

Inserm



Institut national
de la santé et de la recherche médicale

université
de **BORDEAUX**

Place de l'échographie dans la gestion du remplissage vasculaire

Dr H. de Courson

Service Anesthésie-Réanimation tripode

CHU de Bordeaux

TUSAR 04 mai 2023

Qui remplir ? Sur quels critères ?



Fluid challenges in intensive care: the FENICE study

A global inception cohort study

*Cecconi et al
ICM 2015*



Etude observationnelle

Multicentrique (311 centres, 46 pays)

2279 sujets bénéficiants d'un fluid challenge

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Table 3 Indications and variables used to predict fluid responsiveness ($N = 2213$)

Indication	<i>n</i> (%)
Hypotension	1211 (58.7 [56.7–60.8])
Weaning vasopressor	146 (7.1 [6.0–8.2])
Cardiac output	62 (3.0 [2.3–3.7])
Oliguria	372 (18.0 [16.4–19.6])
Skin mottling	36 (1.7 [1.2–2.2])
Lactate	128 (6.2 [5.2–7.2])
SvO ₂ /ScvO ₂	10 (0.5 [0.2–0.8])
SVV/PPV	37 (1.8 [1.3–2.4])
CVP/PAOP	60 (2.9 [2.2–3.6])

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Hemodynamic variable used to predict fluid responsiveness	<i>n</i>
No variable used	945
Any variable used	1268
Static	785
CVP	572
PAOP	31
GEDVI	33
Other	149
Dynamic	483
PPV	88
SVV	88
PPV + SVV	24
PLR	238
Echo variables	45

Fluid challenges in intensive care: the FENICE study

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43 % !!



Fluid challenges in intensive care: the FENICE study

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2 % !!

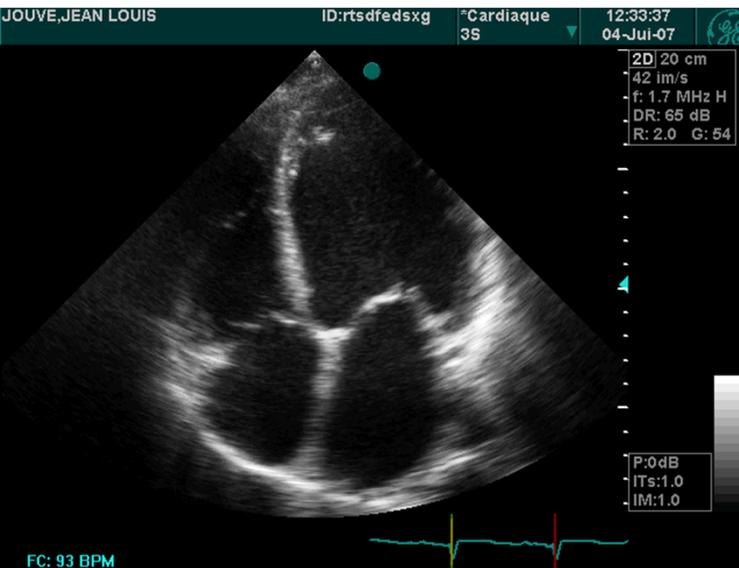
Place de l'échographie dans la gestion du remplissage vasculaire

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- Etape 2 : les bases de l'hémodynamique
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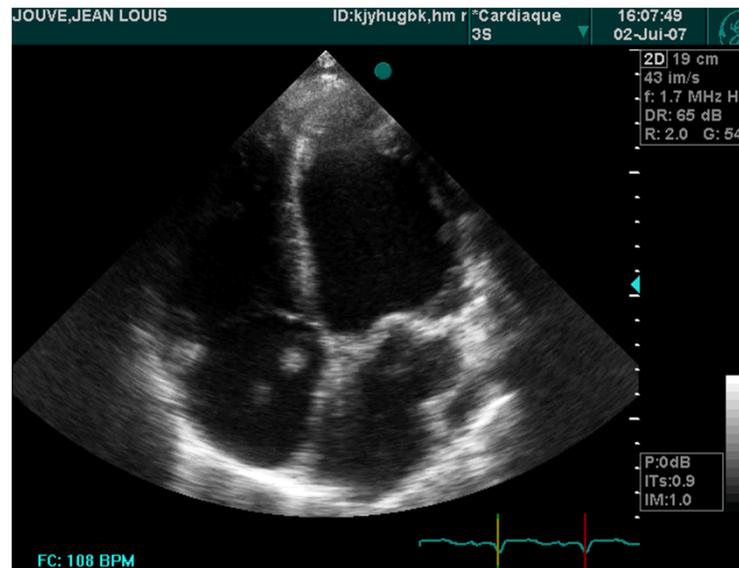
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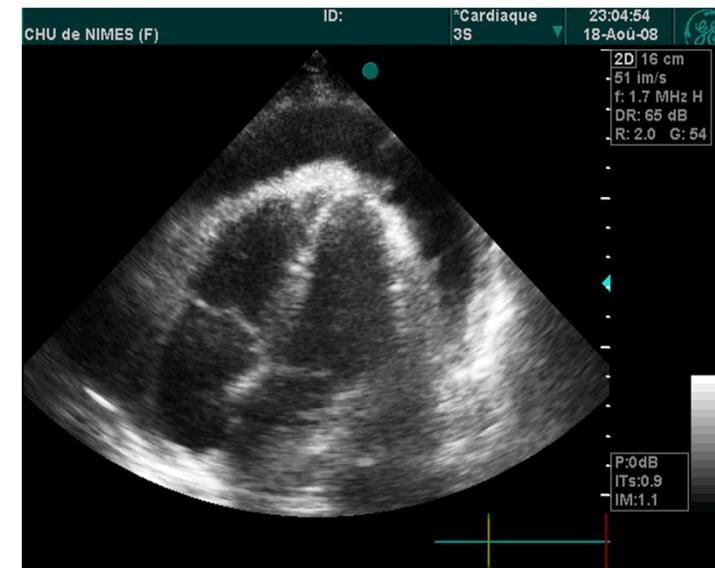
Evaluation de la fonction cardiaque globale



Défaillance VG



Défaillance VD



Tamponnade

L'ETT permet dans 95% des cas d'éliminer une des 3 causes amenant à un traitement spécifique !

Joseph et al Chest 2004
Orme et al Br J Anaesth 2009

Place de l'échographie dans la gestion du remplissage vasculaire

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Les bases de l'hémodynamique

Pressions **basses** + débit **bas**



HYPOVOLEMIE

Pressions **hautes** + débit **bas**



INSUFFISANCE
CARDIAQUE

Pressions **hautes/basses** + débit **haut**

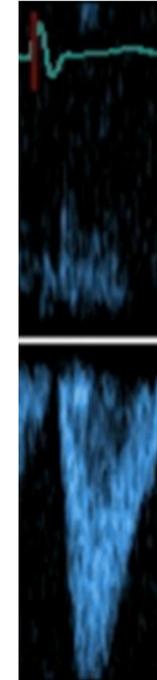
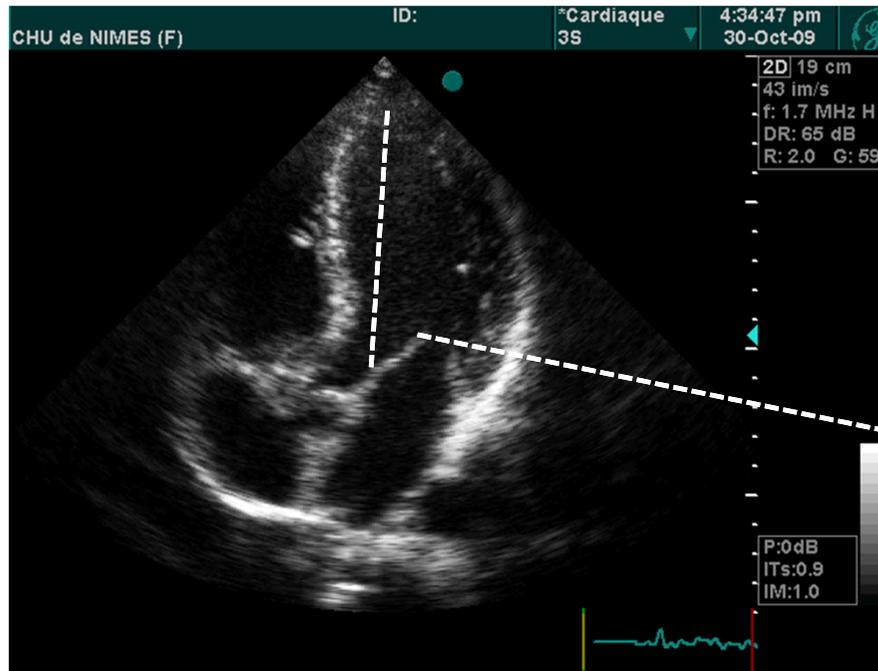


VASOPLÉGIE

Place de l'échographie dans la gestion du remplissage vasculaire

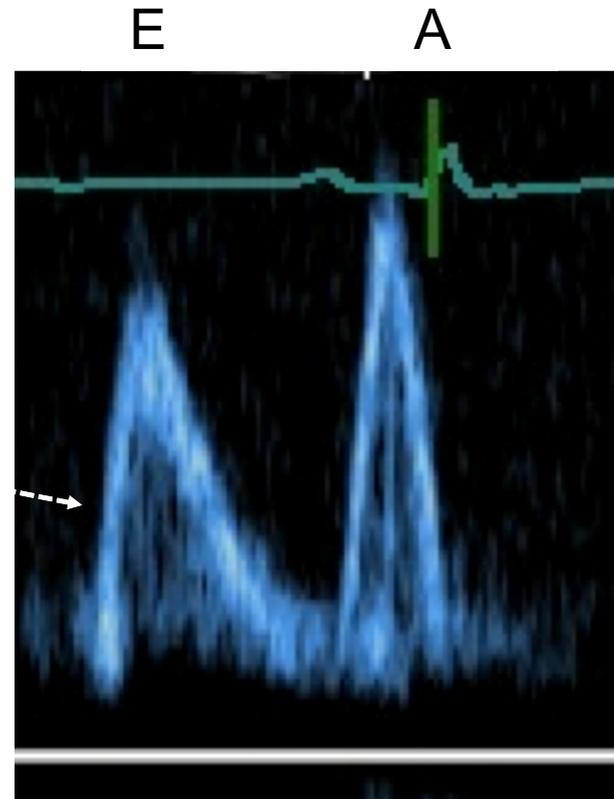
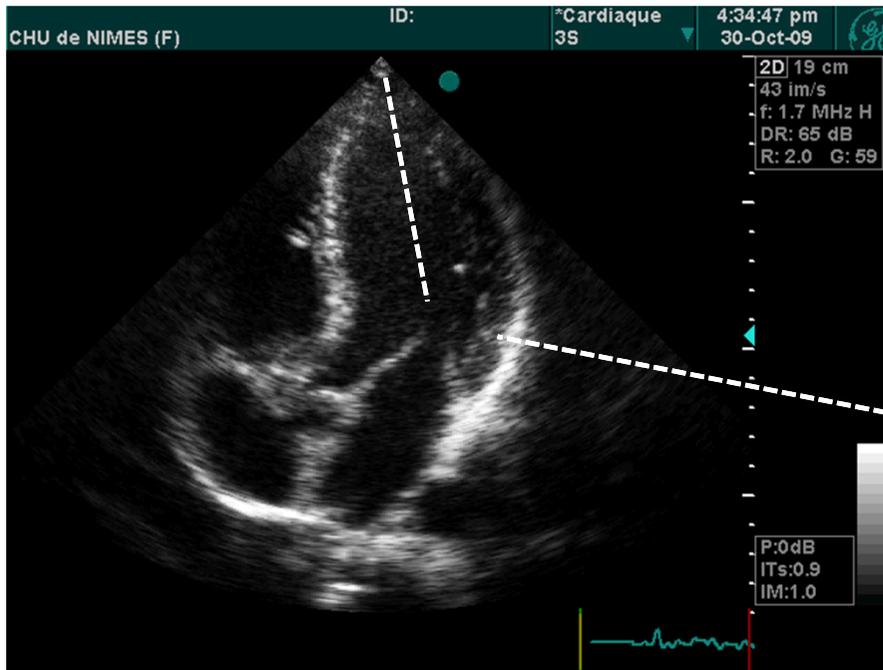
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Mesurer le débit cardiaque



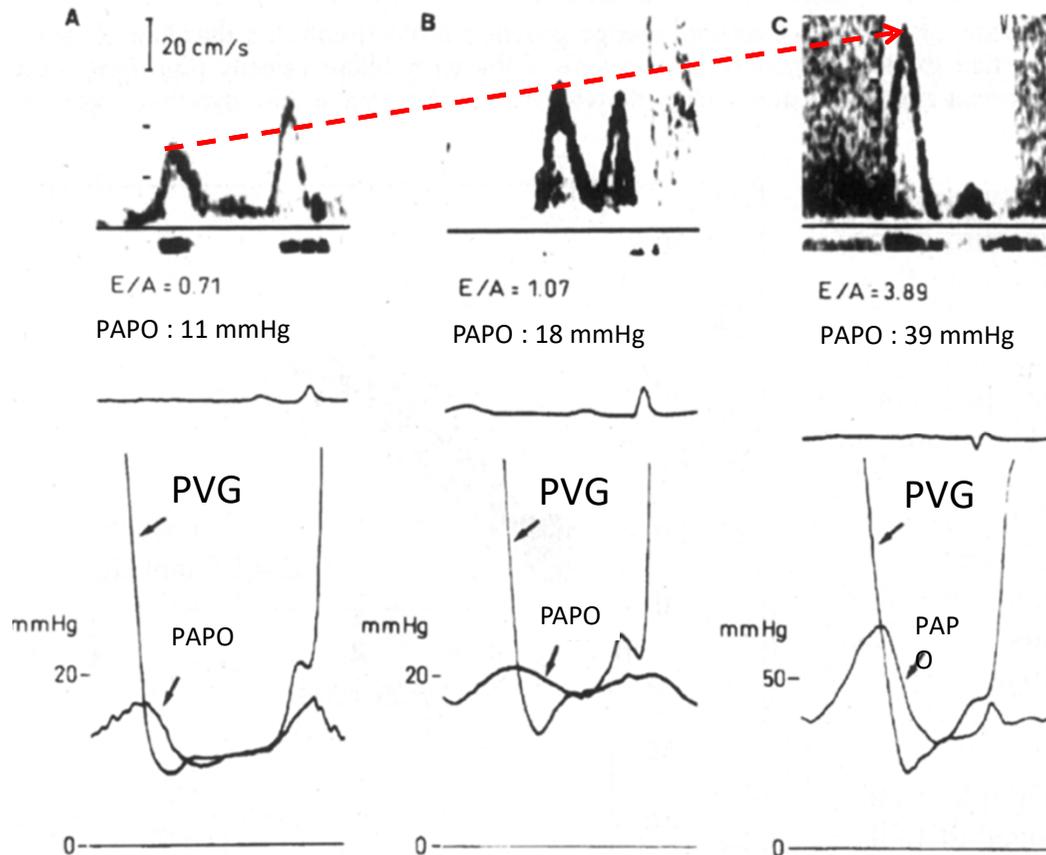
L'ITV sous-aortique suffit !
Normale : 14 – 20 cm

Mesurer les pressions: profil mitral



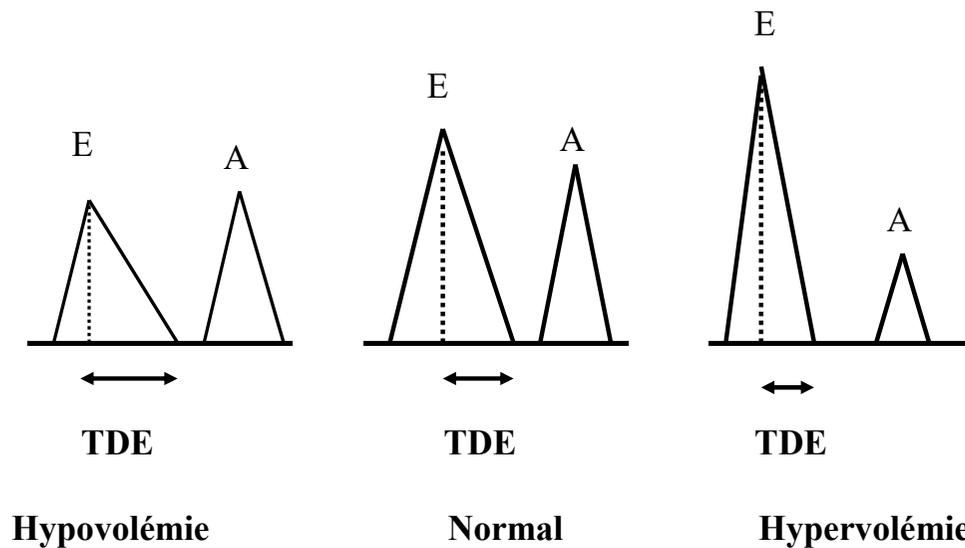
Le flux doppler mitral = évalue grossièrement les pressions de remplissage

Mesurer les pressions: profil mitral



Le profil mitral est
corrélé à la PTDVG

Mesurer les pressions: profil mitral



L'onde E varie
avec la volémie !

Vélocité normale de l'onde E = 0,7 – 0,9 m/s

Mesurer les pressions: profil mitral

Table 1 Characteristics of the general population and comparison between responders and non-responders at baseline (before fluid challenge)

	All patients (n = 40)	Responders (n = 20)	Non-responders (n = 20)	P-value
Age, years	63 (56, 70)	61 (49, 70)	66 (53, 75)	0.58
Weight, Kg	72 (65, 77)	67 (63, 76)	76 (63, 88)	0.14
Height, cm	169 (164, 173)	170 (162, 176)	168 (160, 173)	0.38
APACHE II score	17 (14, 23)	18 (14, 29)	14 (11, 21)	0.30
Heart rate, bpm	101 (91, 116)	101 (91, 125)	103 (79, 121)	0.78
Mean arterial pressure, mmHg	71 (66, 77)	70 (61, 88)	72 (65, 87)	0.56
LVEF, %	55 (50, 60)	55 (50, 60)	55 (47, 60)	0.41
Velocity time index, cm	16 (14, 18)	14 (12, 16)	17 (15, 21)	< 0.01
E velocity, cm/s	75 (70, 80)	65 (53, 76)	82 (75, 93)	< 0.01
E/A velocity ratio	0,9 (0,8, 1,1)	0,8 (0,6, 1,1)	1,0 (0,8, 1,4)	< 0.01
Ea velocity, cm/s	12 (10, 13)	12 (9, 14)	11 (9, 15)	0.79
E/Ea velocity ratio	6 (5, 8)	5 (5, 10)	7 (5, 8)	0.40
cIVC, %	34 (16, 64)	64 (28, 100)	19 (5, 35)	< 0.01

Data are expressed in medians with 5th and 95th percentiles. APACHE: Acute Physiology and Chronic Health Evaluation; cIVC, collapsibility index of the inferior vena cava.

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Onde E < 0,75
Hypovolémie ?

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Mesurer les pressions: profil mitral

122 sujets, ETT \leq 20 minutes avant cathéterisme cardiaque
Onde E et mesure de la pression télé-diastolique du VG (PTDVG)

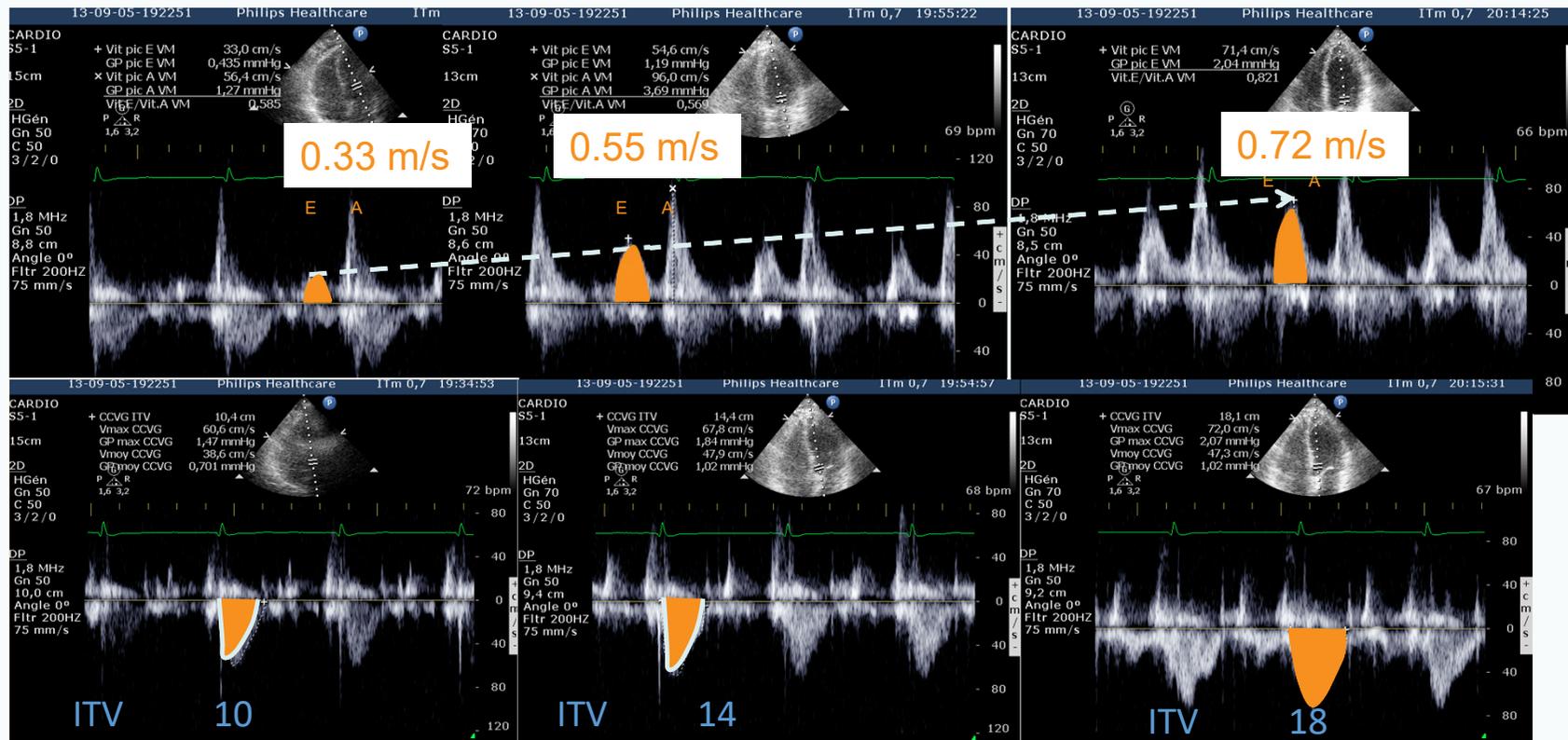
Mesurer les pressions: profil mitral

122 sujets, ETT \leq 20 minutes avant cathéterisme cardiaque
Onde E et mesure de la pression télé-diastolique du VG (PTDVG)

Finally, in this population, E
<60 cm/sec ruled out, and E>90 cm/sec ruled in,
elevated LVEDP with high negative and positive
predictive values, respectively, which, in the right
clinical setting, may be useful screening tools in
this population for the presence of DHF.

