Master de Biologie et Physiologie de la respiration
et de la circulation

INTERACTIONS CARDIORESPIRATOIRES

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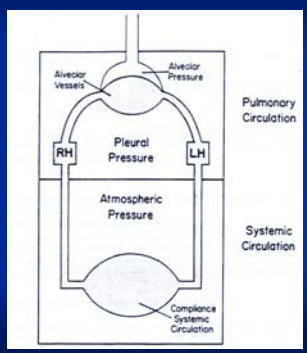
SCHEMA DE LA CIRCULATION

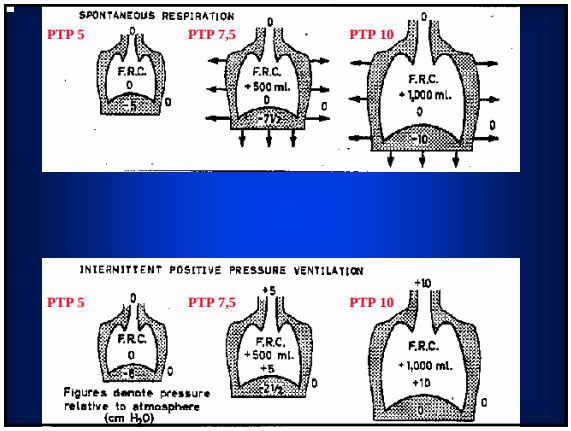


From Permutt

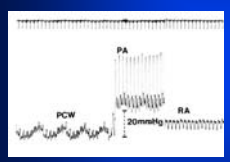
PRESSION TRANSPULMONAIRE

PTP = Palv - Ppl

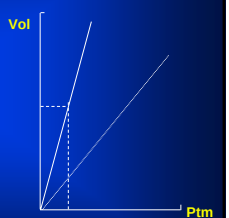
C = ΔV / ΔPTP



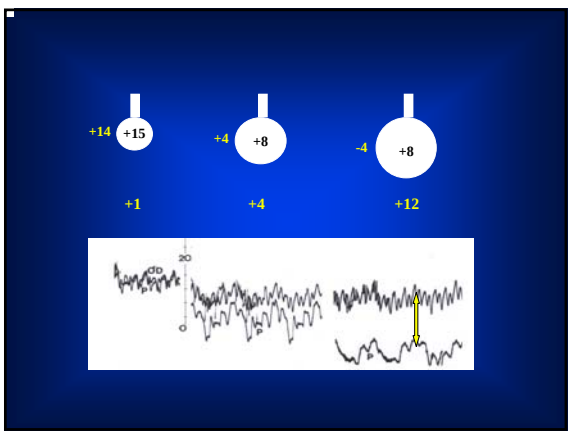
P INTRAVASCULAIRE
P TRANSMURALE



P intravasculaire
=
Pression mesurée par le KT



P transmurale
=
Pression de distension (Pint - Pext)



