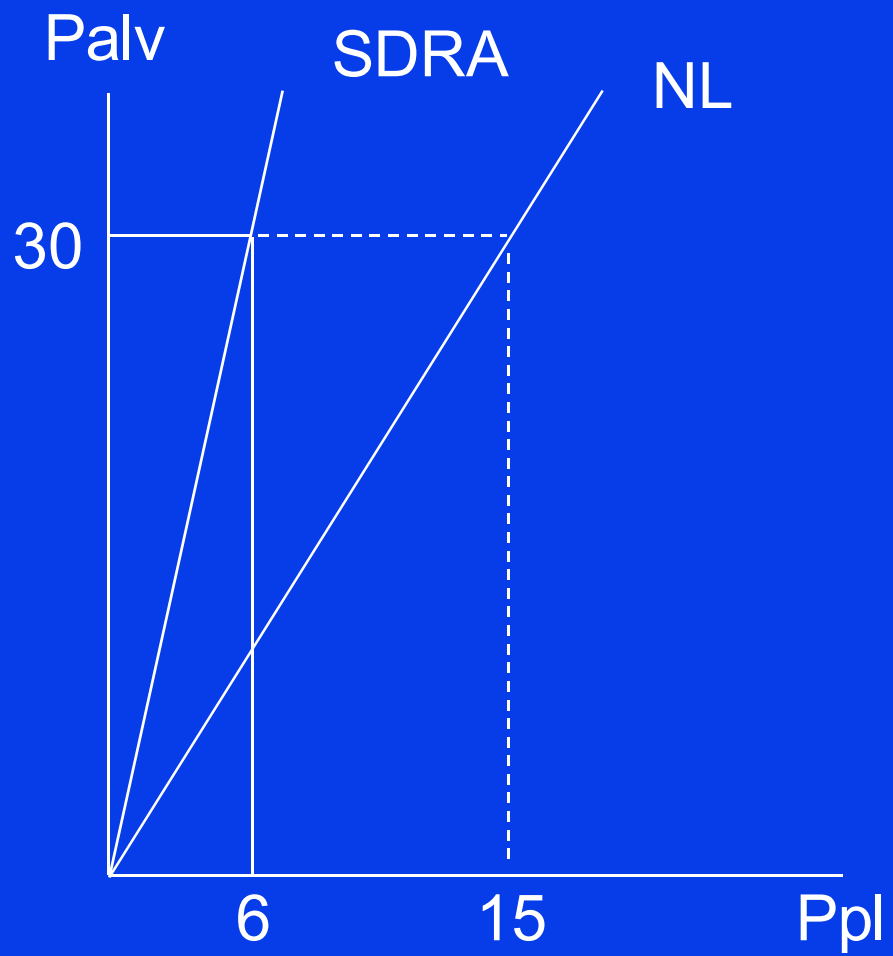
Jardin Catheterization and Cardiovascular Diagnosis 1989

	Basal	Chest strapping
P_{airway} (cmH_2O)	23±9	21±9
TV (ml)	637±89	259±56 **
C_{rs} ml/cmH_2O	28 ±14	12 ± 8 **
IS (cm^3/m^2)		
Exp	33.0±7.7	31.7±11.1
Insp	26.1±9.2 *	27.4±10.3
	(-21%)	(-14%) **