Mesurer les pressions: profil mitral

Femme de 72 ans, choc, péritonite



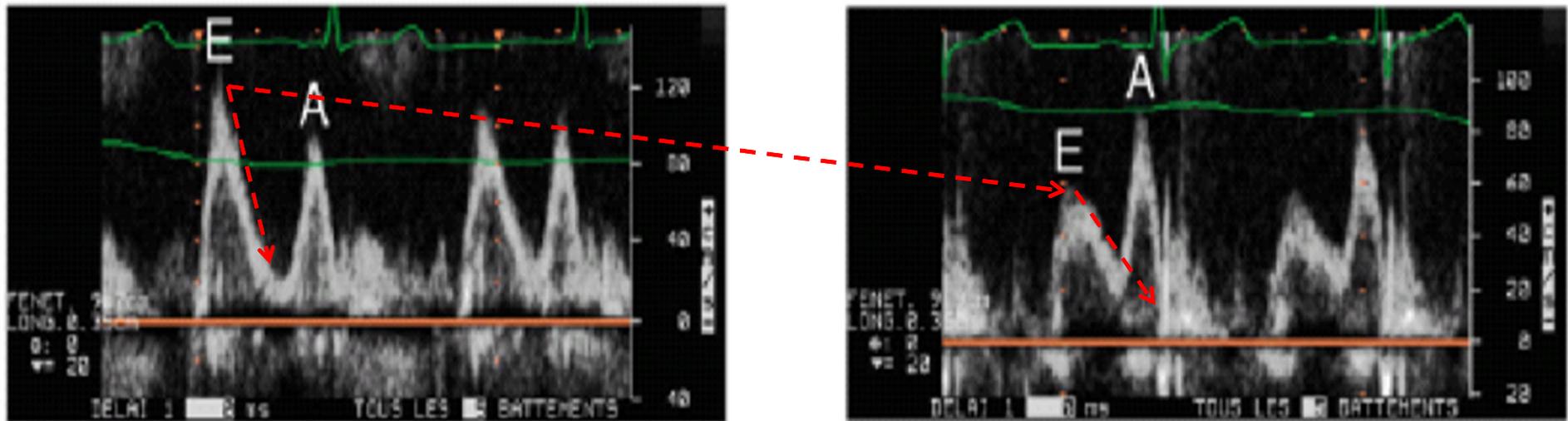
Avant remplissage

500 mL

1000 mL

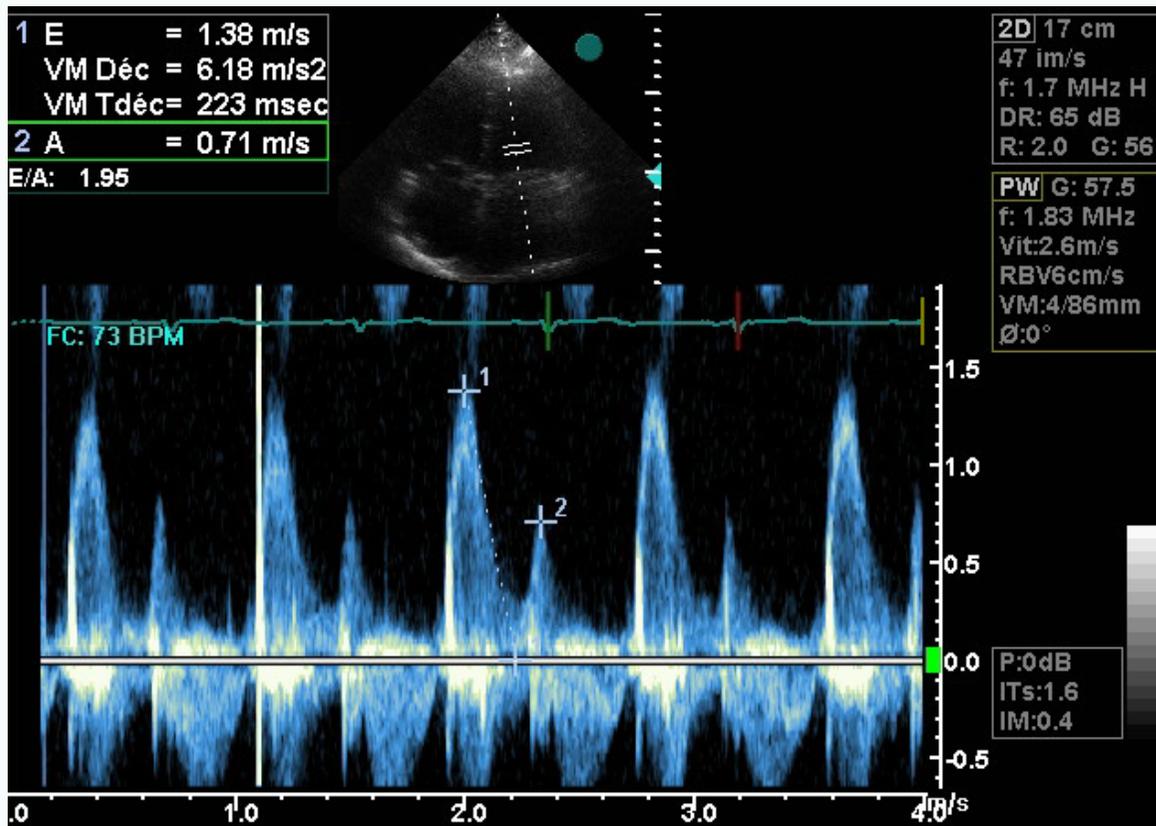
Mesurer les pressions: profil mitral

Avant dialyse ← 3000 ml de déplétion → Après dialyse



Vignon et al Crit Care 2007

Mesurer les pressions: profil mitral



E/A ratio > 2

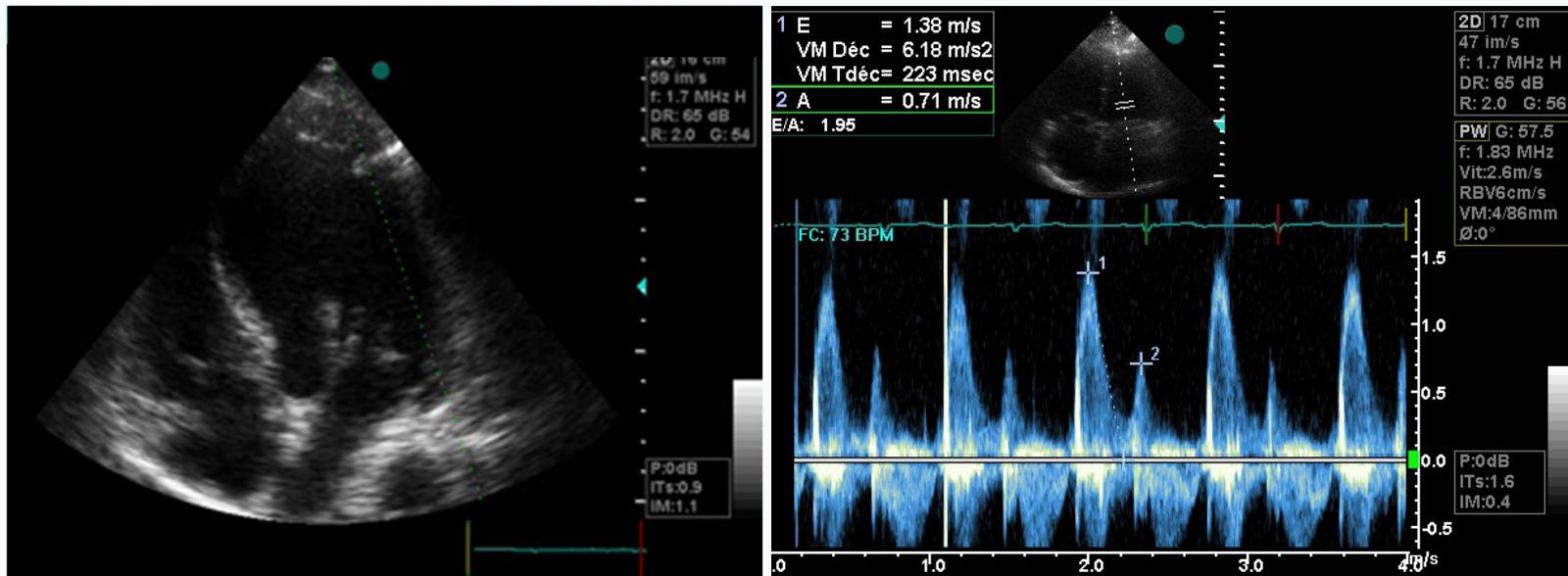
=

PAP0 > 18 mmHg

PP value = 100 %

Mesurer les pressions: profil mitral

Homme 72 ans, $T^{\circ}=38,5^{\circ}$, toux, PA= 130/80 mmHg
Est-ce seulement une pneumopathie ?



Amélioration clinique après diurétiques !

Mesurer les pressions: profil mitral

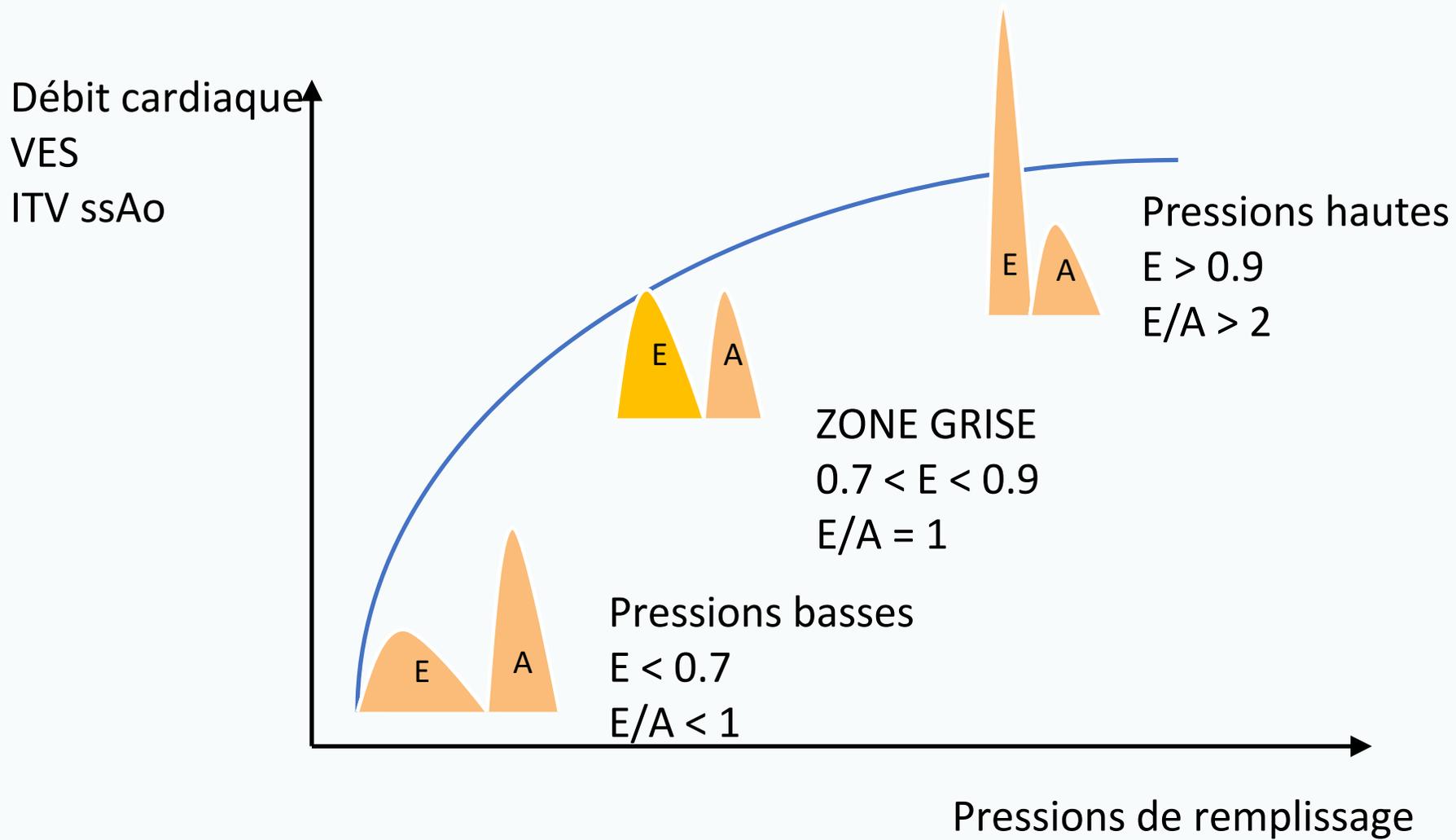
Chez un sujet jeune et sportif :

- L'onde E peut être > 1 m/s de façon physiologique
- E/A peut être > 2 de façon physiologique!

=> Dans ce cas, regarder les autres indices

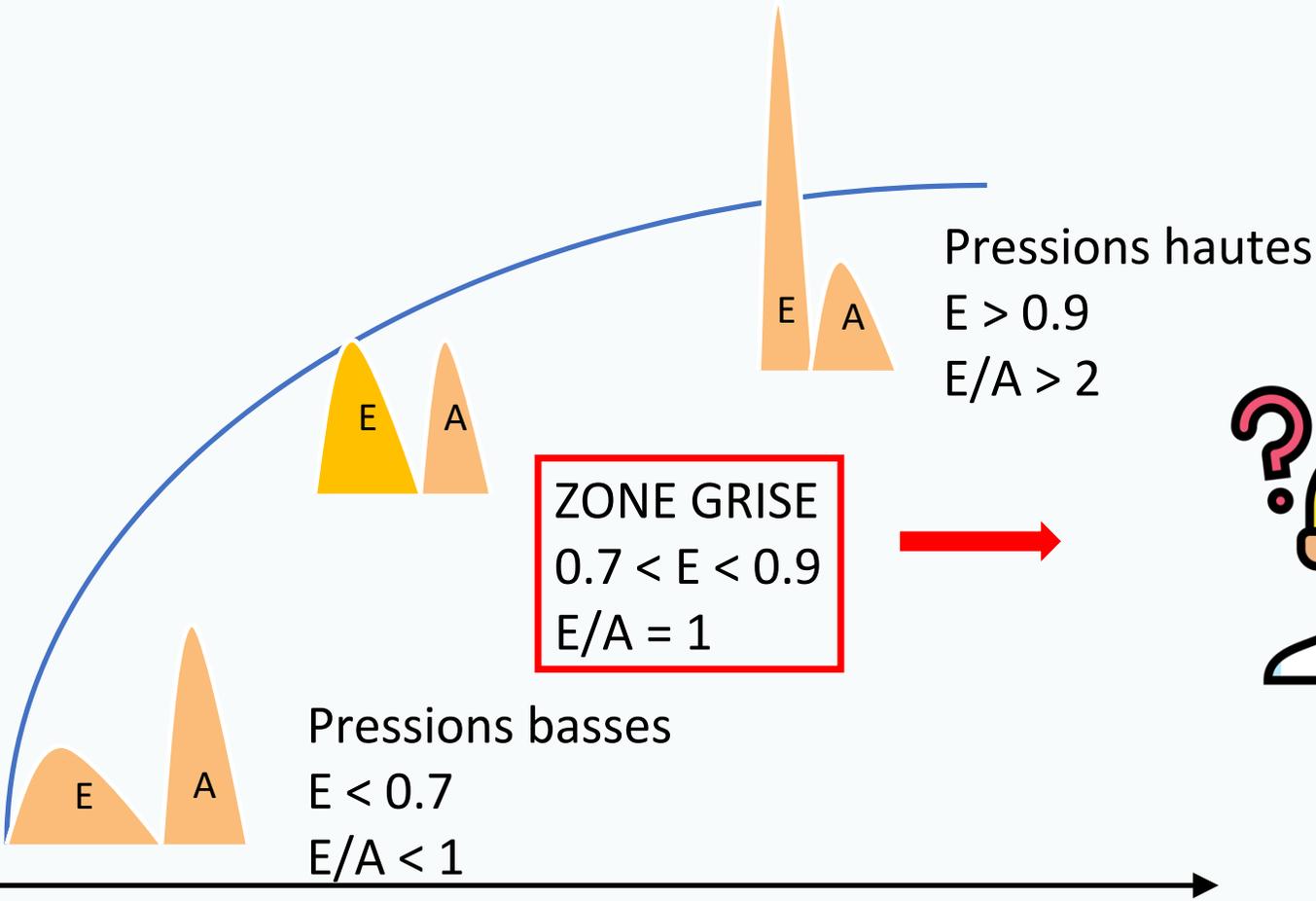


Franck et Starling



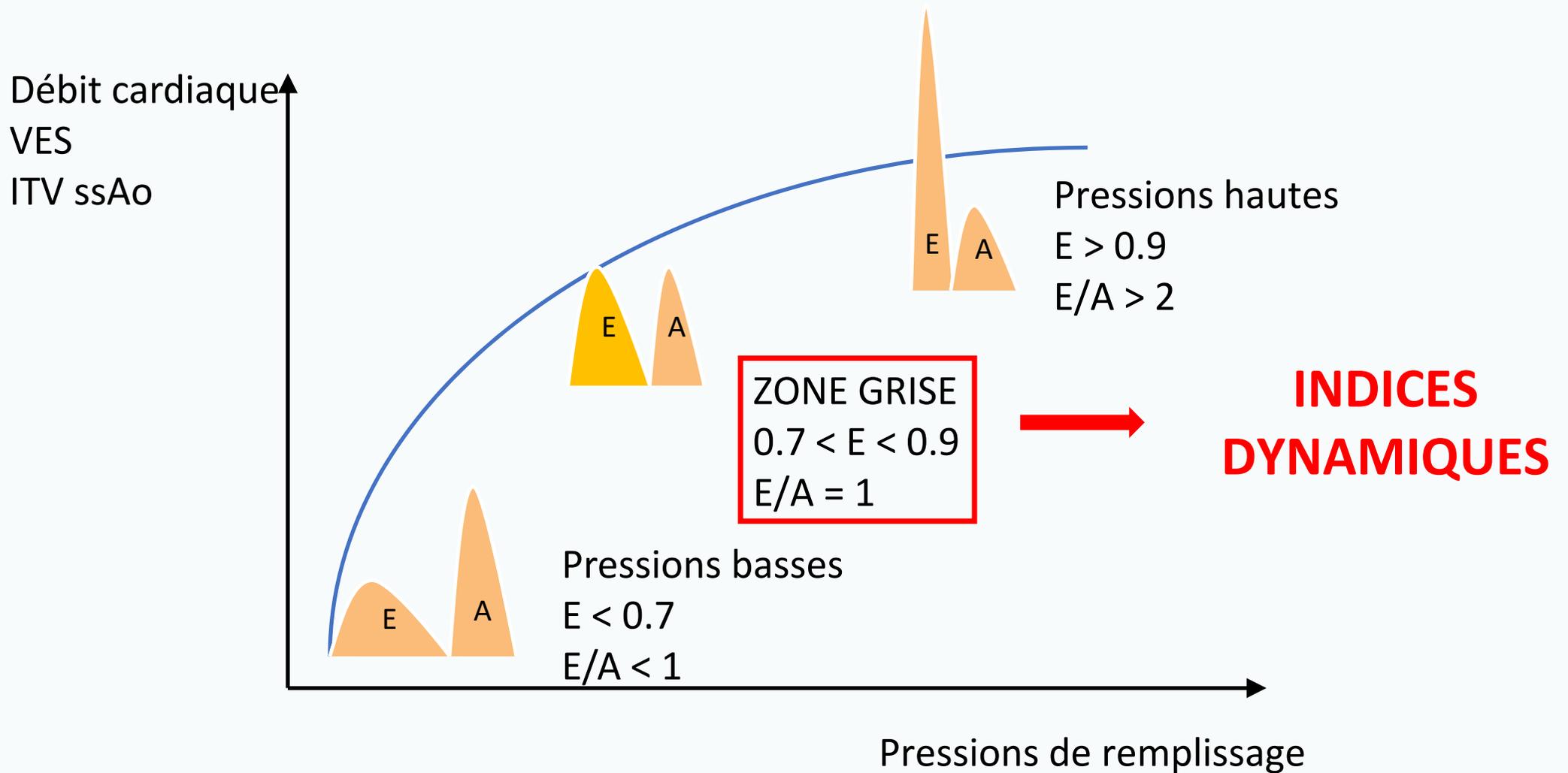
Franck et Starling

Débit cardiaque
VES
ITV ssAo



Pressions de remplissage

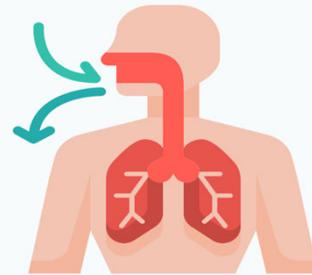
Franck et Starling



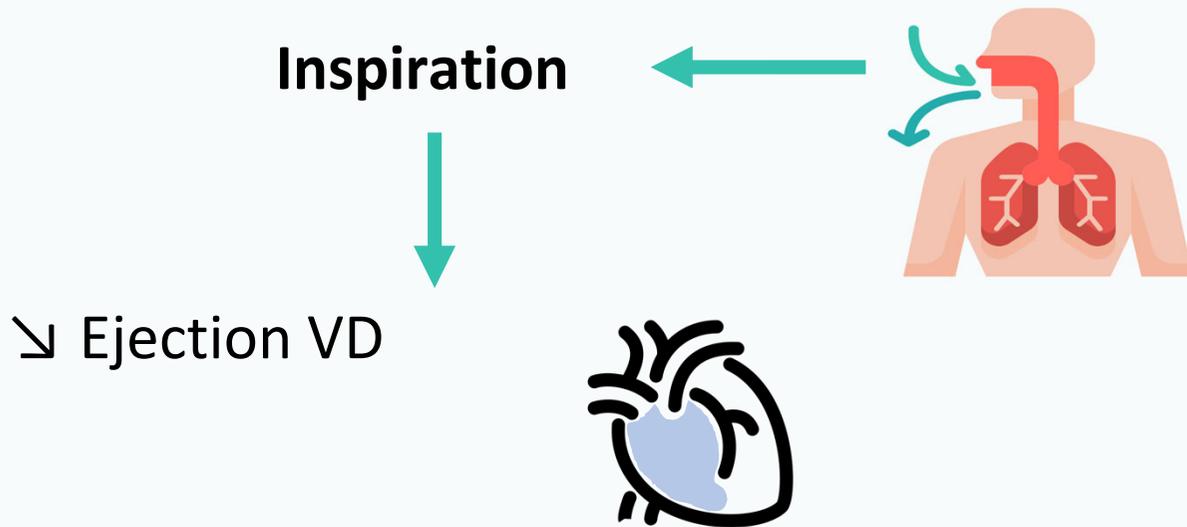
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Effet de la ventilation mécanique