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

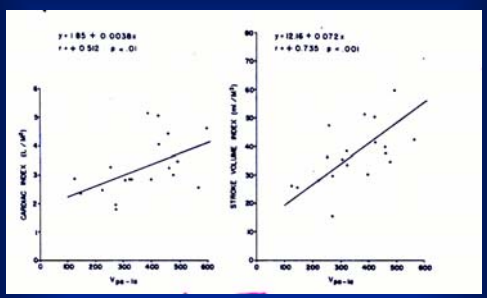
Capillaires pulmonaires: 120 ml

Veines pulmonaires: 300ml

OD, VD

OG, VG

VTDVG = 70 ml/m²



Milnor Circulation 1960

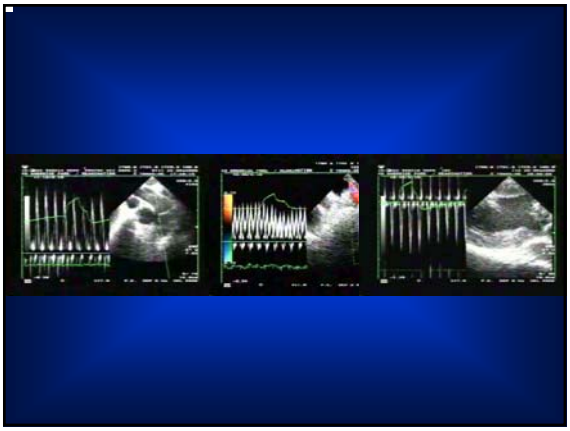
Augmentation postcharge

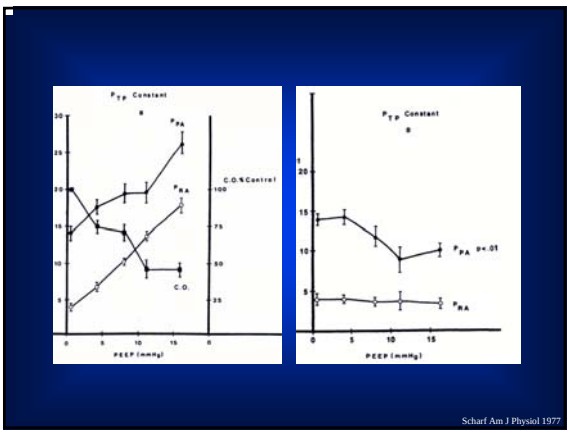
VD

Diminution RVS

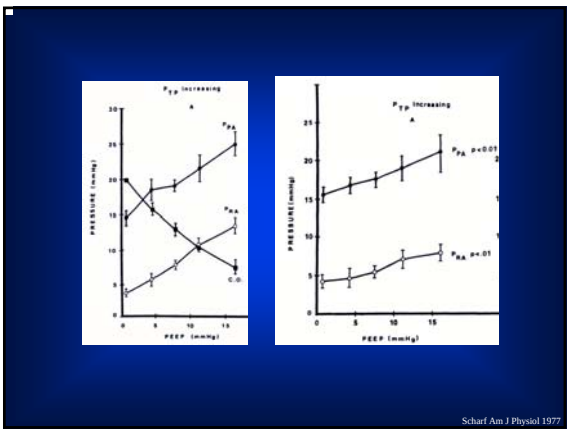
VG

dDown





Scharf Am J Physiol 1977



Scharf Am J Physiol 1977

I

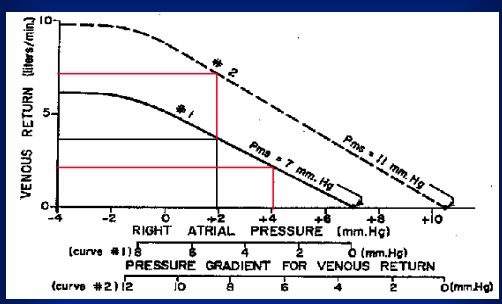
PAR DIMINUTION RETOUR VEINEUX SYSTEMIQUE

RETOUR VEINEUX SYSTÉMIQUE

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

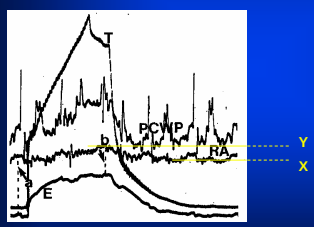
Pression d'aval: pression veineuse centrale (P_{VC})

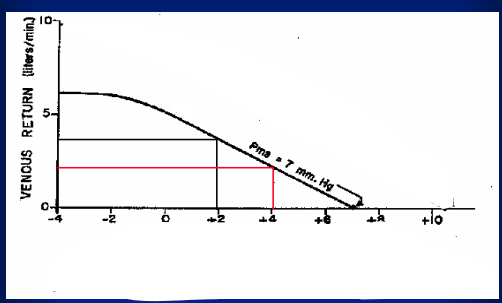
Gradient de pression: P_{amont} - P_{aval}