* $p < 0.05$ b^{tt} 3 vs b^{tt} 1
** $p < 0.05$ vs contention

Vieillard-Baron J Appl Physiol 1999

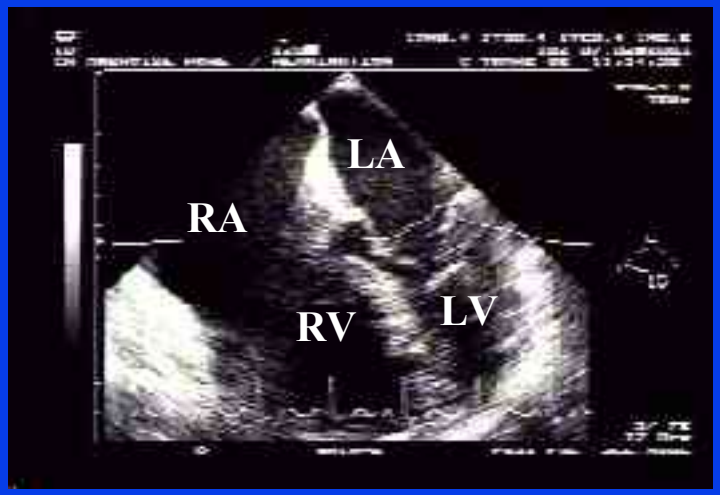
IMPACT DES CONDITIONS MÉCANIQUES



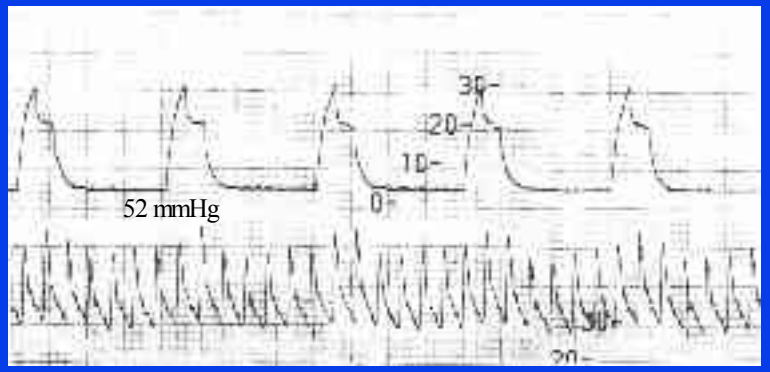
1 PTP = 24
2 PTP = 15

IMPACT DES CONDITIONS HEMODYNAMIQUES

H, 69 ans
Pneumopathie extensive
SDRA



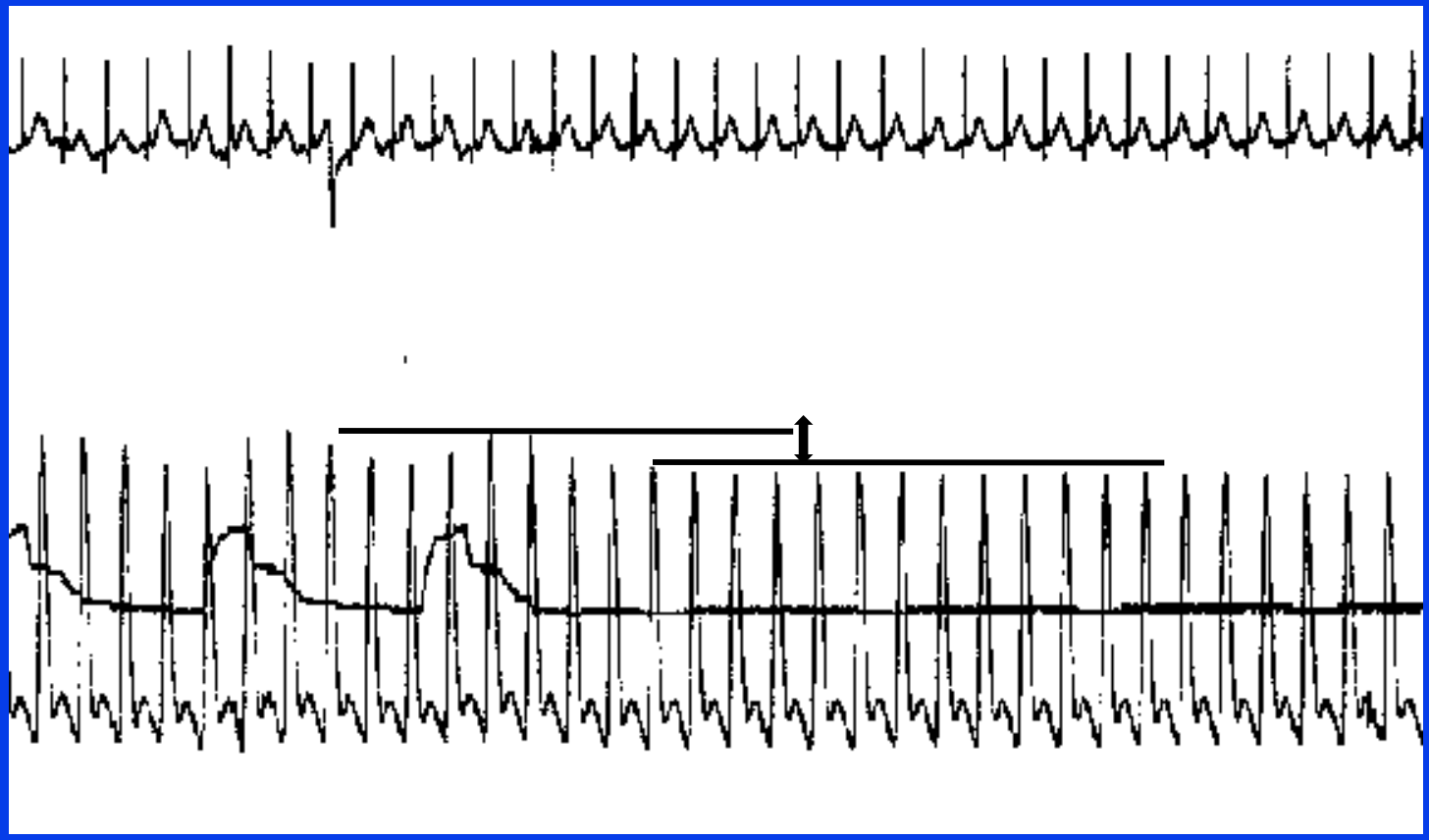
CI: 1.3 L/mn/m²

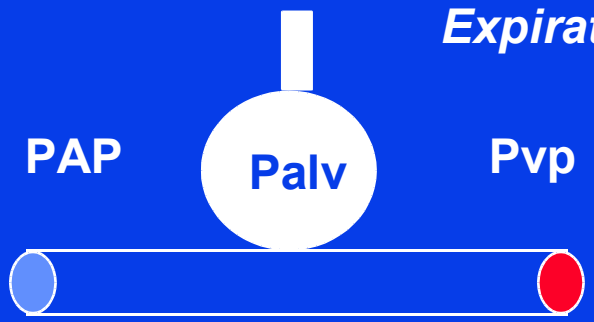


ΔPP: 21%