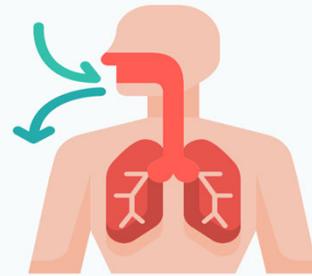


Effet de la ventilation mécanique



Effet de la ventilation mécanique

Inspiration

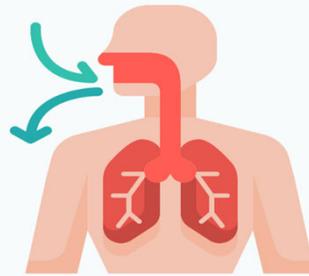


- ↳ Ejection VD
- ↳ retour veineux



Effet de la ventilation mécanique

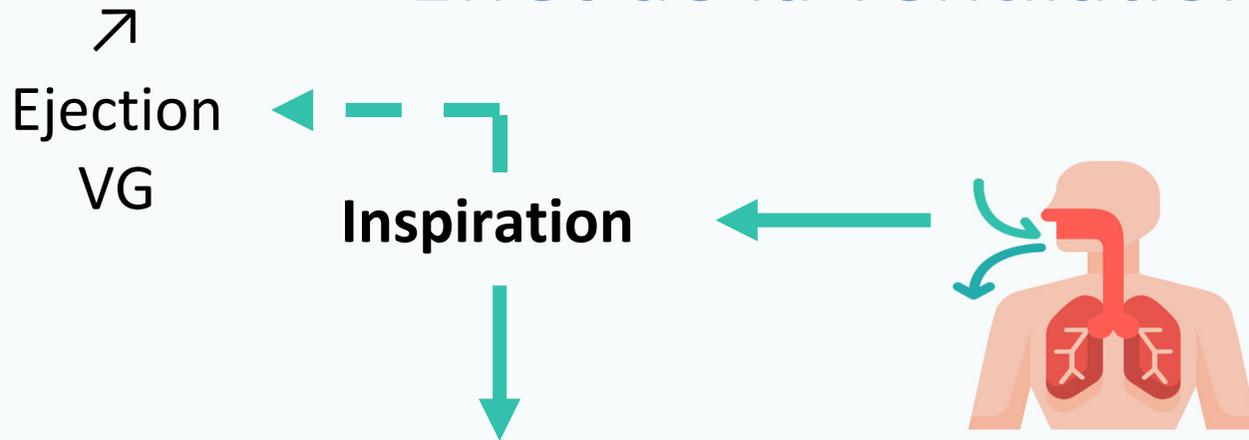
Inspiration



- ∨ Ejection VD
- ∨ retour veineux
- ↗ postcharge VD



Effet de la ventilation mécanique

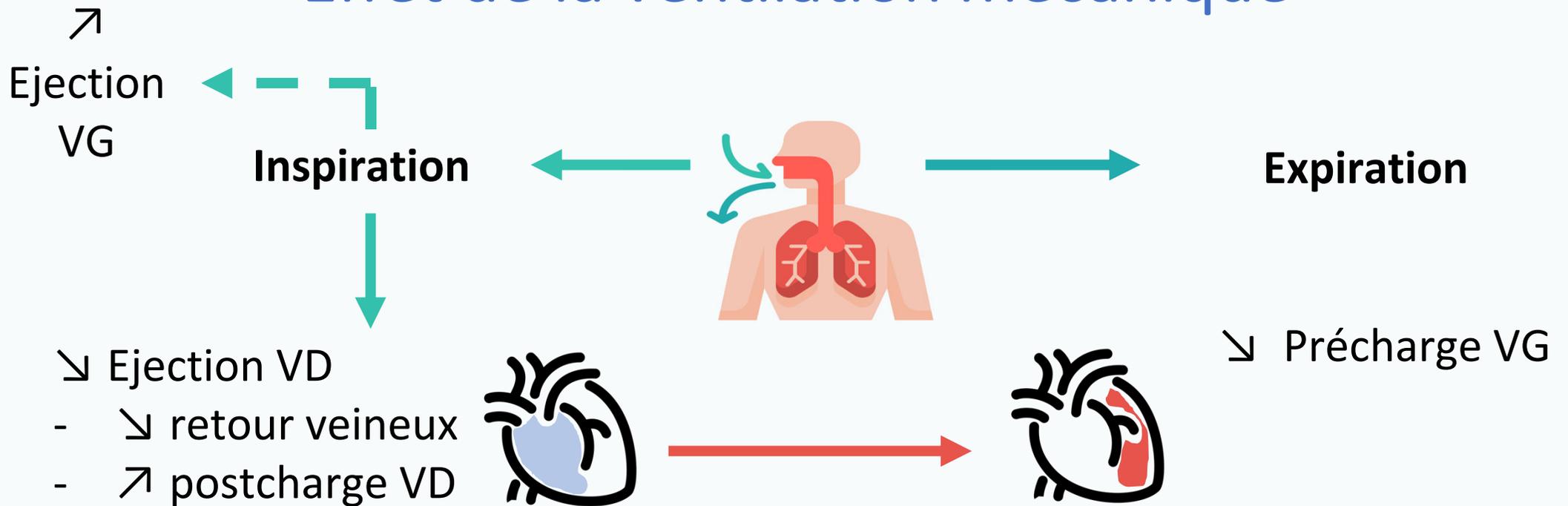


↘ Ejection VD

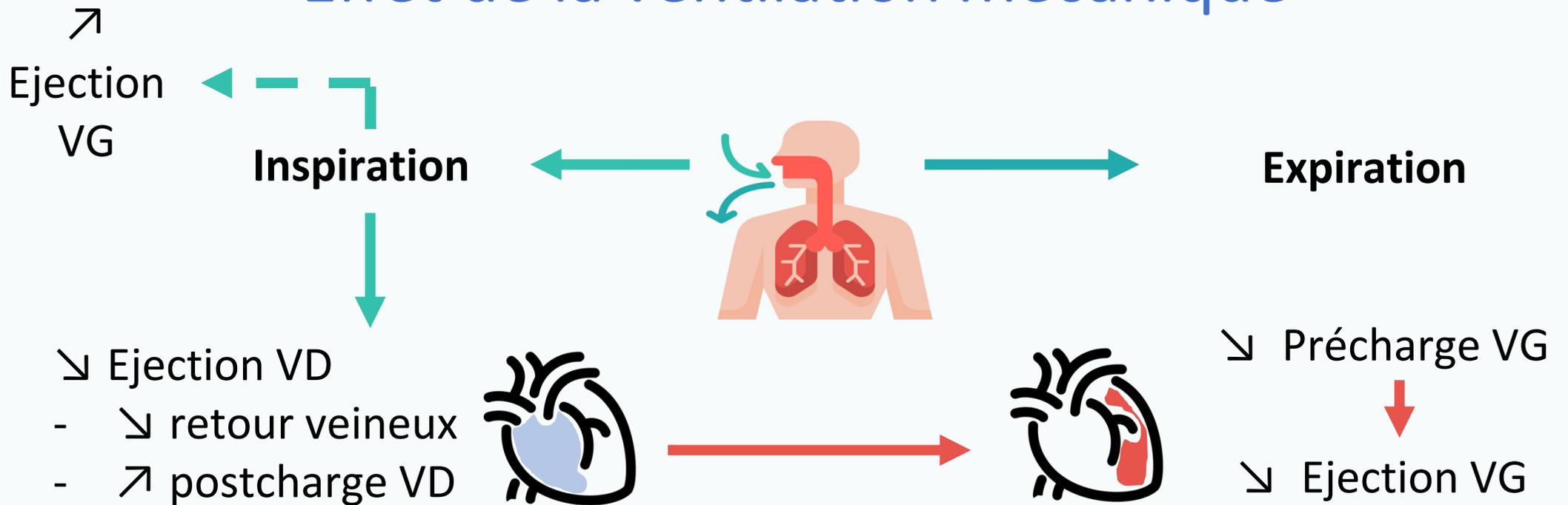
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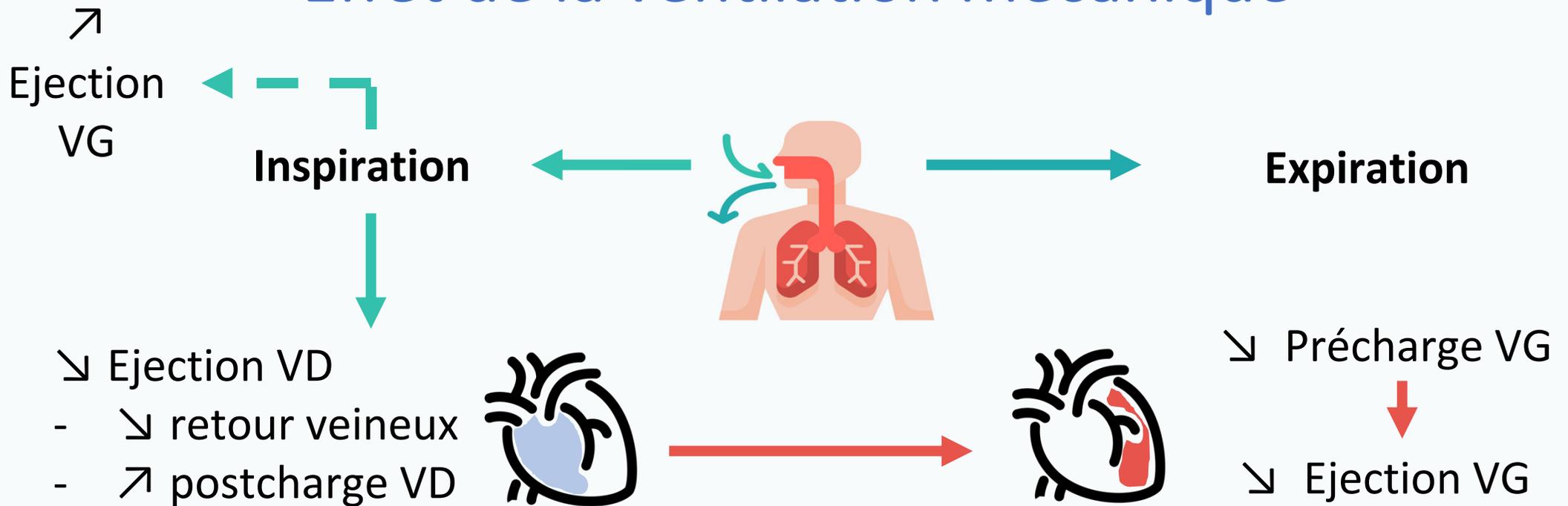
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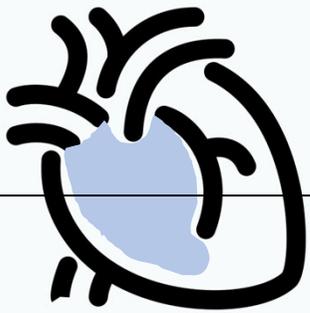


Cœur droit :
Analyse VCS et VCI

Cœur gauche :
Analyse de la
vitesse aortique



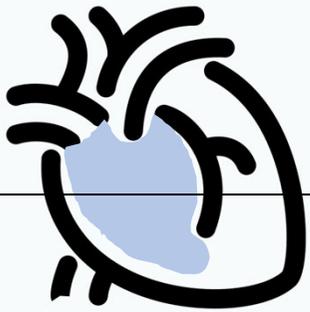
Variations respiratoires des veines caves



Variations respiratoires des veines caves

Veine cave **supérieure** :

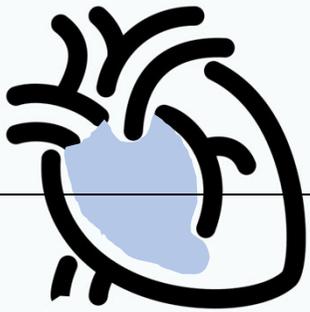
- **Intra**-thoracique
- Se **collabe** à l'inspiration sous VM



Variations respiratoires des veines caves

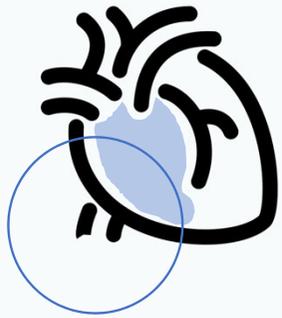
Veine cave **supérieure** :

- **Intra**-thoracique
- Se **collabe** à l'inspiration sous VM



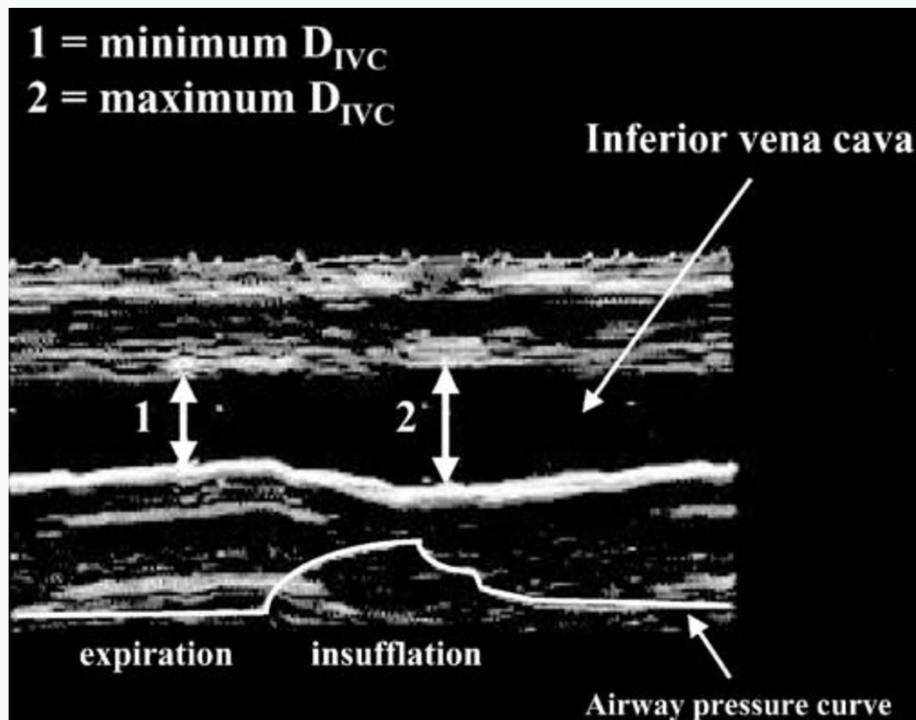
Veine cave **inférieure** :

- **Extra**-thoracique
- Se **dilate** à l'inspiration sous VM



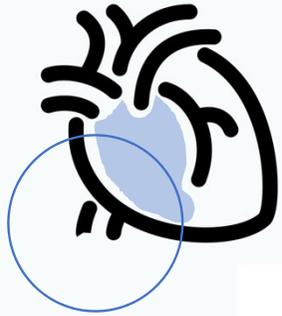
Veine cave inférieure

39 patients sous VM, choc septique



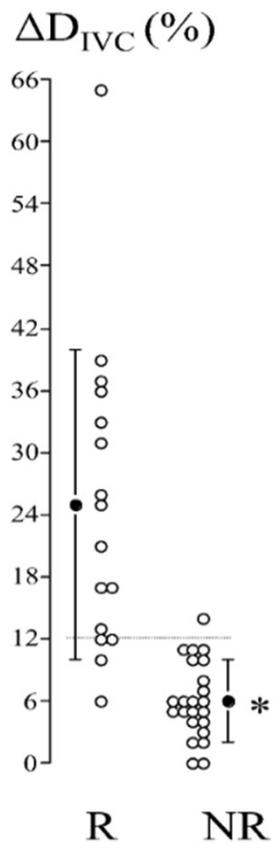
Index de distensibilité de la VCI =

$$\frac{\text{Diamètre max} - \text{Diamètre min}}{(\text{Diamètre max} + \text{Diamètre min})/2}$$



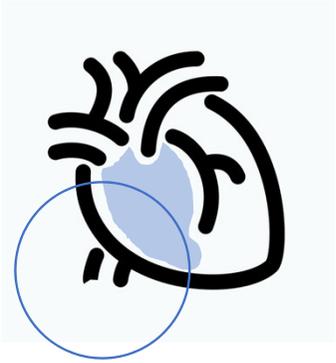
Veine cave inférieure

39 patients sous VM, choc septique



Therefore, the threshold ΔD_{IVC} value of 12% allowed discrimination between responders and non-responders with a positive predictive value of 93% and a negative predictive value of 92%.

Excellentes performances
diagnostiques !



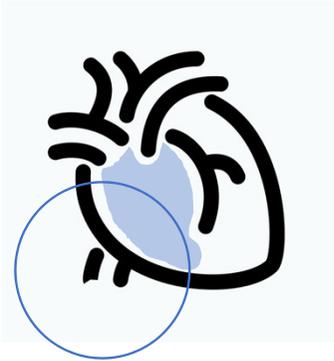
Veine cave inférieure

Does Respiratory Variation in Inferior Vena Cava Diameter Predict Fluid Responsiveness in Mechanically Ventilated Patients? A Systematic Review and Meta-analysis

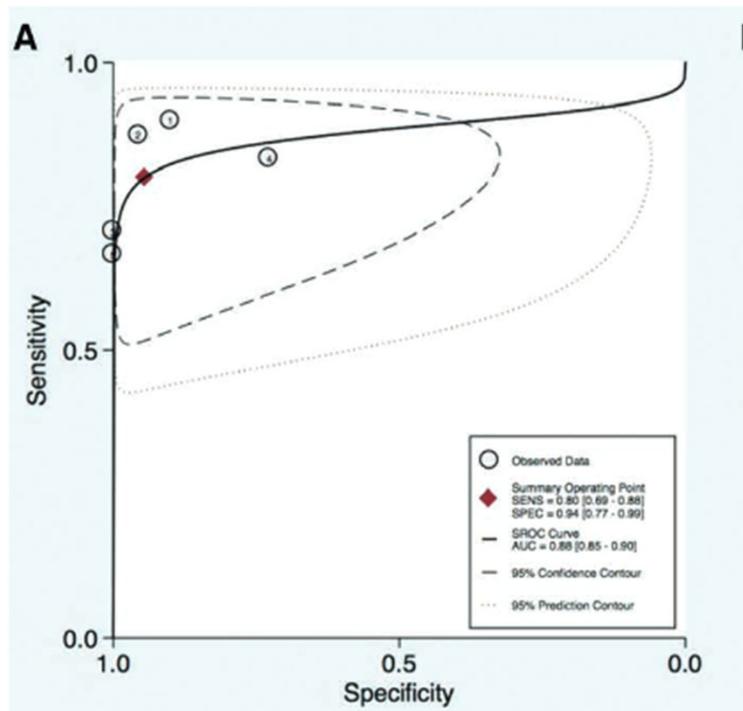
Xiang Si, MD,* Hailin Xu, PhD,* Zimeng Liu, MD,* Jianfeng Wu, PhD, MD,* Daiyin Cao, MD,†
Juan Chen, MD,* Minying Chen, MD,* Yongjun Liu, MD,* and Xiangdong Guan, PhD, MD*

12 études, 753 patients

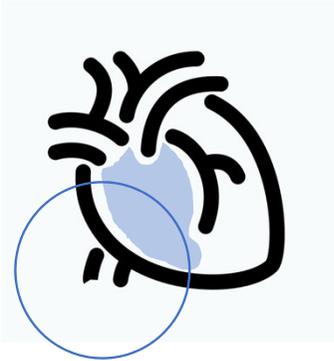
Si et al. Anesth Analg 2018



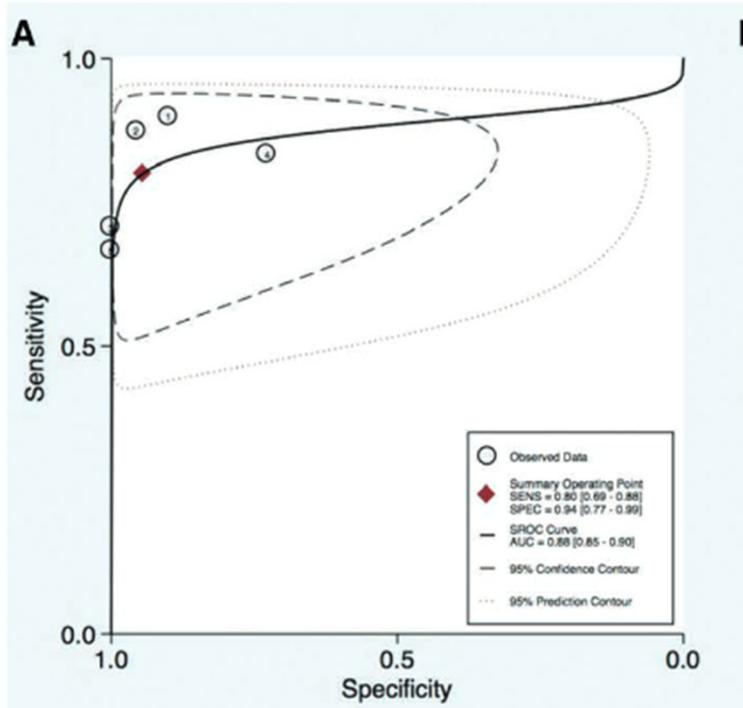
Veine cave inférieure



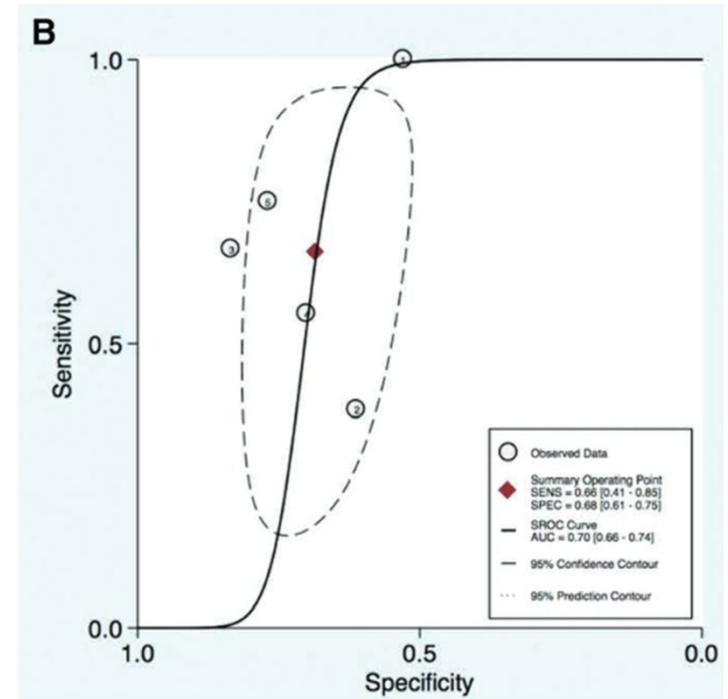
$V_t > 8\text{ml/kg}$ et
 $\text{PEP} < 5\text{ cmH}_2\text{O}$