Guyton Physiol Rev 1955

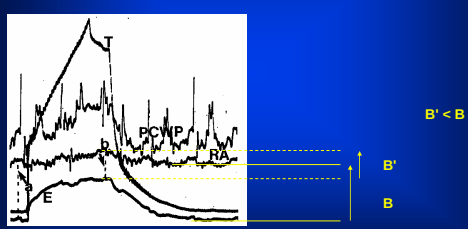
L'élévation de la pression dans les voies aériennes se transmet à la cavité pleurale et entraîne une élévation de la PVC

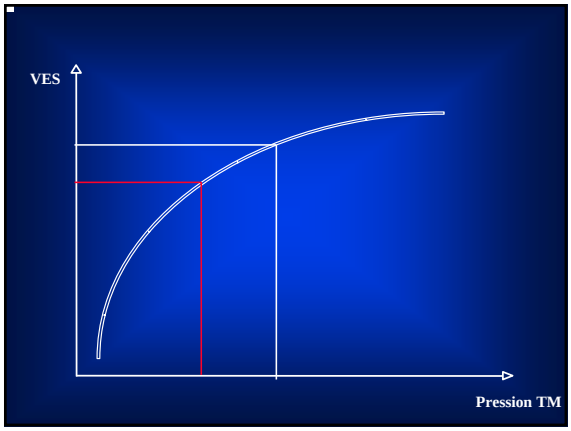




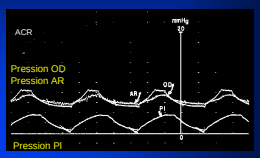
Guyton Physiol Rev 1955

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





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

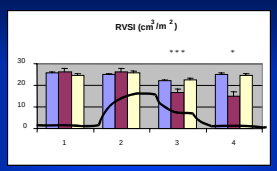
L'augmentation de la pression intra-thoracique lors de l'insufflation entraîne une diminution de la pression transmurale de la VCS qui devient plus faible que sa pression de fermeture

Basal
PAS 120 mmHg

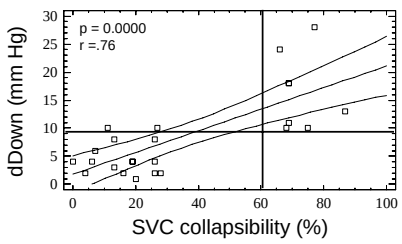
Clampage VCI
PAS 60 mmHg

Vieillard-Baron AJRCCM 2003

N = 22 patients

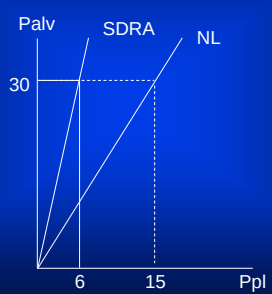


Vieillard-Baron Anesthesiology 2001

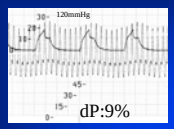


Vieillard-Baron AJRCCM 2003

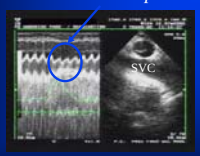
IMPACT DES CONDITIONS MÉCANIQUES



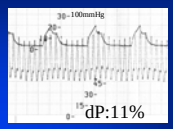
ZEEP



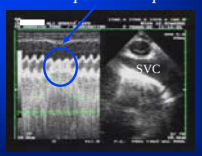
Partial collapse



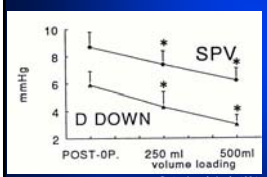
PEEP 5 cmH_2O



Complete collapse



IMPACT DES CONDITIONS HEMODYNAMIQUES

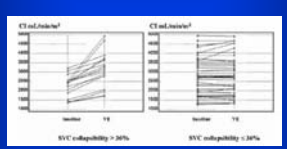


Coriat Anesth Analg 1994

IC 2,5 l/min/m²

IC 4,5 l/min/m²

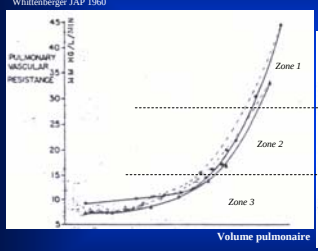
Superior vena caval collapsibility as a gauge of volume status in ventilated septic patients