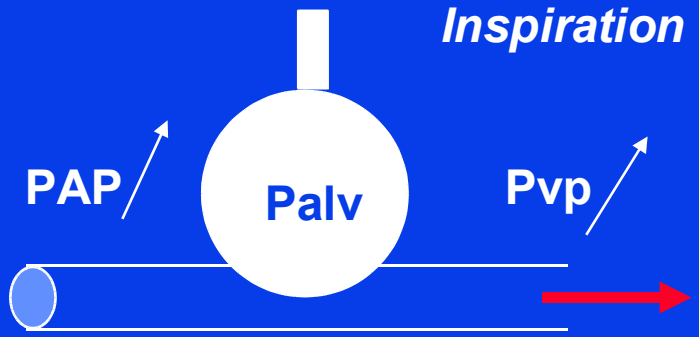
AUGMENTATION INSPIRATOIRE DE L'EJECTION VG

DUP



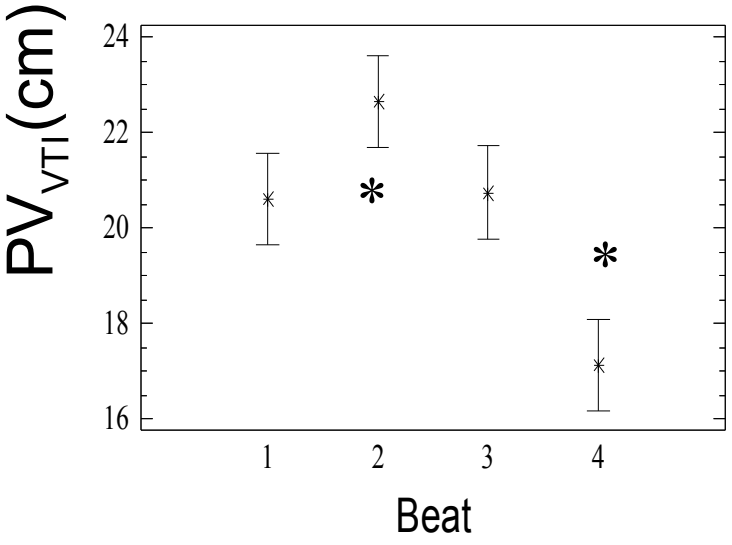


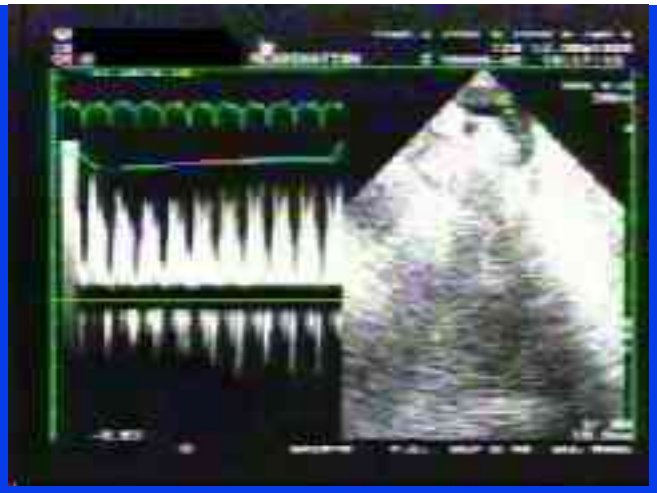
PAP > Pvp > Palv



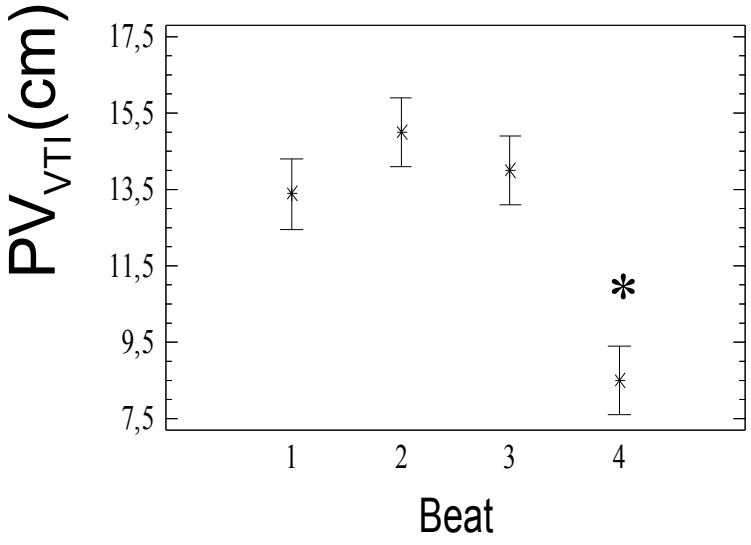
PAP > Palv >Pvp

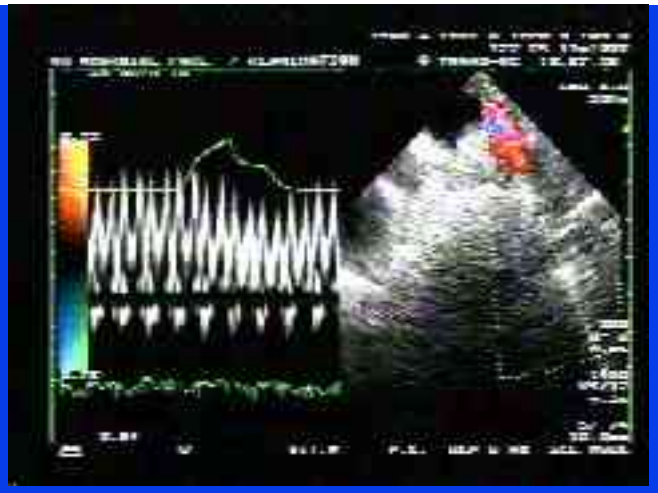
dUp + dDown





dDown





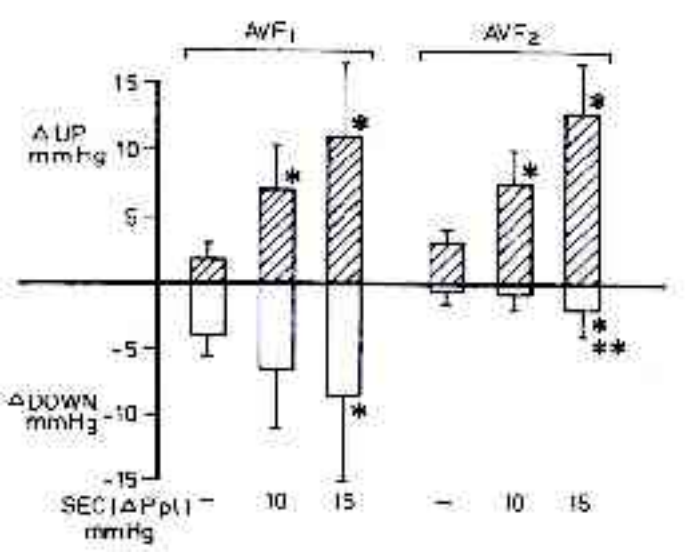
Vieillard-Baron AJRCCM 2003

	Period 1 (Baseline)	*Period 2* (Chest Strapping)
LAD, cm		
Exp	24.6 ± 9.4	26.8 ± 11
Insp	30.6 ± 8.6* (+24%)	30.1 ± 9.9* (+12%†)

Vieillard-Baron JAP 1999

FIN

LV AFTERLOAD EFFECT?



Pizov Anesth Analg 1989

Measurement	Beat No. 1	2	3	4
LVFAC, %	45.3 ± 0.9	46.8 ± 0.9	48.2 ± 0.9*	44.8 ± 0.9
LVEF, %	42.3 ± 1.5	45.4 ± 1.5	47.5 ± 1.5*	42.2 ± 1.5
$LVEI_{max}$, mm Hg · cm^{-3}	4.4 ± 0.2	4.1 ± 0.2	4.1 ± 0.2	4.4 ± 0.2
LVSWS, dynes · cm^{-3} · 10^3	155.1 ± 1.6	156.3 ± 1.6	162.4 ± 1.6*	156.1 ± 0.6

Vieillard-Baron AJRCCM 2003