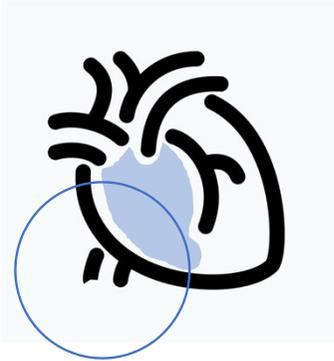
Veine cave inférieure



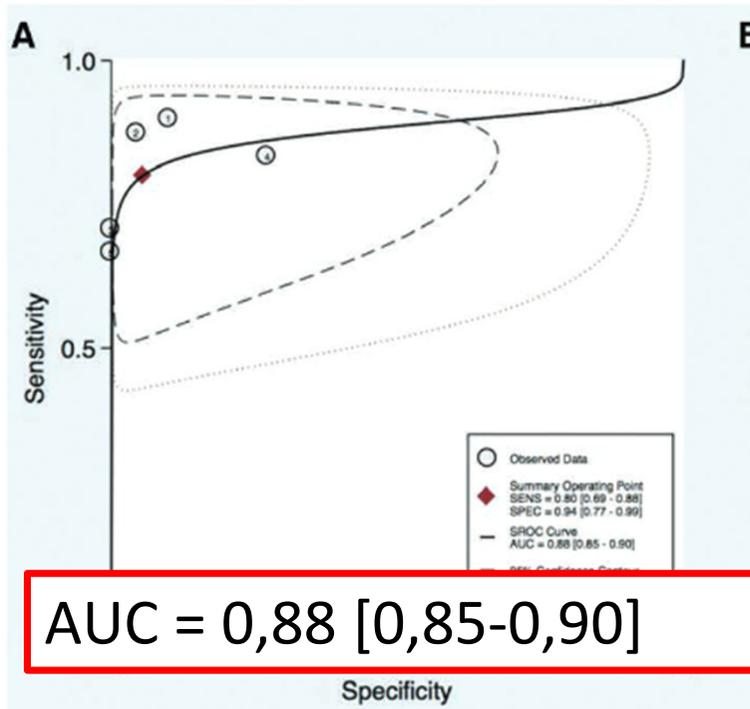
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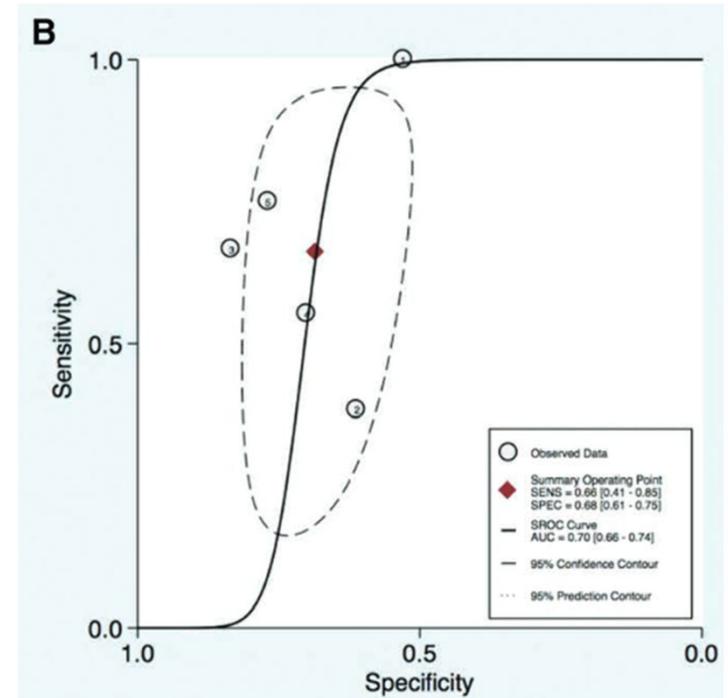
$V_t < 8\text{ml/kg}$ ou
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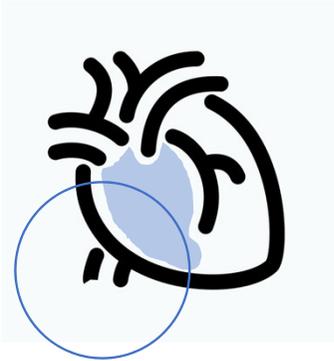
Veine cave inférieure



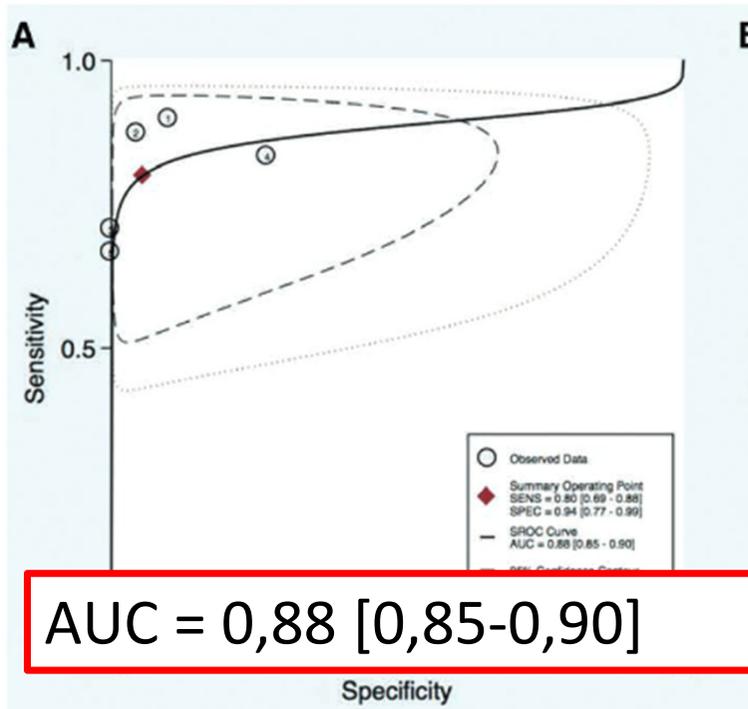
Vt > 8ml/kg et
PEP < 5 cmH₂O



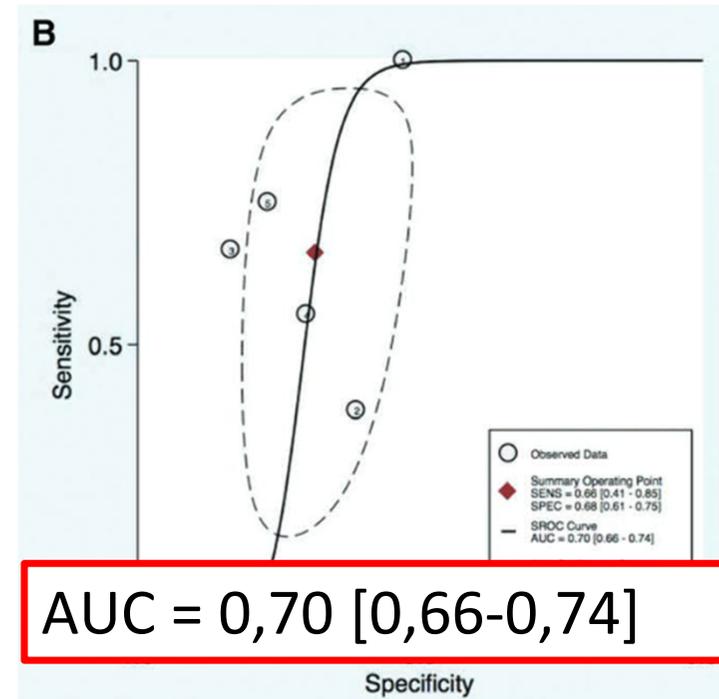
Vt < 8ml/kg ou
PEP > 5 cmH₂O



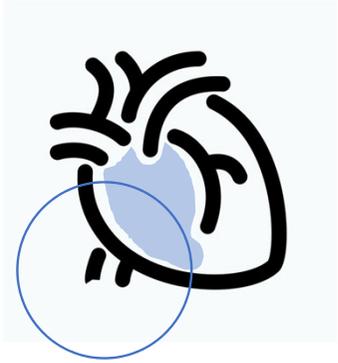
Veine cave inférieure



Vt > 8ml/kg et
PEP < 5 cmH₂O

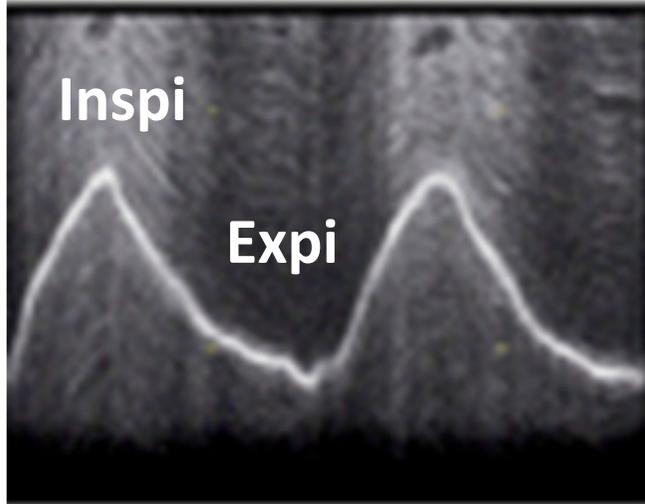
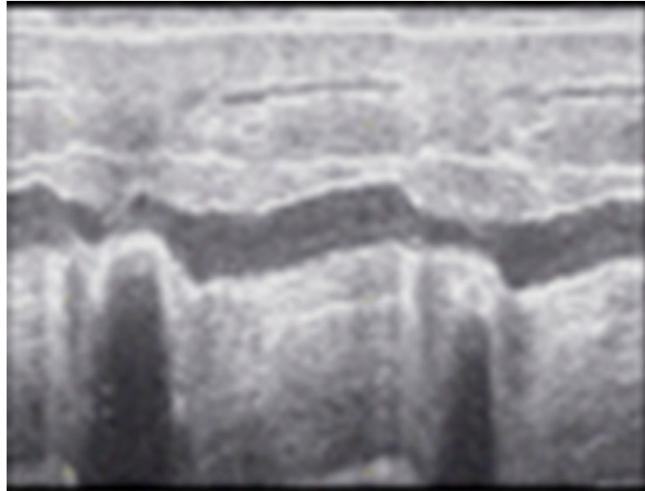


Vt < 8ml/kg ou
PEP > 5 cmH₂O



Veine cave inférieure

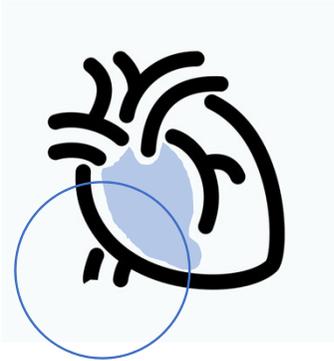
VCI



Diaphragme

Ventilation spontanée :

- Pression négative intra-thoracique à l'inspiration
- Collapsus inspiratoire de la VCI



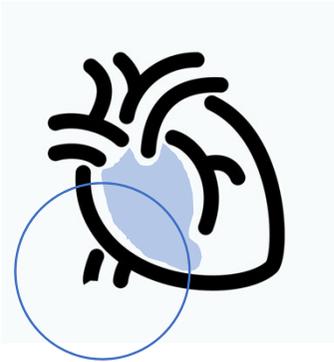
Veine cave inférieure

8 études, 497 patients, hétérogénéité +++

Table 2 Data extracted from included studies assessing accuracy of IVcC as a predictor of fluid responsiveness.

Author and year	N	Fluid responders	IVcC cut-off	IVcC – responders	IVcC – non responders	Sensitivity	Specificity	AUC (95% CI)
Mcgregor, 2020	30	63.3%	>40%	NA	NA	47%	63%	0.46 (0.26–0.67)
Corl, 2019	85	52%	>25%	38.2%	12.9%	86%	78%	0.82 (0.74–0.88)
Bortolotti, 2018	55	53%	>37%	49%	11%	66%	85%	0.82 (0.70–0.93)
Corl, 2017	124	49.2%	>25%	NA	NA	87%	81%	0.84 (0.76–0.81)
Preau, 2017	90	55%	>31%	47%	14%	76%	88%	0.82 (0.73–0.91)
Airapetian, 2015	59	49%	>42%	35%	27%	31%	97%	0.62 (0.49–0.74)
Lanspa, 2013	14	35%	>15%	52%	11%	100%	66%	0.83 (0.58–1.00)
Muller, 2012	40	50%	>40%	64%	19%	70%	80%	0.77 (0.60–0.88)

Legend – IVcC: inferior vena cava collapsibility; AUC: *area under curve*; 95% CI: 95% confidence interval; NA: not available.



Veine cave inférieure

8 études, 497 patients, hétérogénéité +++

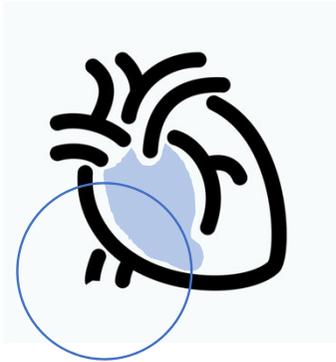
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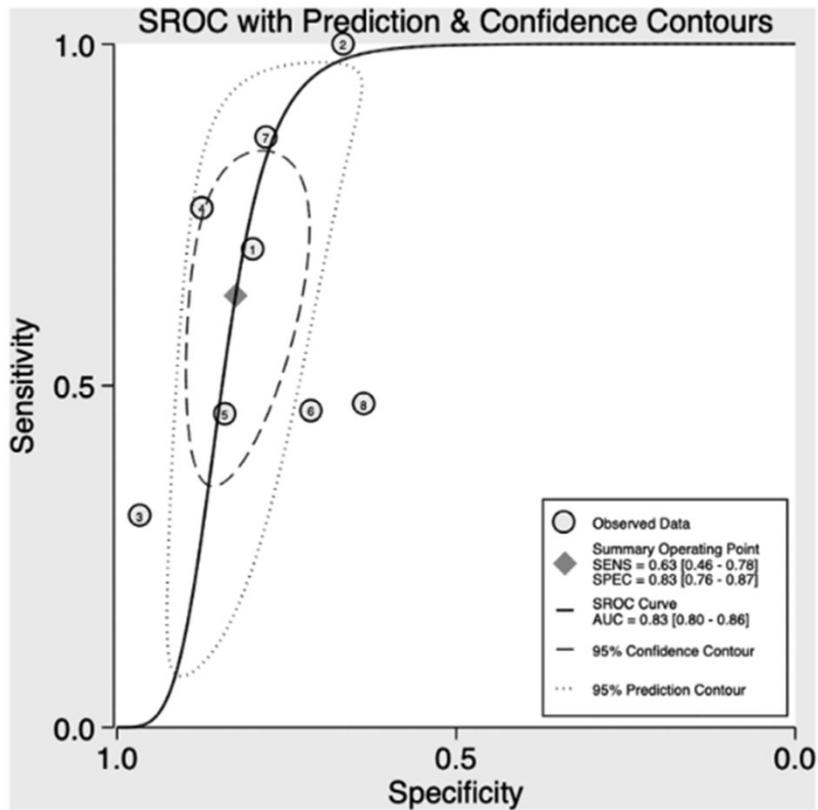
Legend – IVCc: inferior vena cava collapsibility; AUC: area under curve; 95% CI: 95% confidence interval; NA: not available.

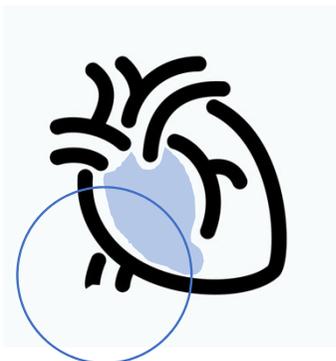
40% : seuil conservateur

LCM Cardozo Jnr et al. Med Int 2023

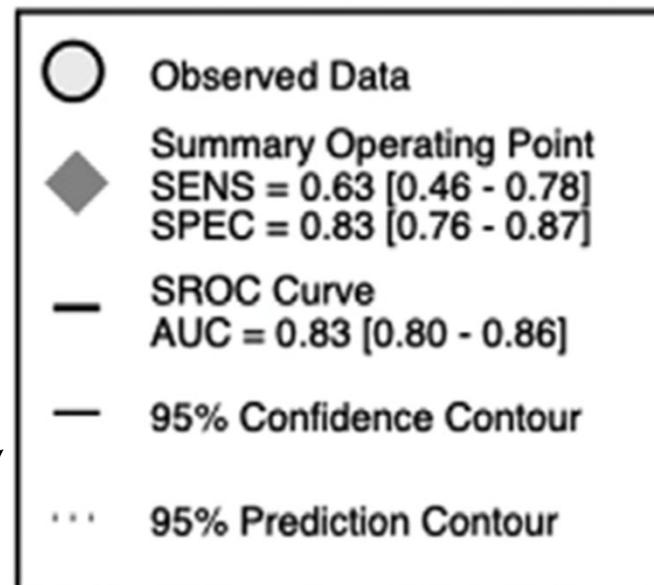
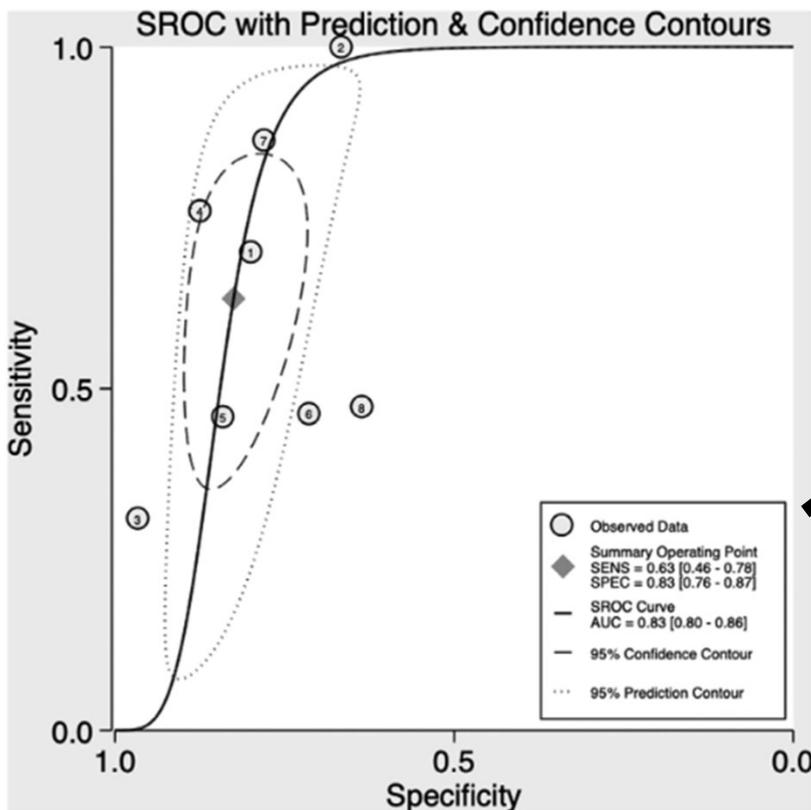


Veine cave inférieure





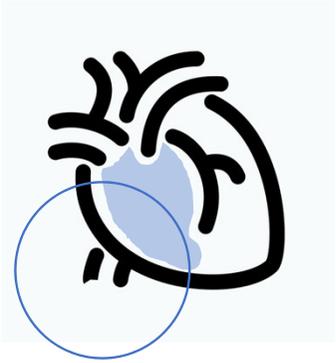
Veine cave inférieure



Proba post-test

si + : 80 %

si - : 30 %



Veine cave inférieure

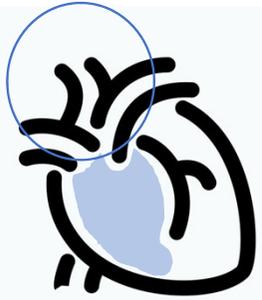
En conclusion :

- Sous ventilation mécanique :

- Dist VCI $> 12\%$ ($\frac{\text{max}-\text{min}}{(\text{max}+\text{min}/2)}$) = hypovolémie
- Dist VCI $< 12\%$ = pas d'hypovolémie

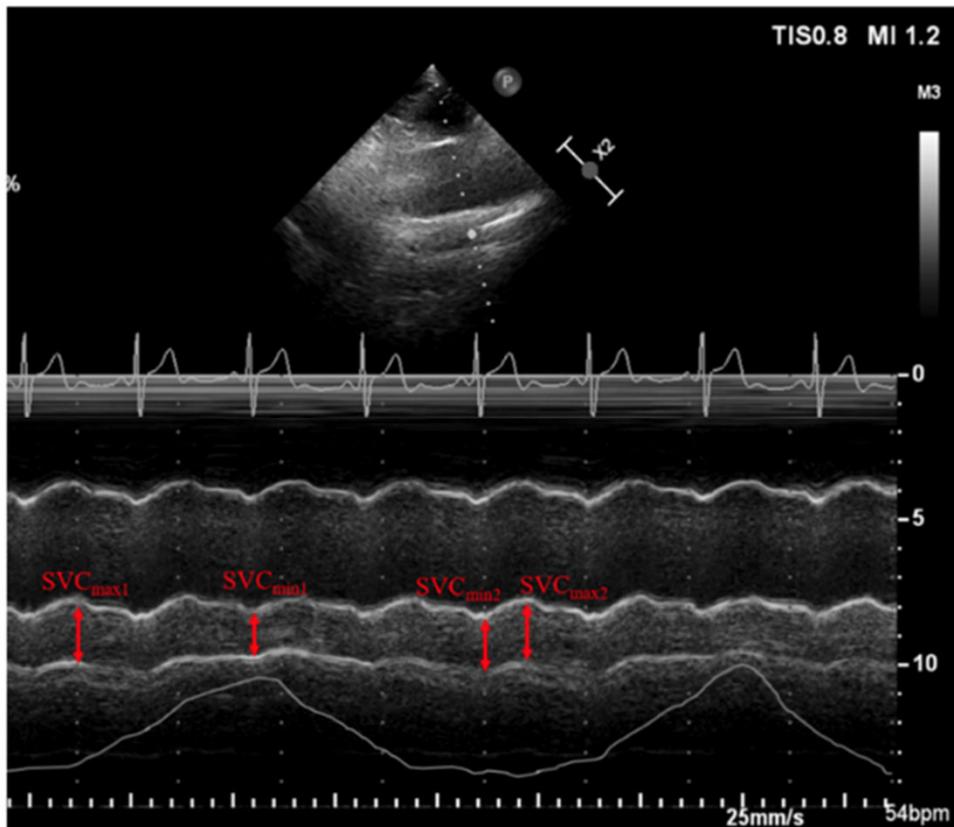
- En ventilation spontanée :

- Coll VCI $> 40\%$ ($\frac{\text{max}-\text{min}}{\text{max}}$) = hypovolémie
- Coll VCI $< 40\%$ = on ne sait pas

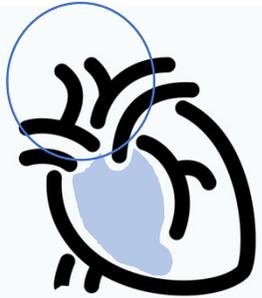


Veine cave supérieure

VCI intra-thoracique , si collapsibilité = retour veineux insuffisant



$$\text{Index collapsibilité} = \frac{\text{Diamètre max(expi)} - \text{Diamètre min(inspi)}}{\text{Diamètre max(expi)}}$$



Veine cave supérieure

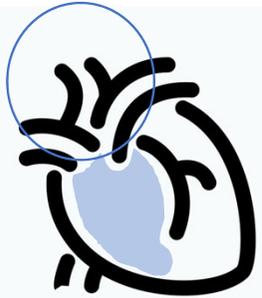
66 patients, choc septique + acute
lung injury