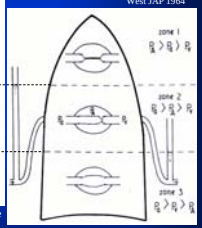
II

PAR AUGMENTATION DE LA POSTCHARGE VD

Whittenberger JAP 1960

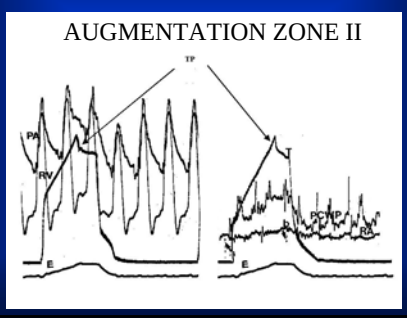


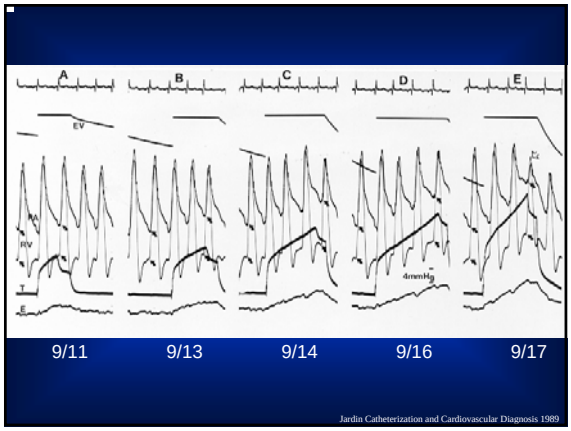
West JAP 1964

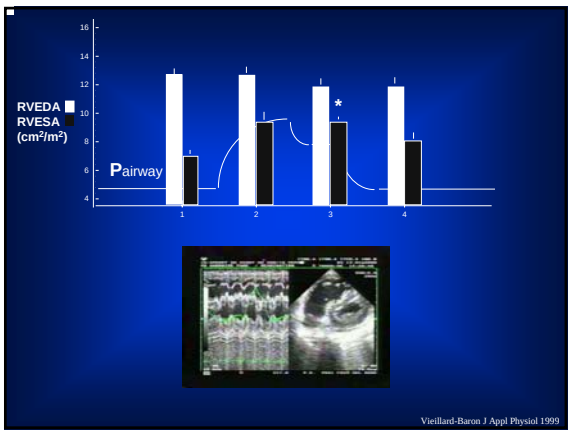


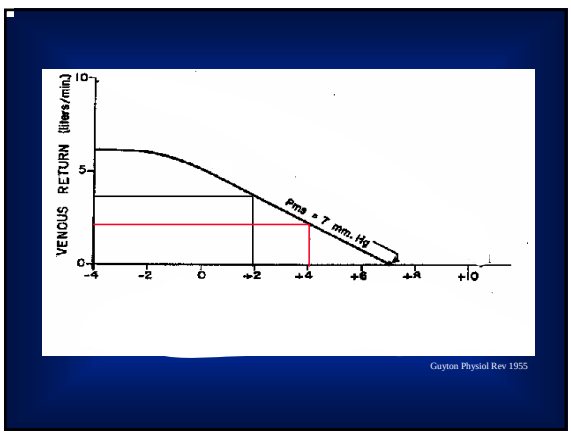
LA PRESSION TRANSPULMONAIRE AGIT SUR LA CIRCULATION PULMONAIRE

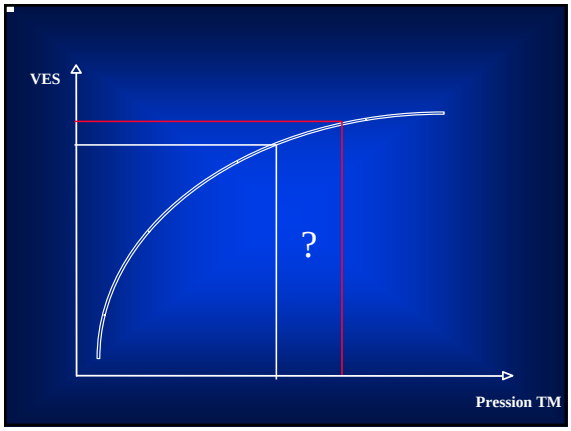
AUGMENTATION ZONE II

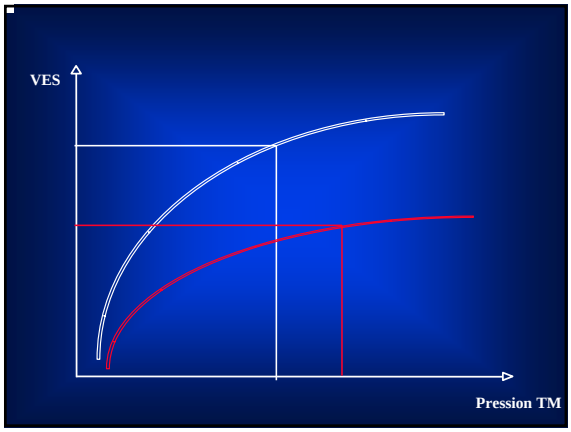


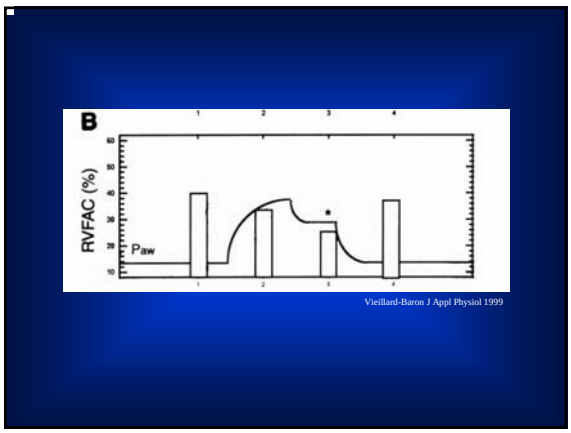

A
B
C
D
E
EV
RV
9/11
9/13
9/14
9/16
9/17
Jardin Catheterization and Cardiovascular Diagnosis 1989


RVEDA
RVESA