SVCCi > 36%

Se : 90 % / Sp = 100 %

AUC = 0,91

Veillard-Baron et al. Anesthesio 2001



Veine cave supérieure

66 patients, choc septique + acute lung injury

SVCCi > 36%

Se : 90 % / Sp = 100 %

AUC = 0,91

Veillard-Baron et al. Anesthesio 2001

70 patients, ICU pour post-op chir abdominale majeure

SVCCi > 19 %

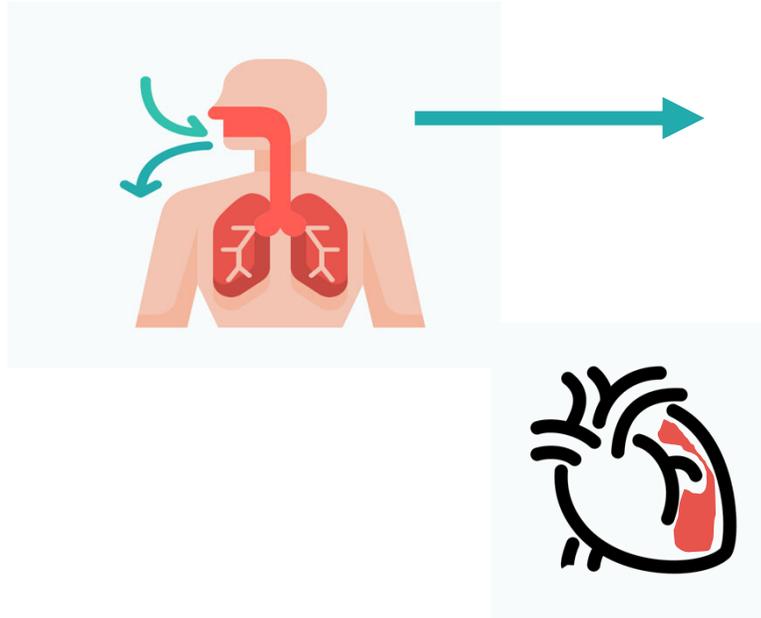
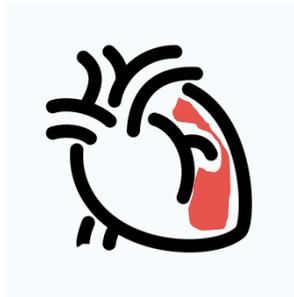
Se : 93,3 % / Sp = 75 %

AUC = 0,885

Ma et al. BMC anesthesio 2022

Effet de la ventilation mécanique

Cœur gauche :
Analyse de la
vélocité aortique



Expiration

- ↘ Précharge VG
- ↓
- ↘ Ejection VG

Variations respiratoires du VES

Relation between Respiratory Changes in Arterial Pulse Pressure and Fluid Responsiveness in Septic Patients with Acute Circulatory Failure

FRÉDÉRIC MICHARD, SANDRINE BOUSSAT, DENIS CHEMLA, NADIA ANGUEL, ALAIN MERCAT, YVES LECARPENTIER, CHRISTIAN RICHARD, MICHAEL R. PINSKY, and JEAN-LOUIS TEBOUL

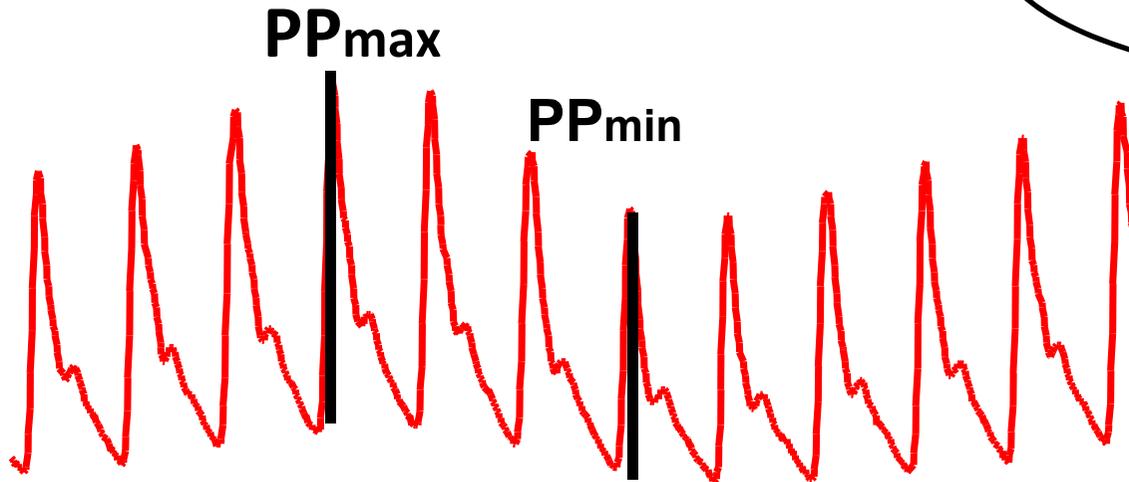
Am J Respir Crit Care Med 2000; 162:134-138

$$PP = VES / \text{compliance}$$

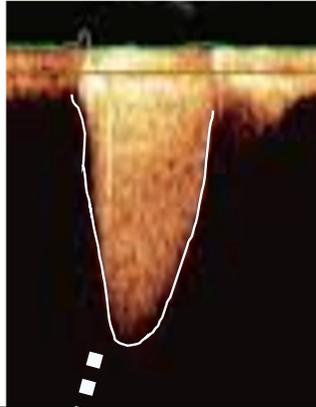
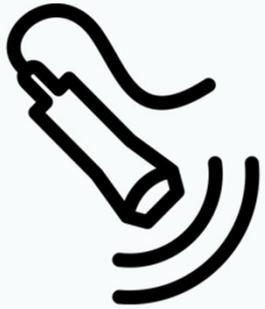
ΔVES = valeur physiologique à approcher

$$\Delta PP = \frac{PP_{\max} - PP_{\min}}{(PP_{\max} + PP_{\min}) / 2}$$

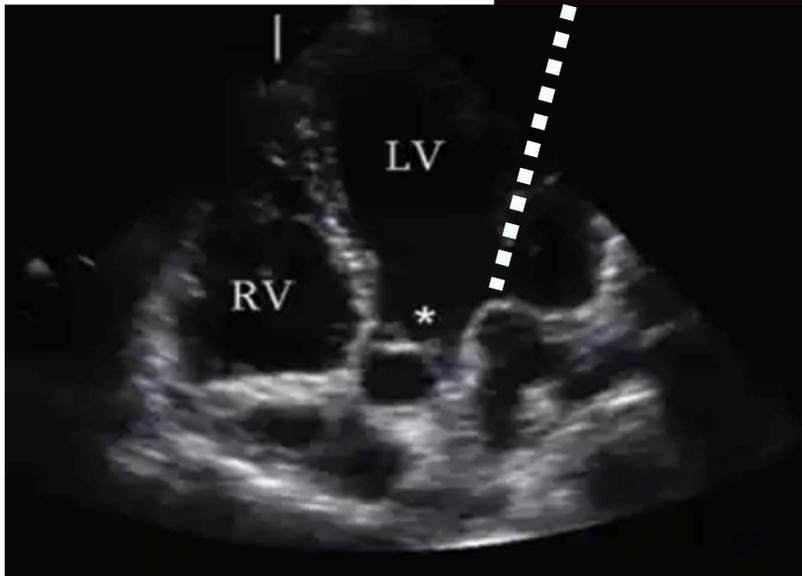
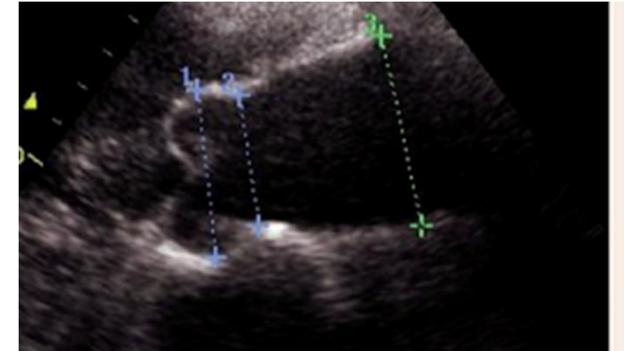
Arterial
Pressure



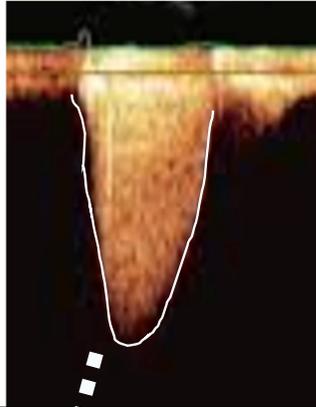
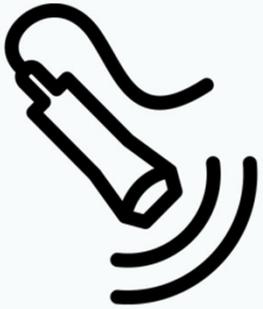
Variations respiratoires du VES



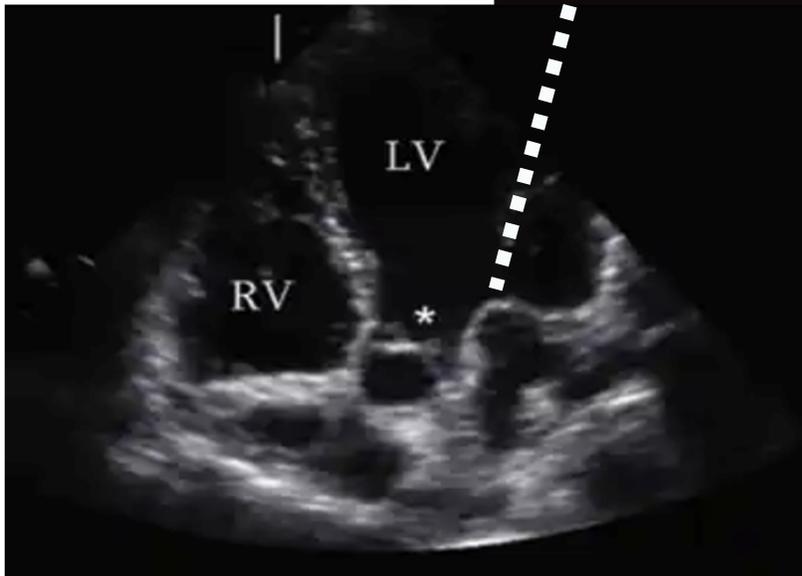
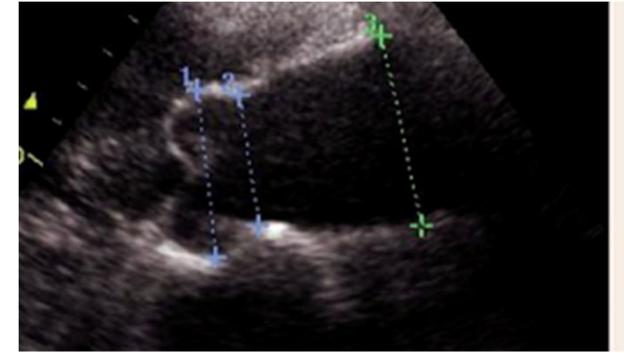
$$\text{VES} = \text{ITV} \times \text{SAo}$$



Variations respiratoires du VES



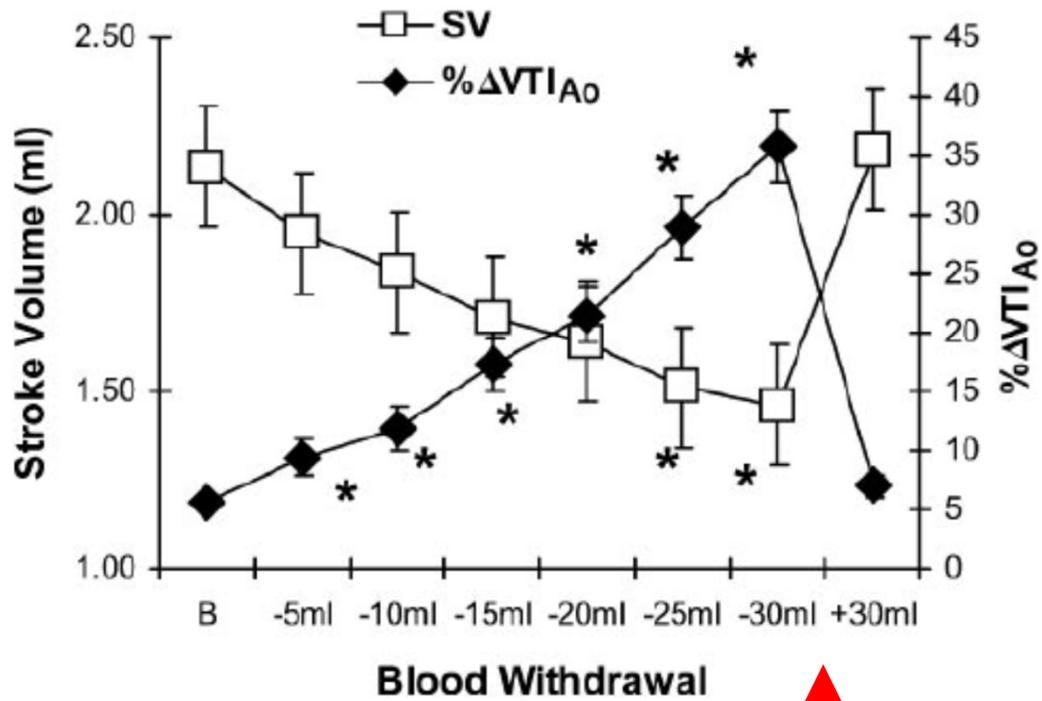
$$\text{VES} = \text{ITV} \times \text{SAo}$$



Surface aortique stable au cours
du cycle respiratoire

$$\text{Donc : } \Delta \text{VES} = \Delta \text{ITV}$$

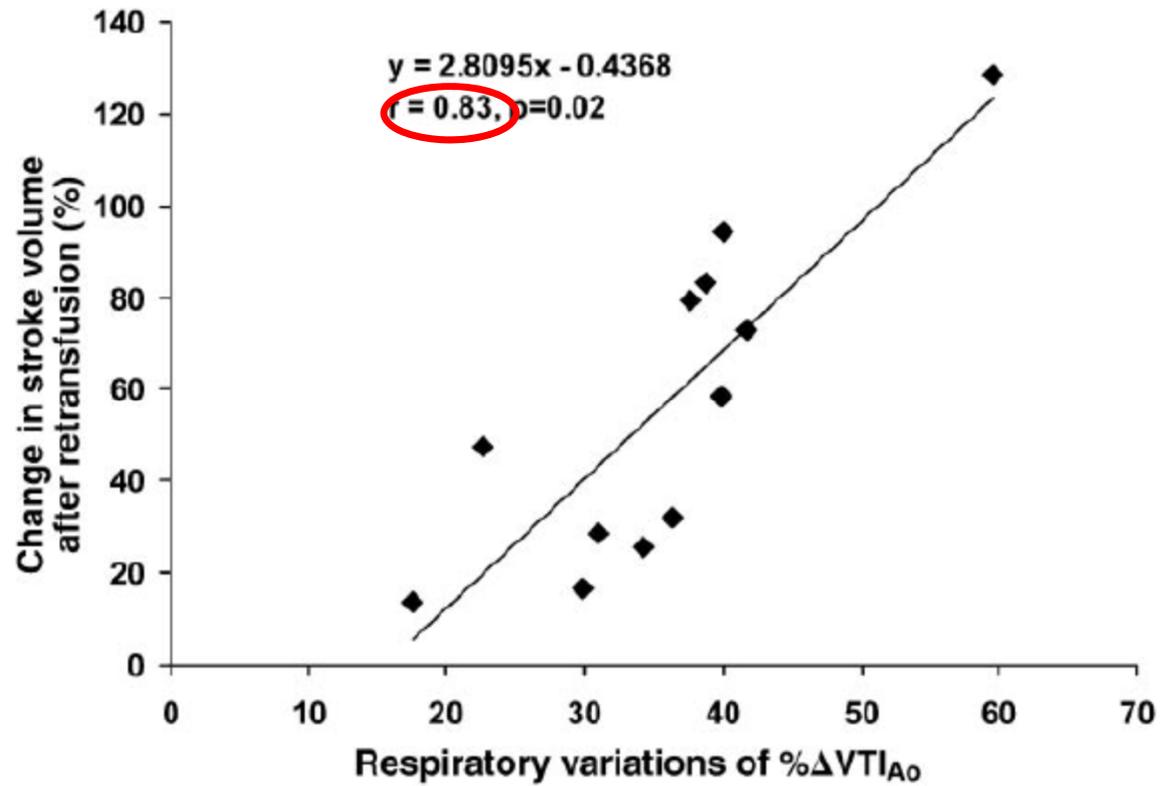
Variations respiratoires du VES



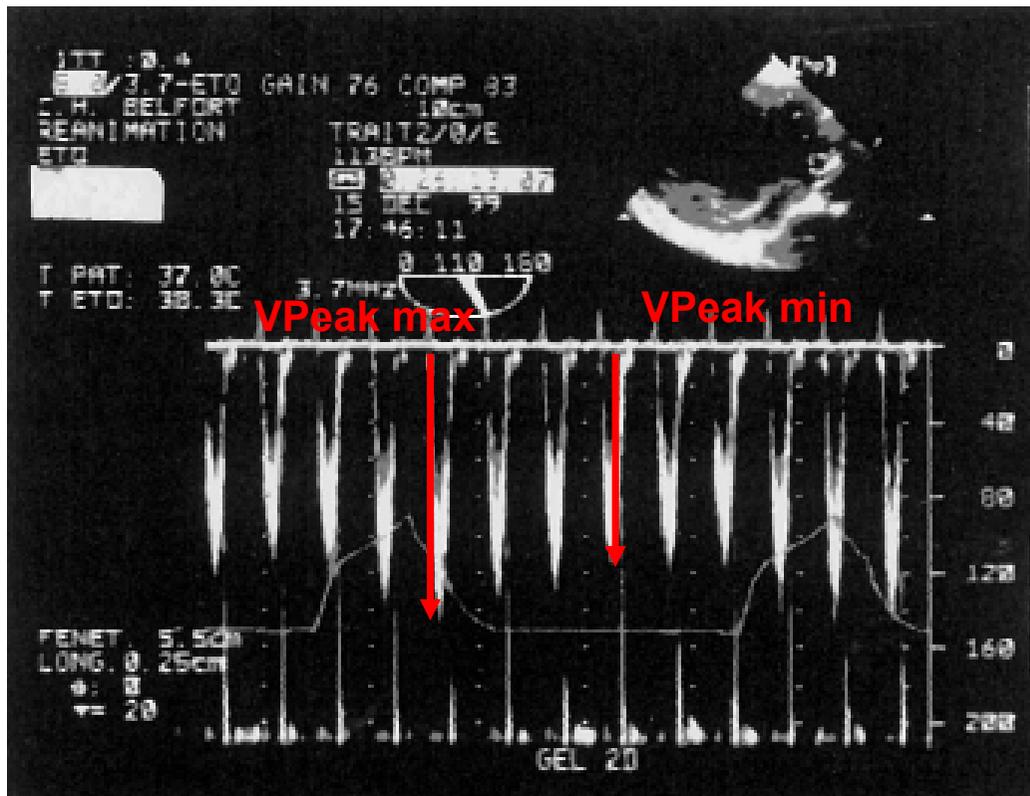
↑
Retransfusion

Etude animale sur
lapin
Spoliation sanguine
puis retransfusion

Variations respiratoires du VES

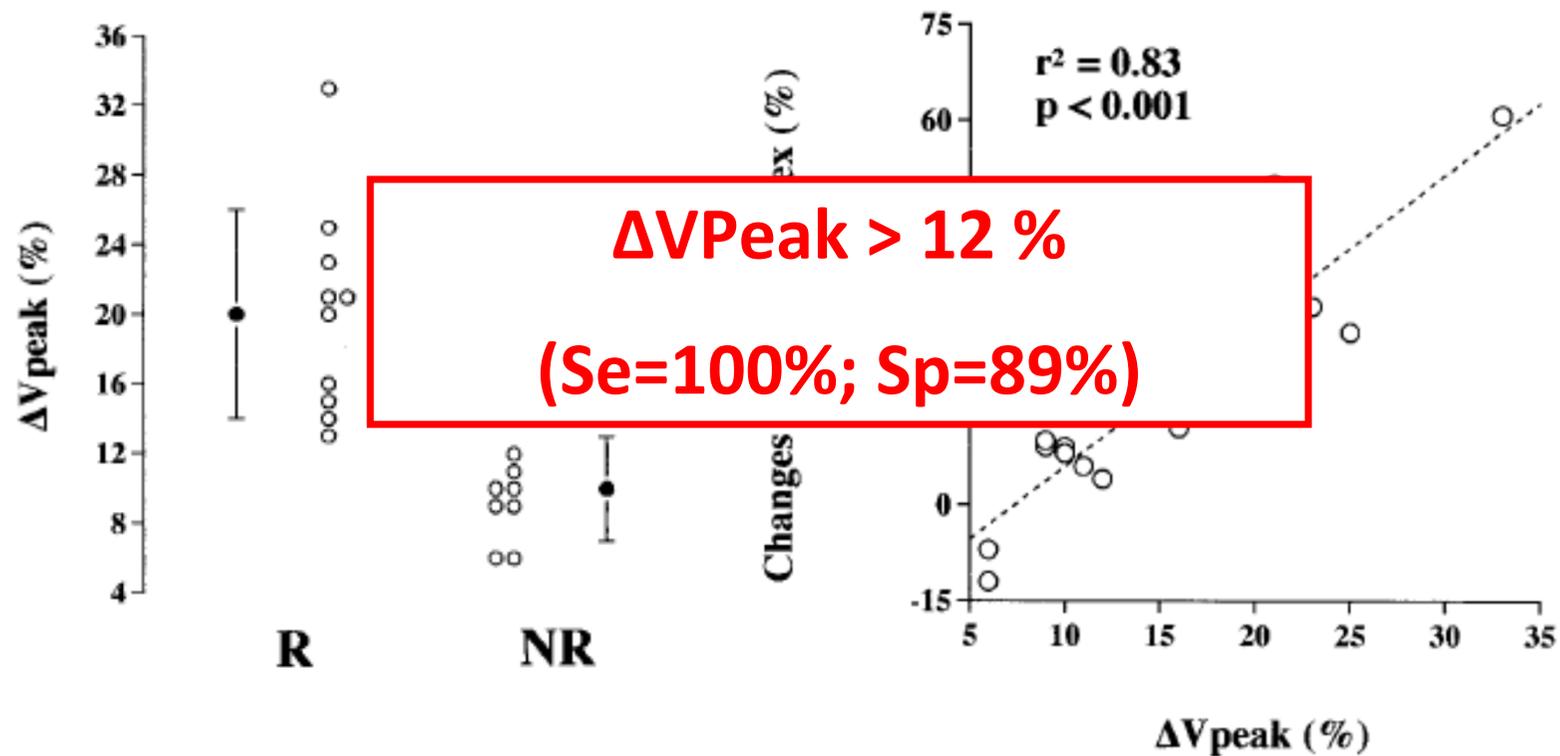


Variations respiratoires du VES

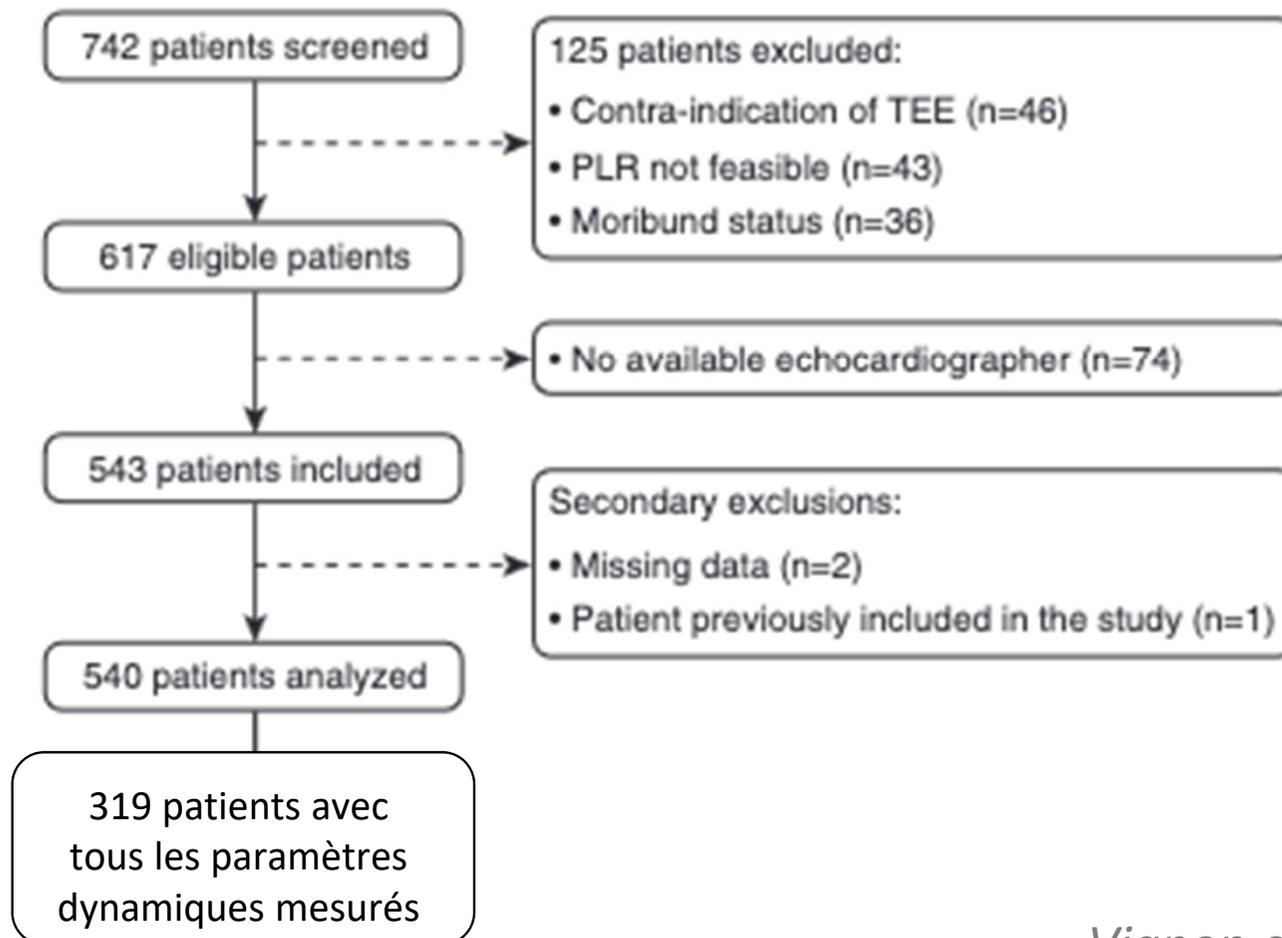


$$\Delta V_{\text{Peak}} = \frac{V_{\text{Peak max}} - V_{\text{Peak min}}}{(V_{\text{Peak max}} + V_{\text{Peak min}}) / 2} \times 100$$

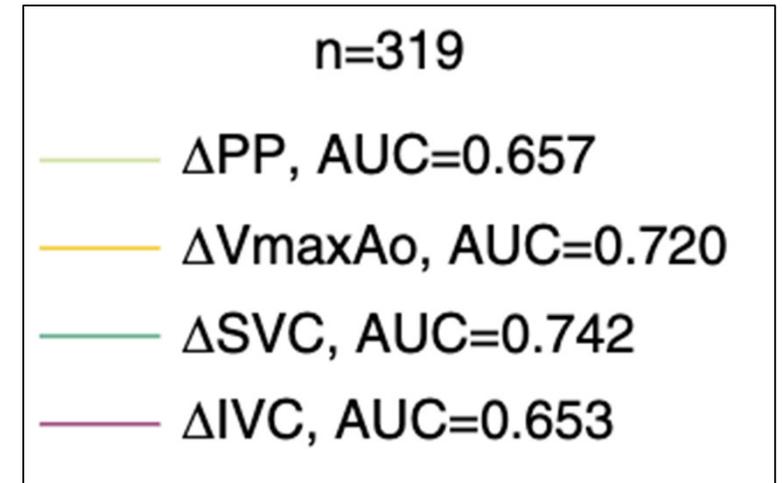
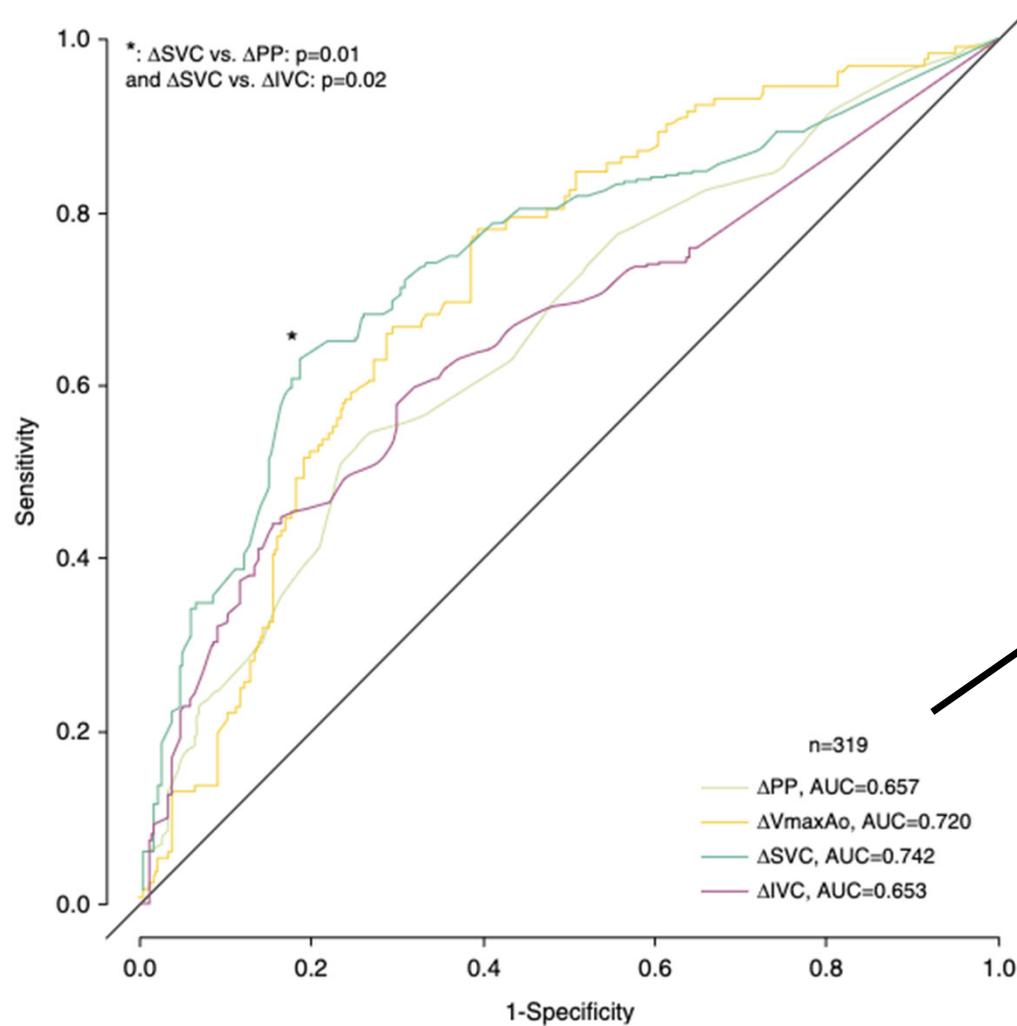
Variations respiratoires du VES



Variations respiratoires du VES



Variations respiratoires du VES



Toutes AUC < 0,75

Les indices dynamiques

Ca fonctionne bien !



Les indices dynamiques

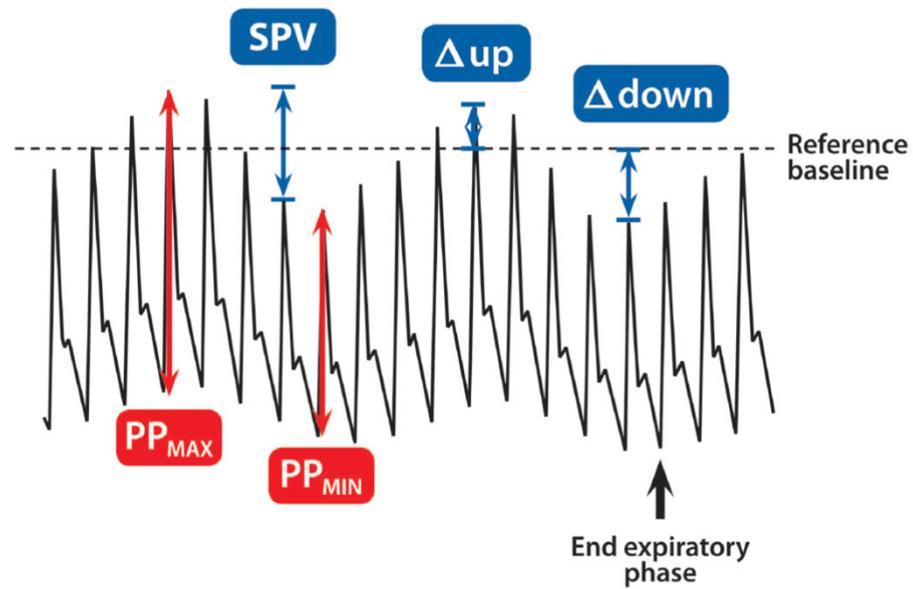
Ca fonctionne bien !



Mais pas souvent...

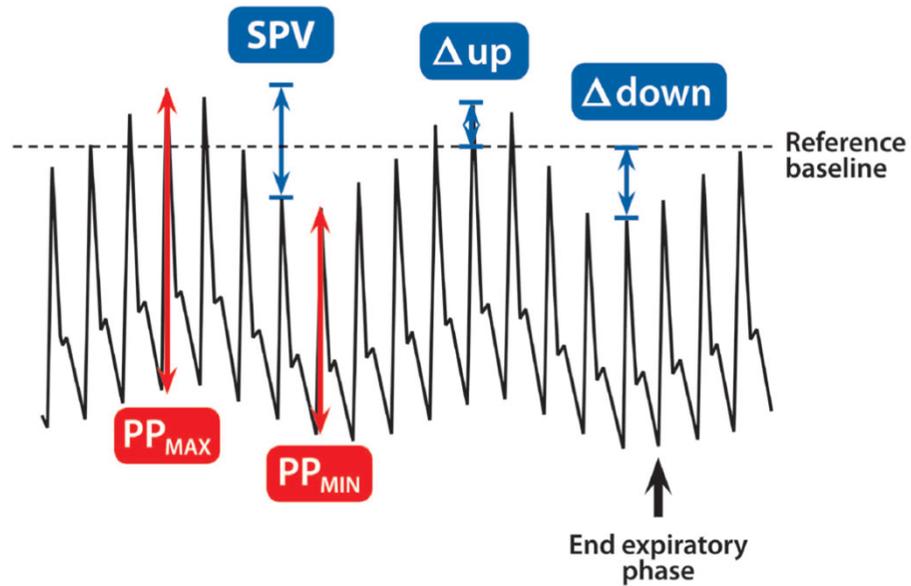


Les indices dynamiques : limites



Les indices dynamiques : limites

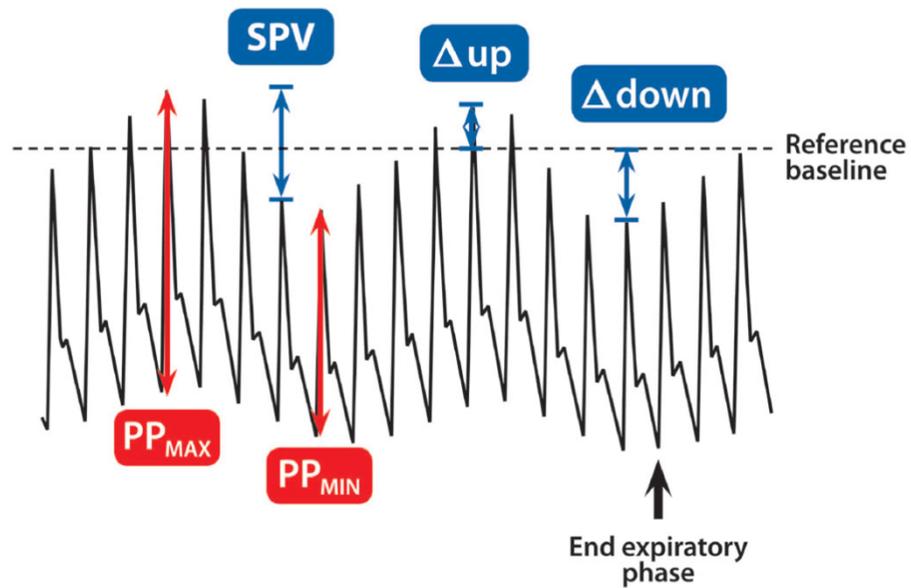
Arythmie



Les indices dynamiques : limites

Arythmie

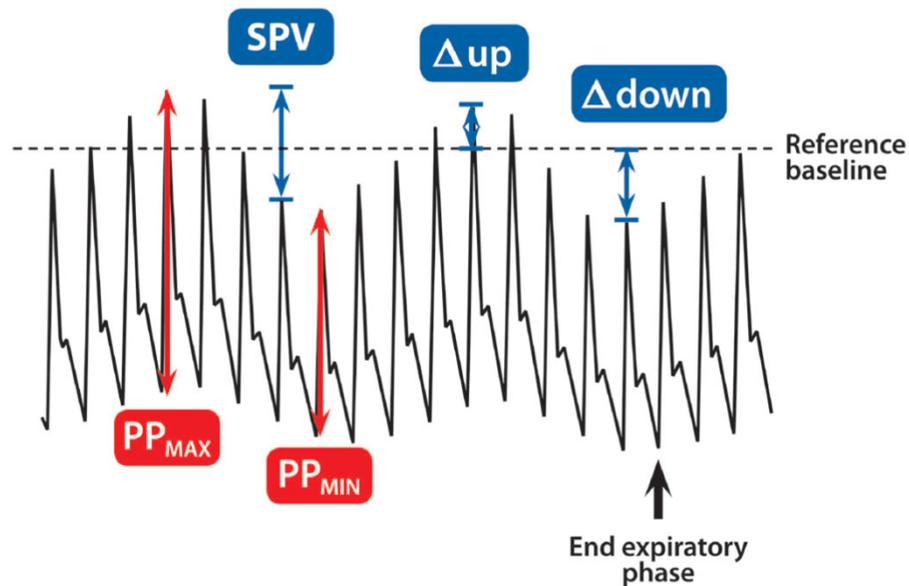
Respiration spontanée



Les indices dynamiques : limites

Arythmie

Respiration spontanée

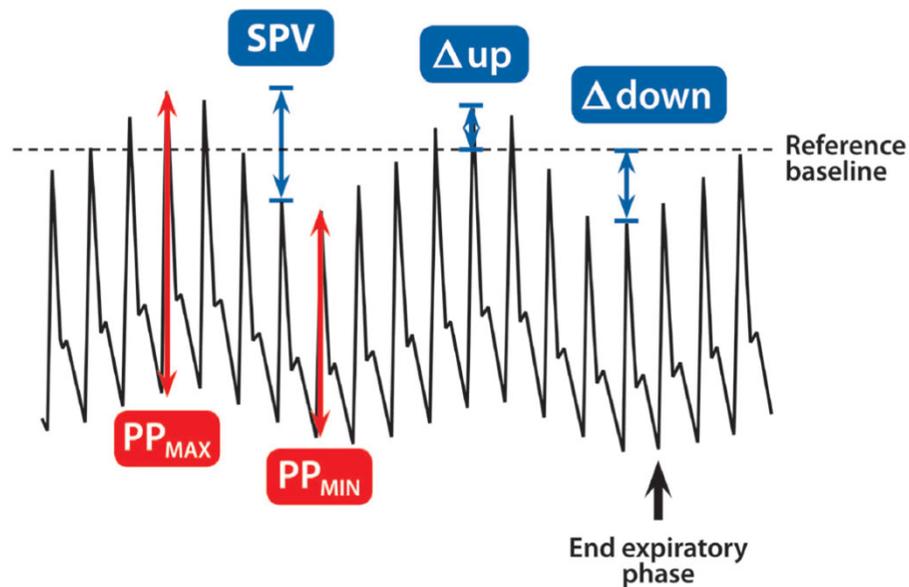


Transmission de pression faible :
Faible Vt

Les indices dynamiques : limites

Arythmie

Respiration spontanée

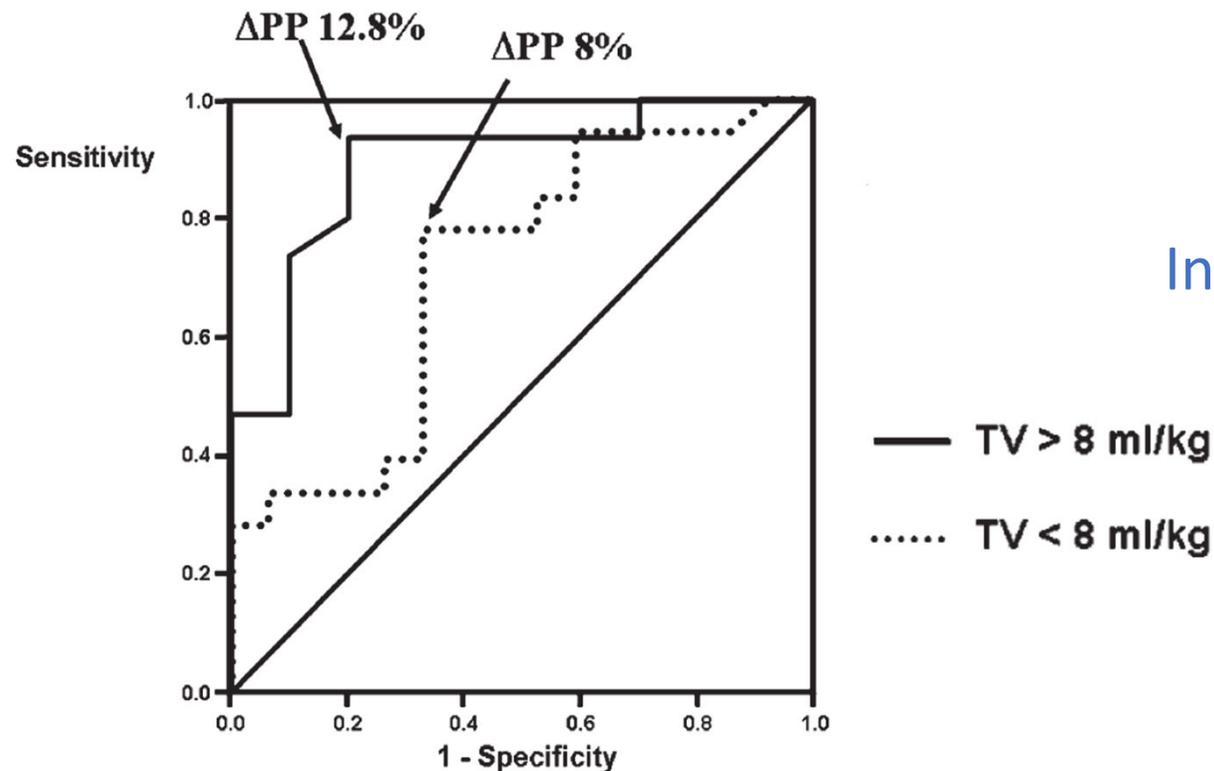


Transmission de pression faible :
Faible Vt

Les indices dynamiques : limites

ORIGINAL

Pulse pressure variations to predict fluid responsiveness: influence of tidal volume



60 patients ventilés
Insuffisance circulatoire aigüe

De Backer et al. Intensive Care 2005

Les indices dynamiques : limites

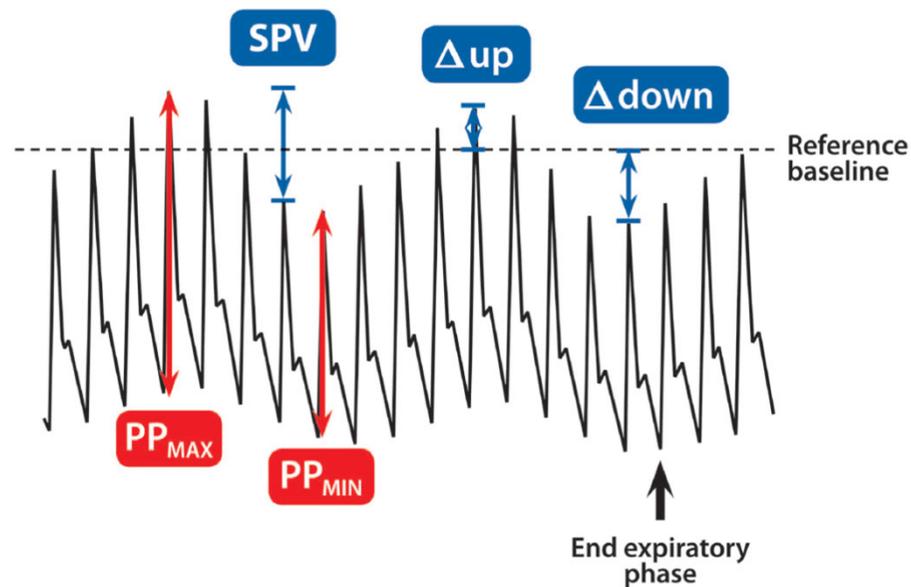
Dynamic changes in arterial waveform derived variables and fluid responsiveness in mechanically ventilated patients: A systematic review of the literature*

68 citations; of these, 38 citations were excluded due to study design, including studies that investigated the dynamic changes in aortic blood flow, (7, 20–22) studied patients with an open chest during cardiac surgery, (23) used pressure-support ventilation or volume-controlled ventilation with a tidal volume of <7 mL/kg, (24, 25); and five citations were

Les indices dynamiques : limites

Arythmie

Respiration spontanée



Transmission de pression faible :
Faible V_t

Temps de transit pulmonaire trop court

Les indices dynamiques : limites

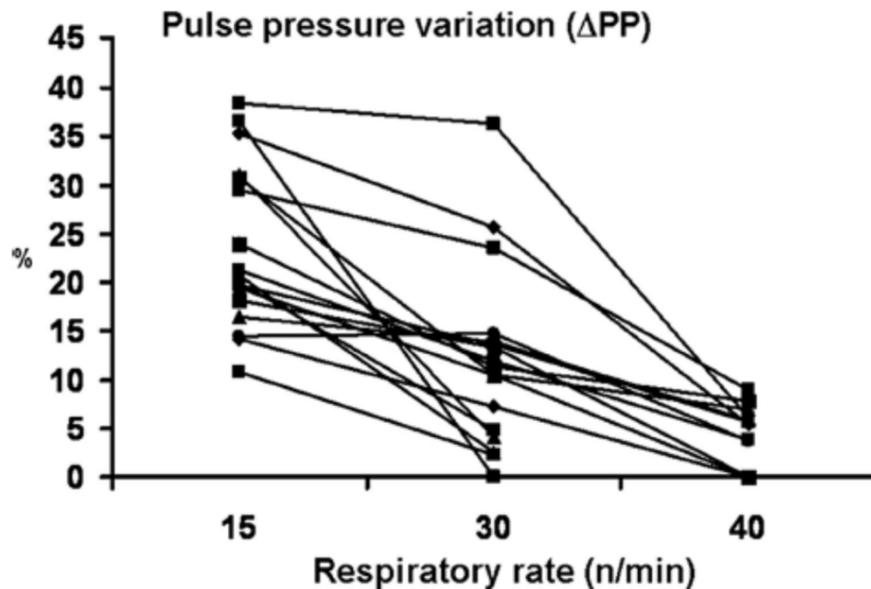
Influence of Respiratory Rate on Stroke Volume Variation in Mechanically Ventilated Patients

17 patients ventilés ($V_t=8-10$ ml/kg), hypovolémiques
FR : 15, 30 et 40 (V_t et I/E identiques)

Les indices dynamiques : limites

Influence of Respiratory Rate on Stroke Volume Variation in Mechanically Ventilated Patients

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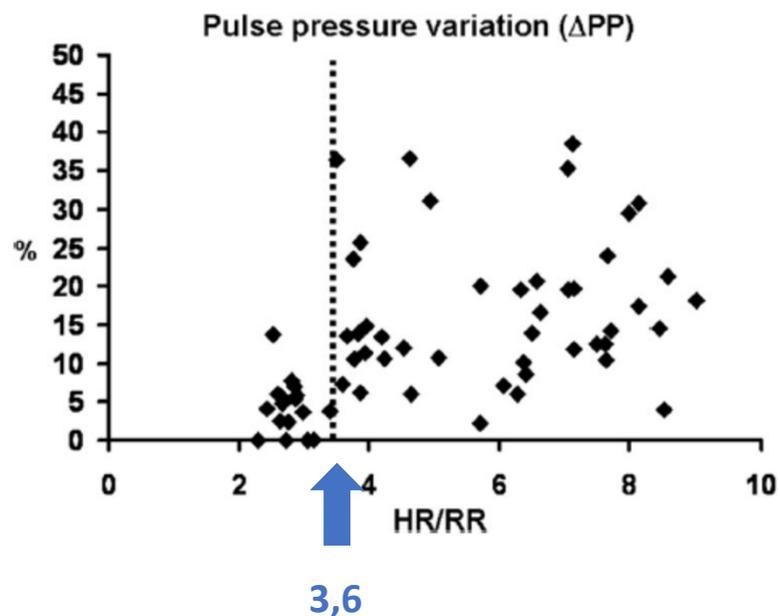


Augmentation FR = diminution
du temps de transit pulmonaire
Diminution du ΔPP

Les indices dynamiques : limites

Influence of Respiratory Rate on Stroke Volume Variation in Mechanically Ventilated Patients

17 patients ventilés ($V_t=8-10$ ml/kg), hypovolémiques
FR : 15, 30 et 40 (V_t et I/E identiques)



Ratio FC / FR < 3,6
 ΔPP inutilisable

Les indices dynamiques : limites



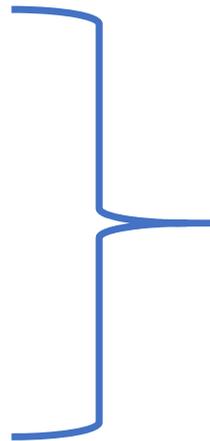
Est-ce fréquent ?