(cm²/m²)
Pairway
Vieillard-Baron J Appl Physiol 1999


VENOUS RETURN (liters/min.)
Pms = 7 mm. Hg
Guyton Physiol Rev 1955

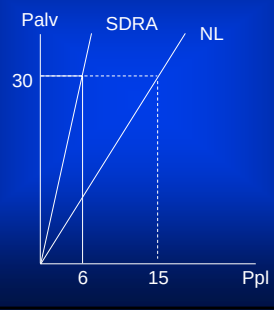






Vieillard-Baron J Appl Physiol 1999

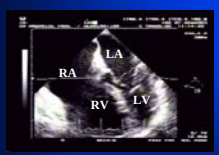
IMPACT DES CONDITIONS MÉCANIQUES



1 PTP = 24
2 PTP = 15

IMPACT DES CONDITIONS HEMODYNAMIQUES

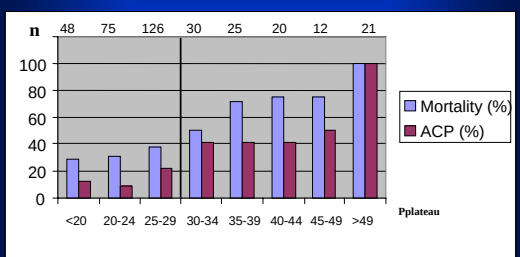
H, 69 ans
Pneumopathie extensive
SDRA



ΔPP: 21%

CI: 1.3 L/mn/m²

357 ARDS patients investigated by echocardiography between 1980 and 2005



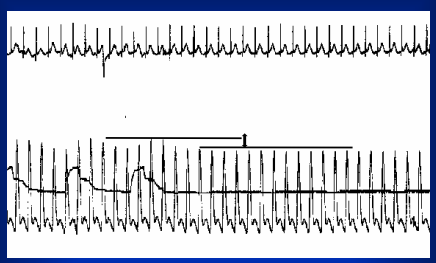
H 41 ans, SDRA
P/F 100
C_{rs} 18 ml/cmH_2O