Ventilation protectrice = bas V_t et
haute fréquence

Exemples :

$FR = 22, FC < 80$

$FR = 25, FC < 90$

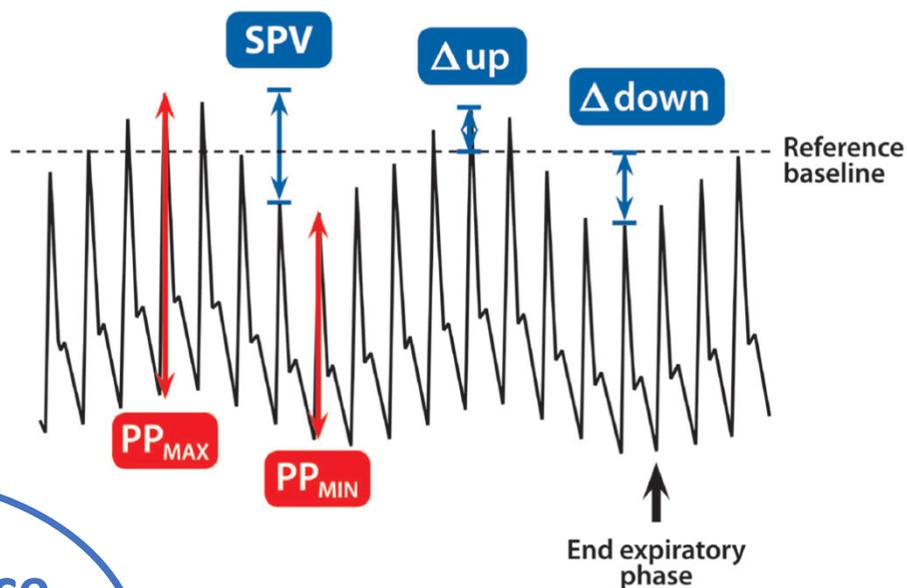


$FC/FR < 3,6$
 ΔPP inutilisable

Les indices dynamiques : limites

Arythmie

Respiration spontanée



Transmission de pression faible : Faible V_t

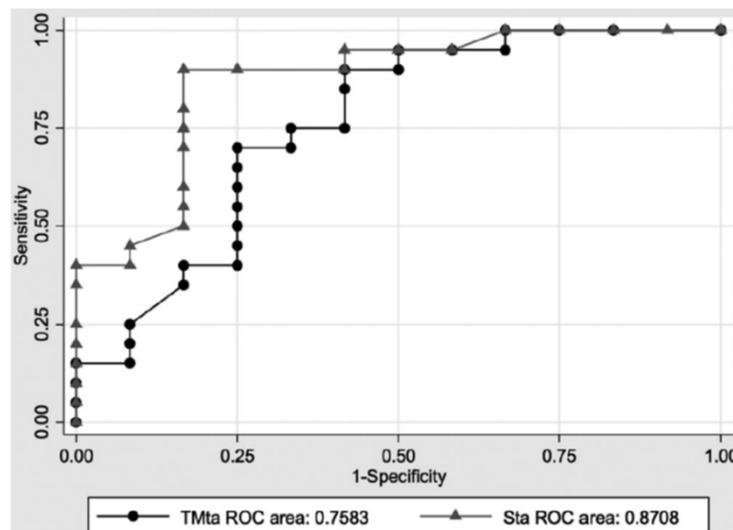
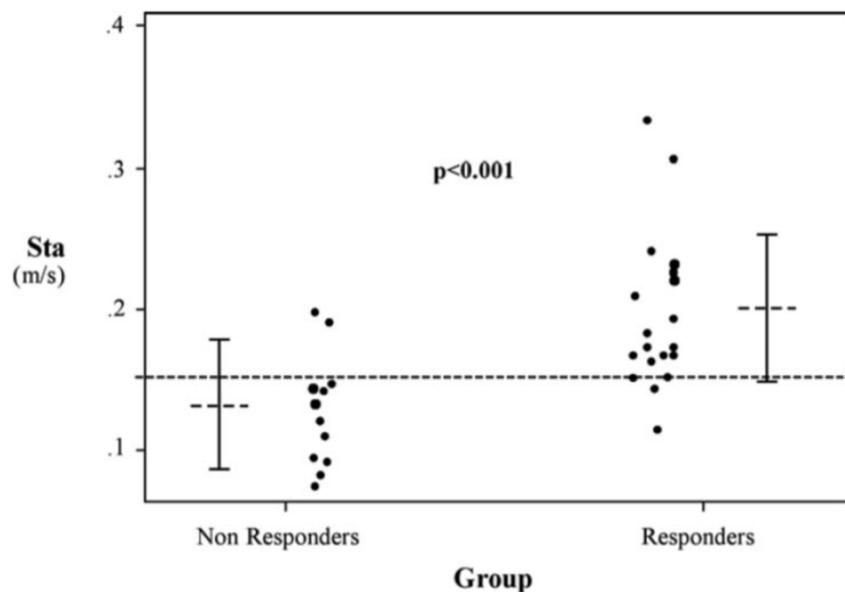
Insuffisance cardiaque droite

Temps de transit pulmonaire trop court

Les indices dynamiques : limites

Assessing fluid responsiveness in critically ill patients:
False-positive pulse pressure variation is detected by Doppler
echocardiographic evaluation of the right ventricle*

35 patients ventilés $\Delta PP > 12\%$
23 répondeurs



Insuffisance Cardiaque Droite = Faux Positifs

Les indices dynamiques : limites

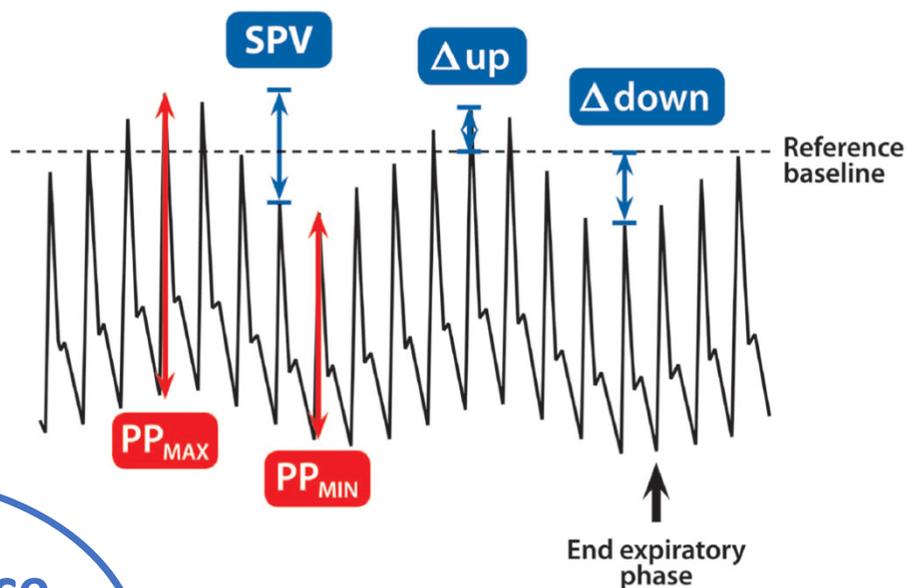
Arythmie

Respiration spontanée

Hypertension intra-abdo

Transmission de pression faible : Faible Vt

Insuffisance cardiaque droite



Temps de transit pulmonaire trop court

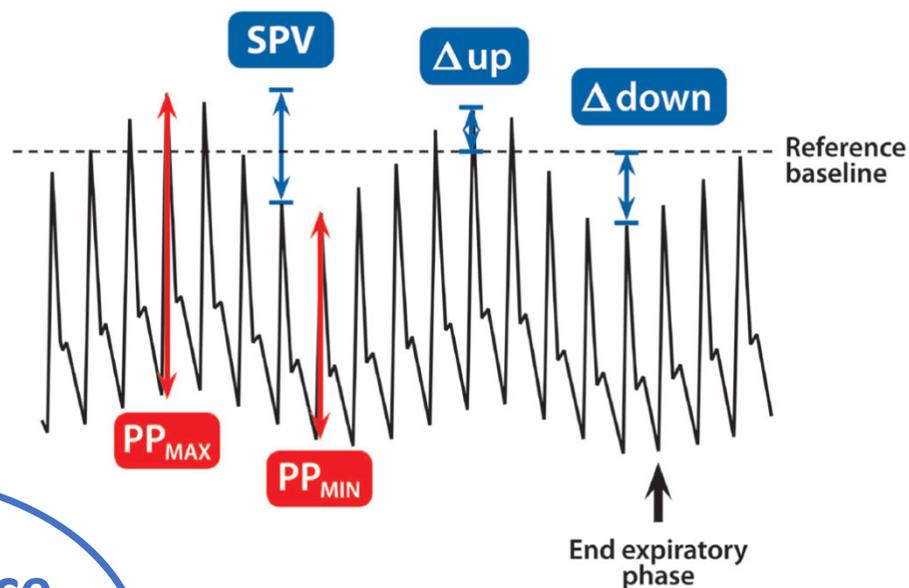
Les indices dynamiques : limites

Arythmie

Décubitus ventral

Hypertension intra-abdo

Insuffisance cardiaque droite



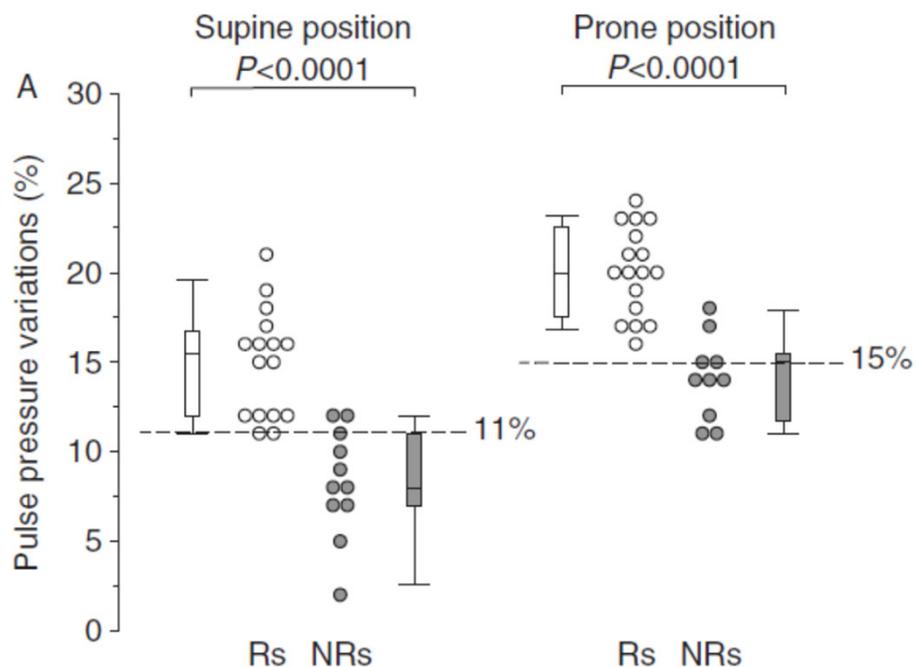
Respiration spontanée

Transmission de pression faible : Faible Vt

Temps de transit pulmonaire trop court

Les indices dynamiques : limites

Abilities of pulse pressure variations and stroke volume variations to predict fluid responsiveness in prone position during scoliosis surgery



Décubitus ventral :

- Augmentation ΔPP

- Augmentation du seuil de 11% à 15%

Biais et al. BJA 2010

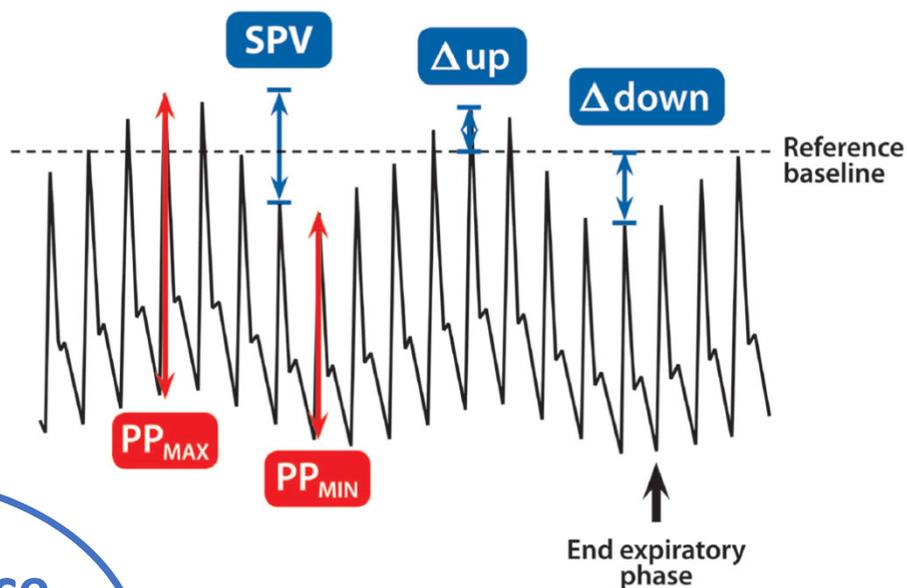
Les indices dynamiques : limites

Arythmie

Décubitus ventral

Hypertension intra-abdo

Insuffisance cardiaque droite



Respiration spontanée

Transmission de pression faible : Faible Vt

Temps de transit pulmonaire trop court

Les indices dynamiques : limites

Arythmie

Décubitus ventral

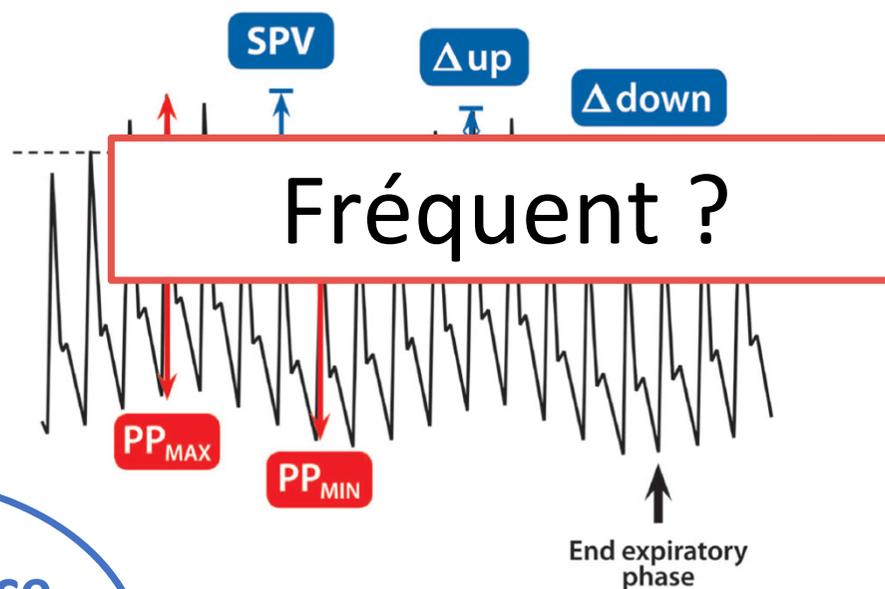
Hypertension intra-abdo

Insuffisance cardiaque droite

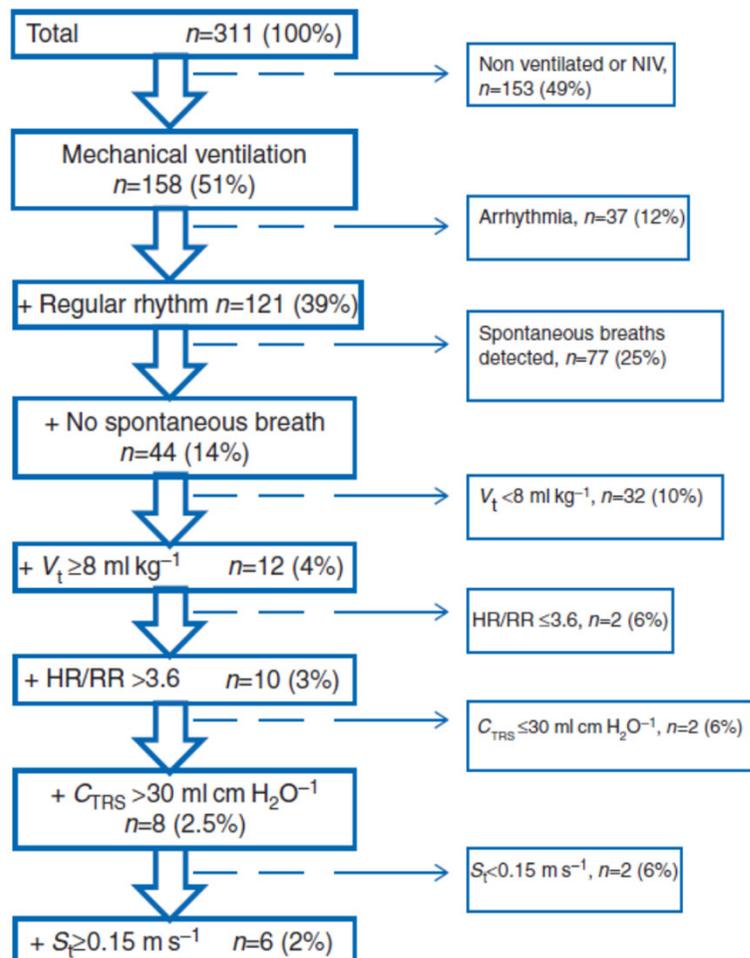
Respiration spontanée

Transmission de pression faible :
Faible Vt

Temps de transit pulmonaire trop court



Les indices dynamiques : limites



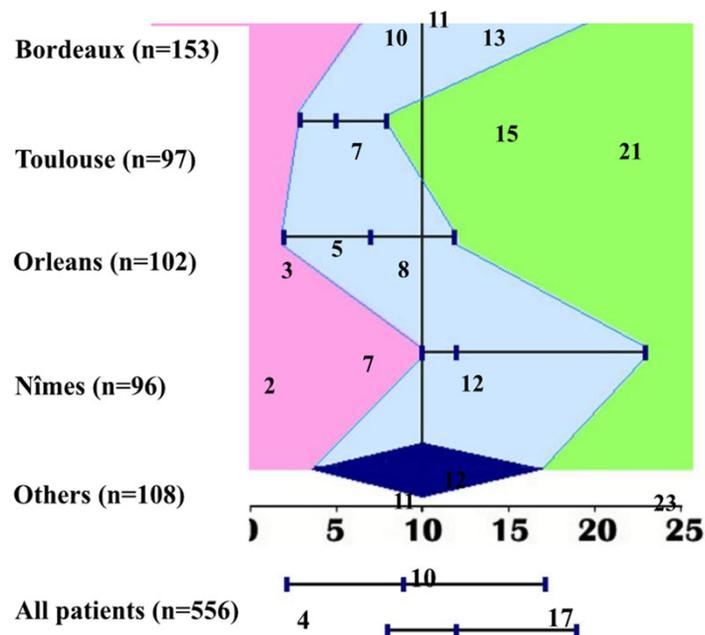
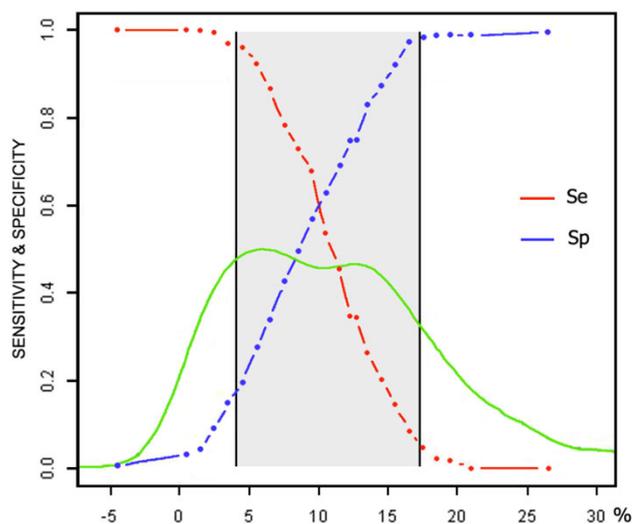
Evaluation of pulse pressure variation validity criteria in critically ill patients: a prospective observational multicentre point-prevalence study[†]

Total n=311 (100%)