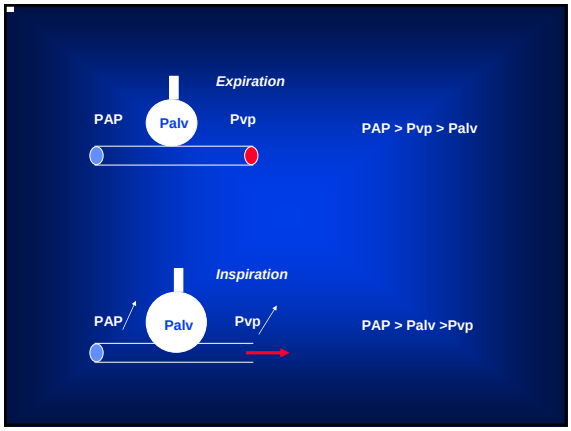
400 x 25
PEEP 5

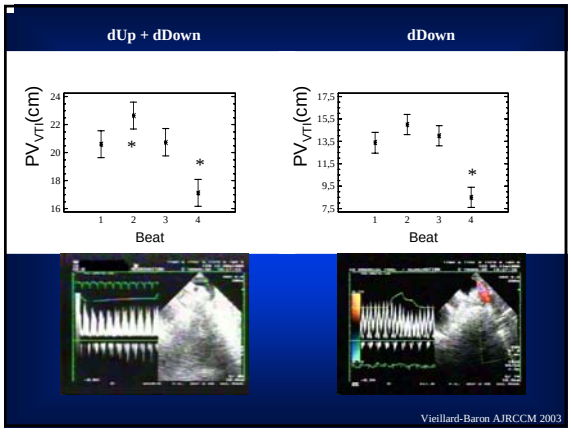
350 x 25
PEEP 5

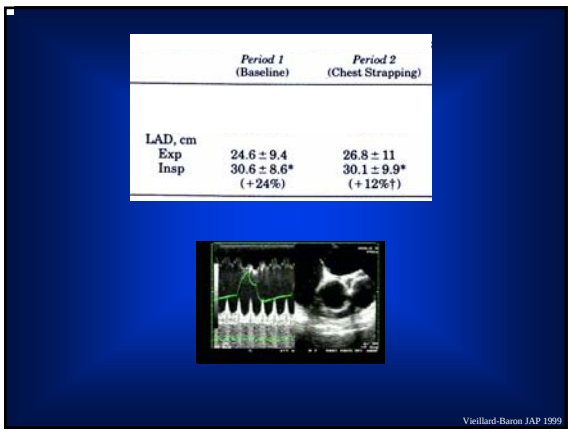
AUGMENTATION INSPIRATOIRE DE L'EJECTION VG

DUP

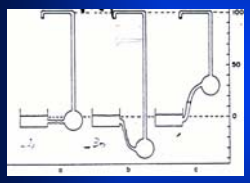



Expiration
PAP
Palv
Pvp
PAP > Pvp > Palv
Inspiration
PAP
Palv
Pvp
PAP > Palv >Pvp

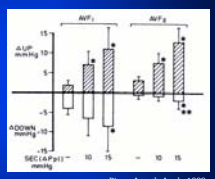

dUp + dDown
dDown
PVVTI(cm)
Beat
PVVTI(cm)
Beat
Vieillard-Baron AJRCCM 2003


Period 1 (Baseline)
Period 2 (Chest Strapping)
LAD, cm
Exp
Insp
24.6 ± 9.4
30.6 ± 8.6*
(+24%)
26.8 ± 11
30.1 ± 9.9*
(+12%†)
Vieillard-Baron JAP 1999

LV AFTERLOAD EFFECT?



McGregor N Engl J Med 1979



Pizov Anesth Analg 1989