PPV utilisable chez 4% des patients ventilés

Les indices dynamiques : limites

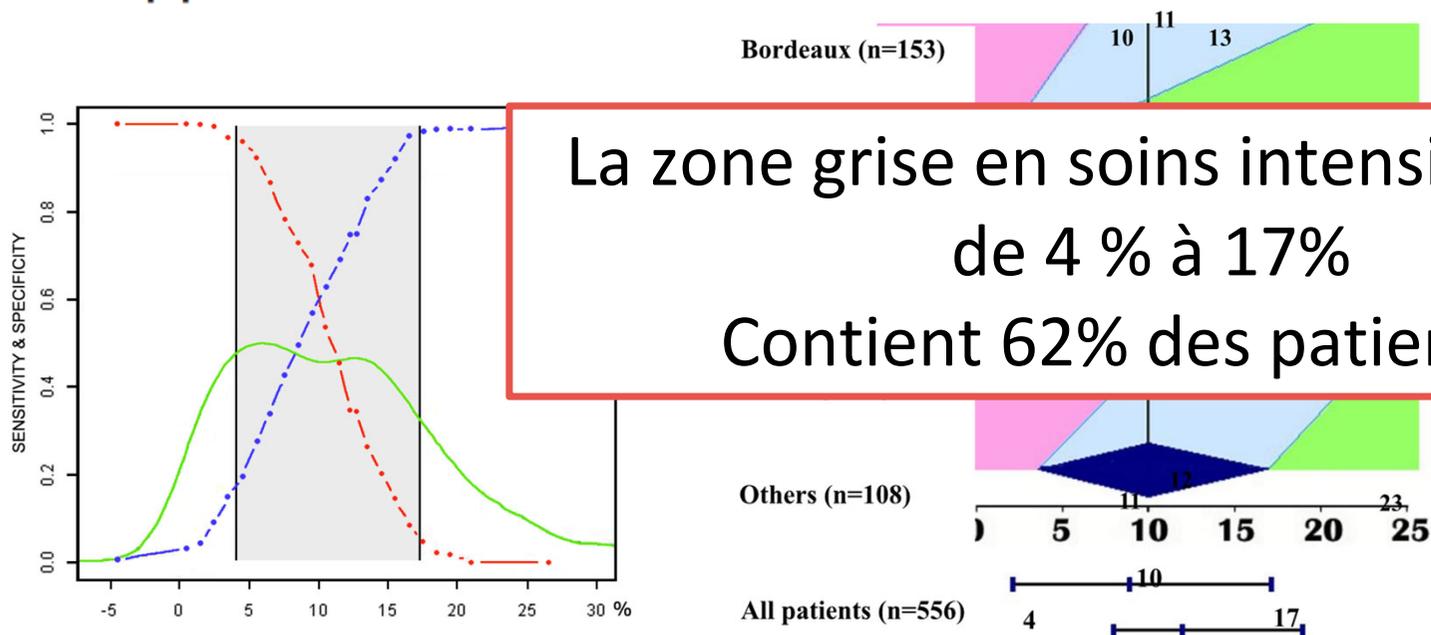
Clinical relevance of pulse pressure variations for predicting fluid responsiveness in mechanically ventilated intensive care unit patients: the grey zone approach



Analyse rétrospective
556 patients

Les indices dynamiques : limites

Clinical relevance of pulse pressure variations for predicting fluid responsiveness in mechanically ventilated intensive care unit patients: the grey zone approach



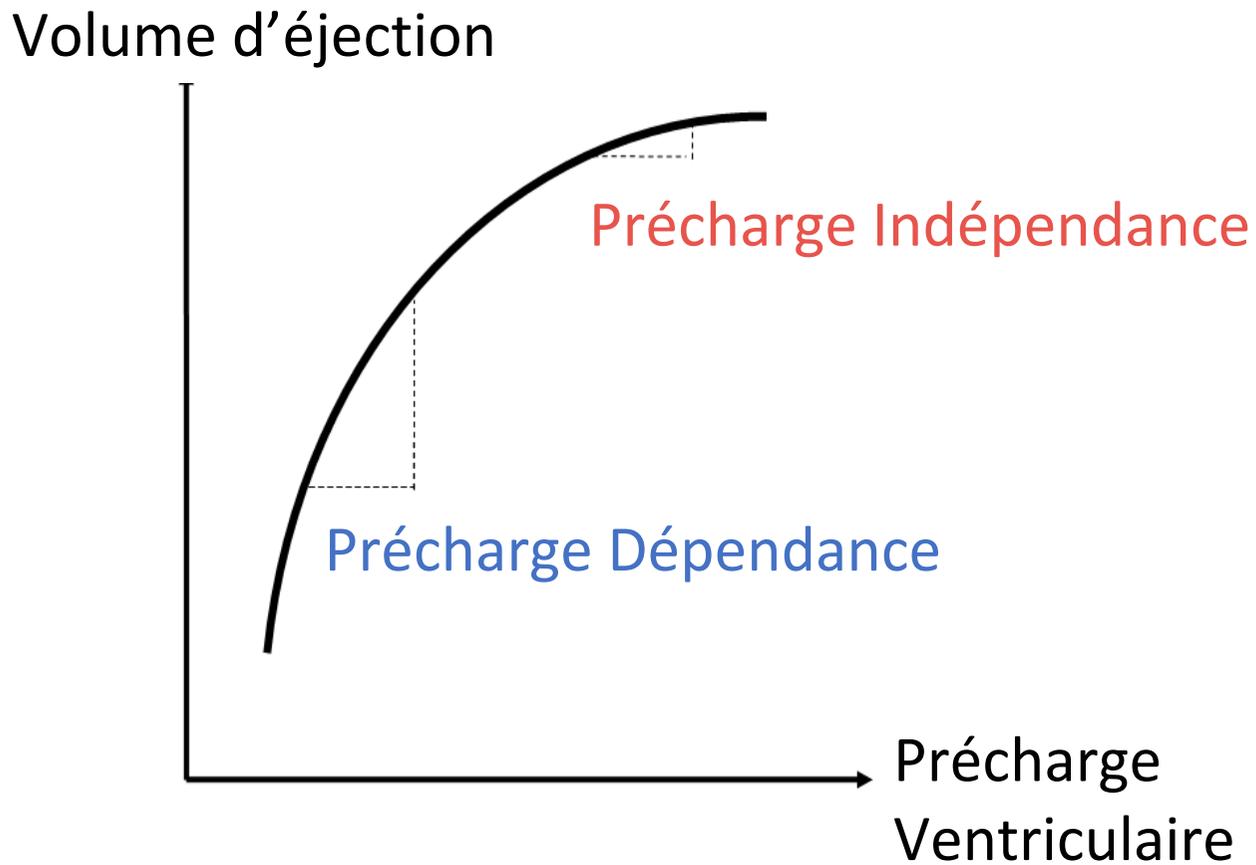
prospective patients

Place de l'échographie dans la gestion du remplissage vasculaire

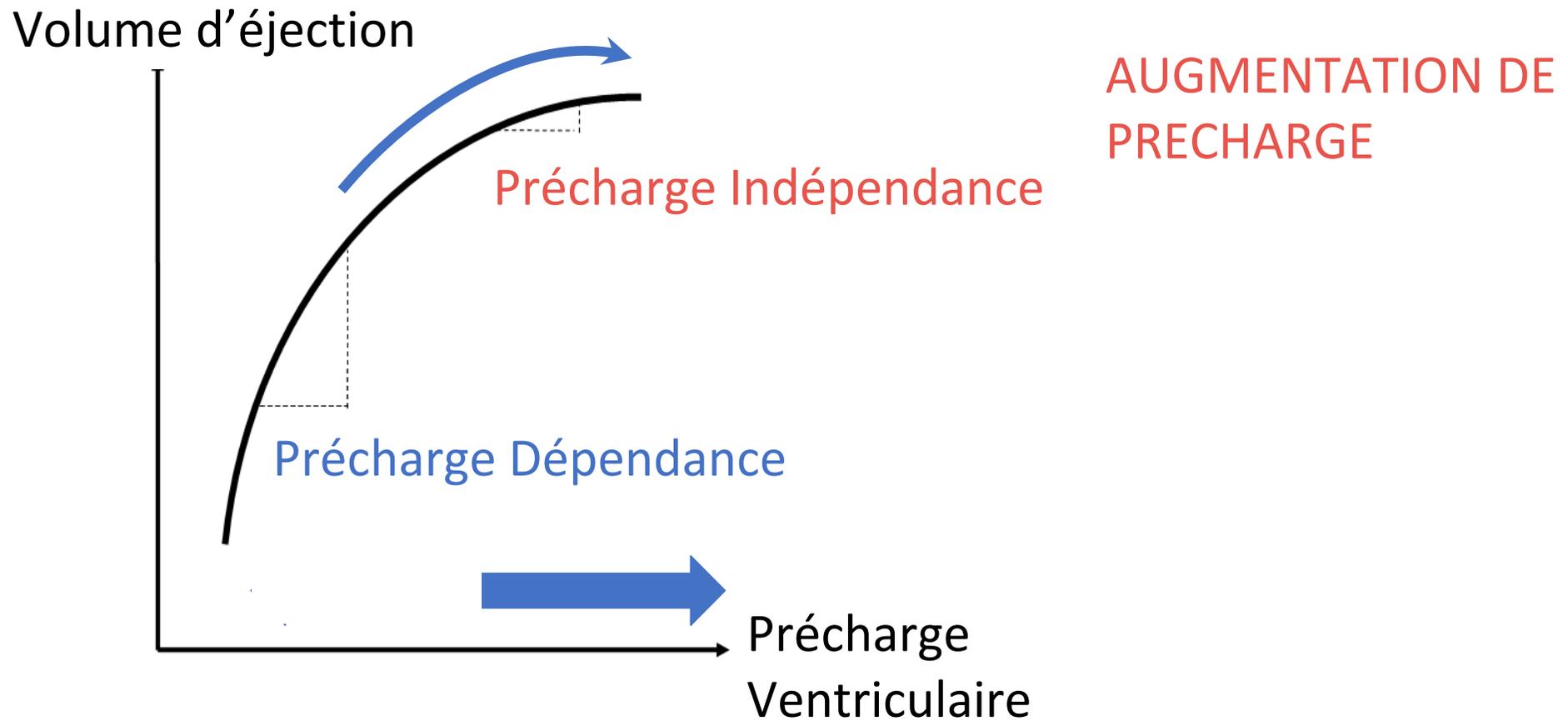
- Etape 1 : évaluation de la fonction cardiaque globale
- Etape 2 : les bases de l'hémodynamique
- Etape 3 : approche statique
- Etape 4 : indices dynamiques
- **Etape 5 : fluid challenge (et dérivés)**
- Etape 6 : quid de la vasoplégie ?

Alternatives aux indices dynamiques

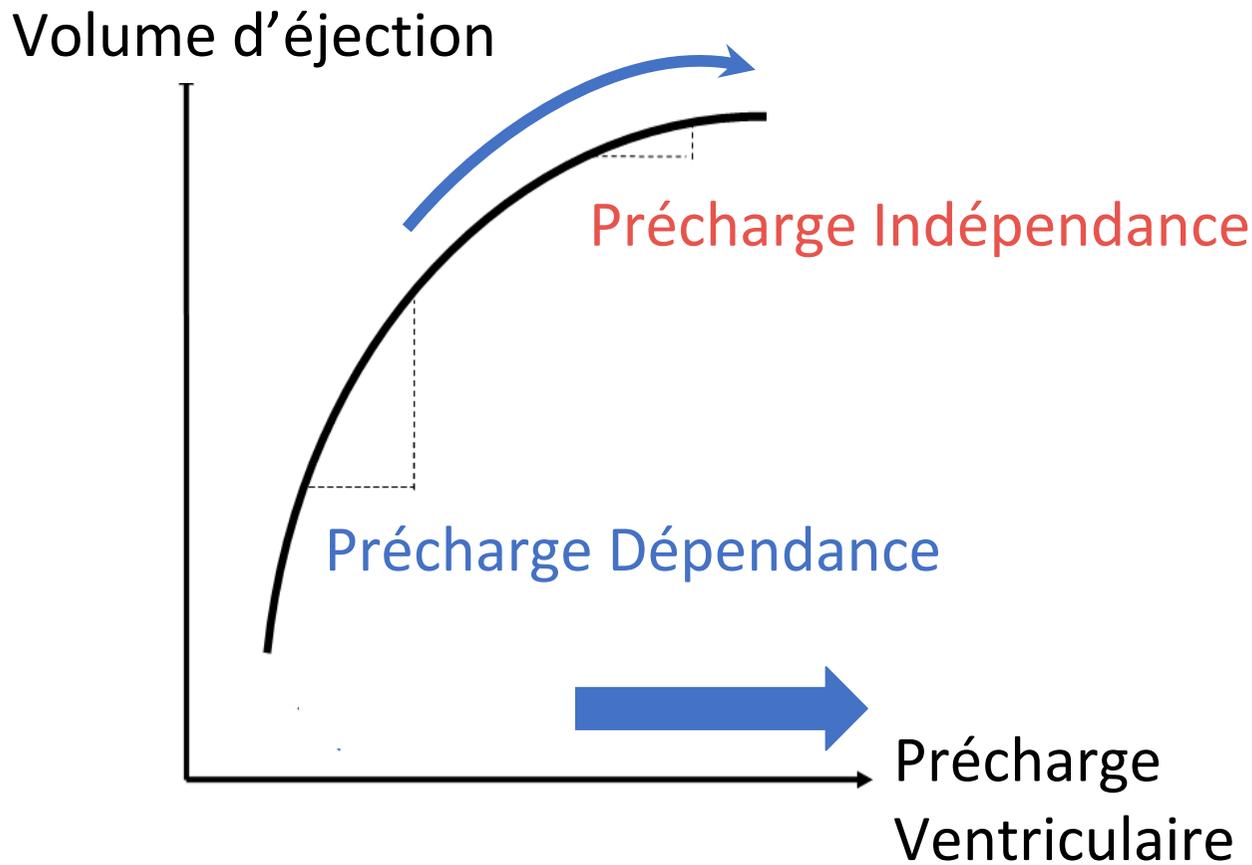
Alternatives aux indices dynamiques



Alternatives aux indices dynamiques



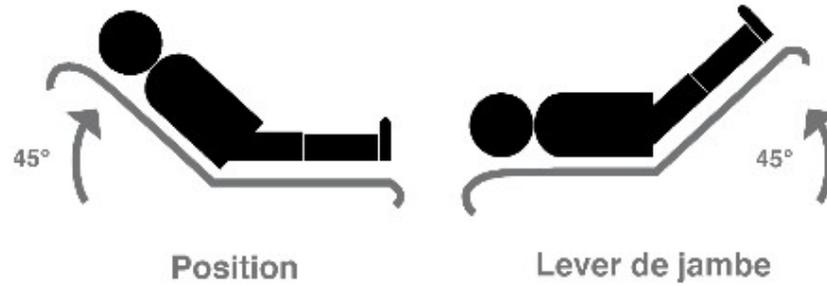
Alternatives aux indices dynamiques



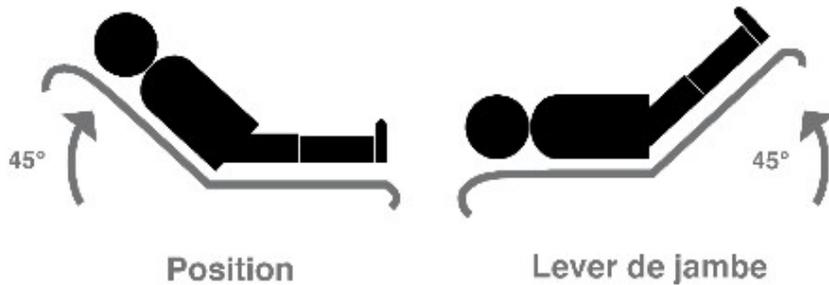
AUGMENTATION DE
PRECHARGE

- Lever de jambe passif

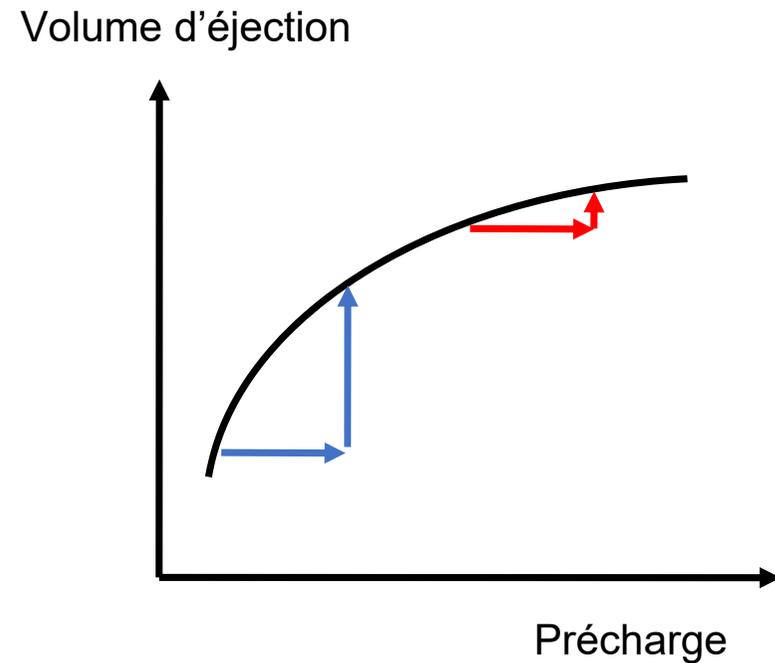
Lever de jambe passif



Lever de jambe passif



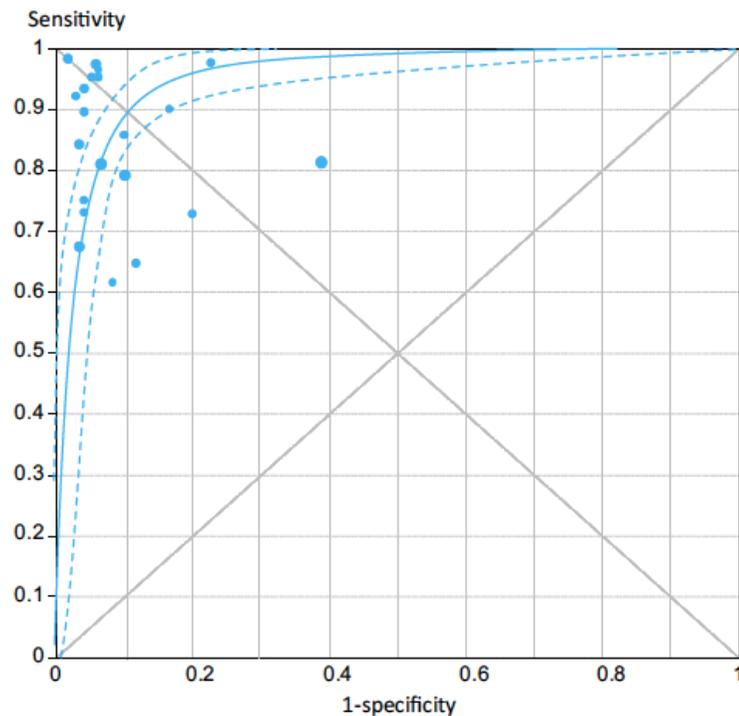
Mime un RV, réversible
Transfert de sang
Augmentation de la précharge



↑ du VES pendant le LJP = précharge dépendance
Pas d'↑ du VES pendant le LJP = précharge indépendance

Lever de jambe passif

Passive leg raising for predicting fluid responsiveness: a systematic review and meta-analysis



Méta-analyse

21 études

991 patients

AUC = 0.95±0.01

$I^2 = 34%$ (95%CI: 0 – 44%)

Monnet et al. ICM 2016

Lever de jambe passif

The passive leg-raising maneuver cannot accurately predict fluid responsiveness in patients with intra-abdominal hypertension*

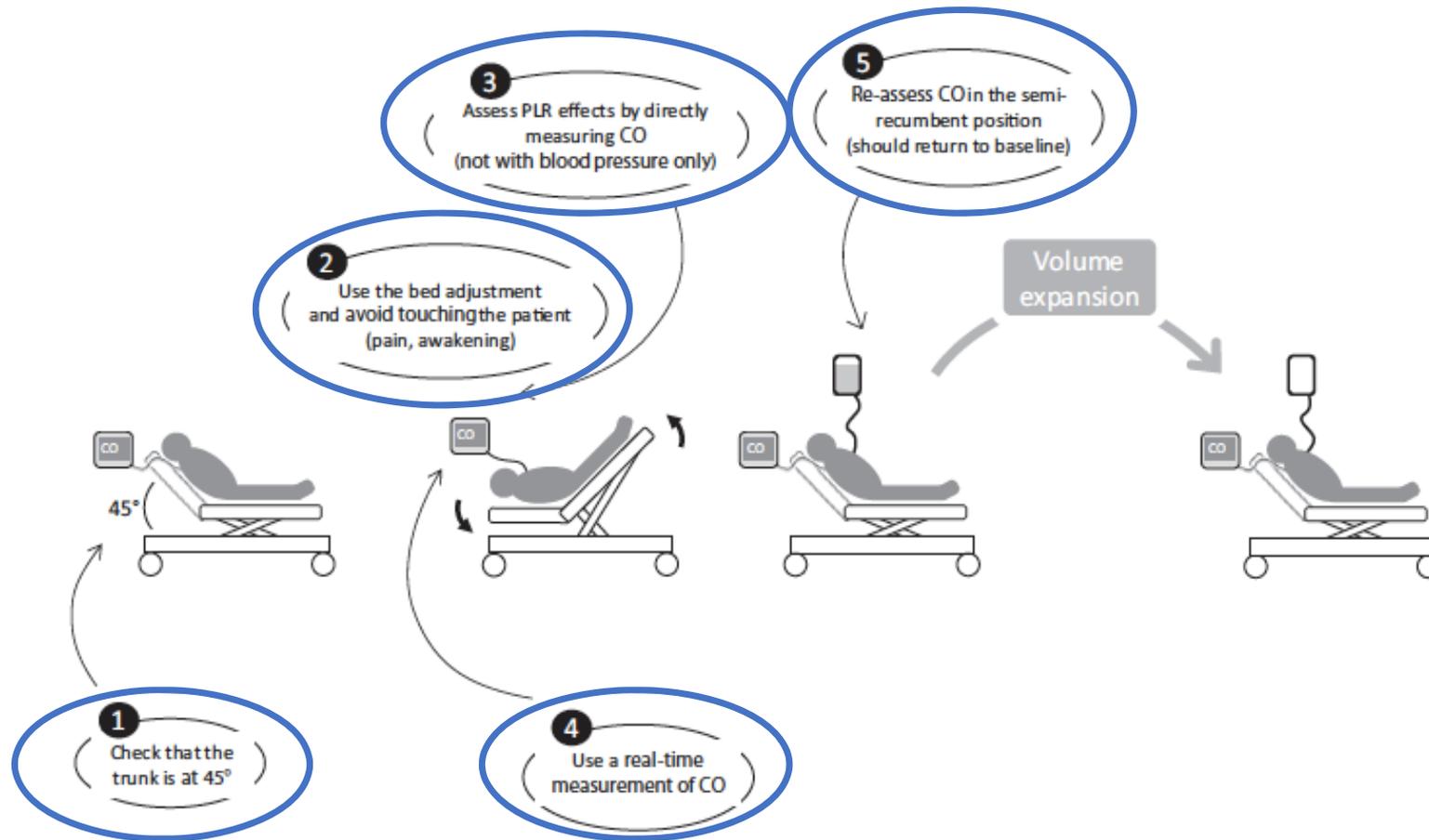
Hyperpression intra-abdominale = empêche le retour veineux lors du LJP

Absence d'augmentation du VES

Faux NEGATIF

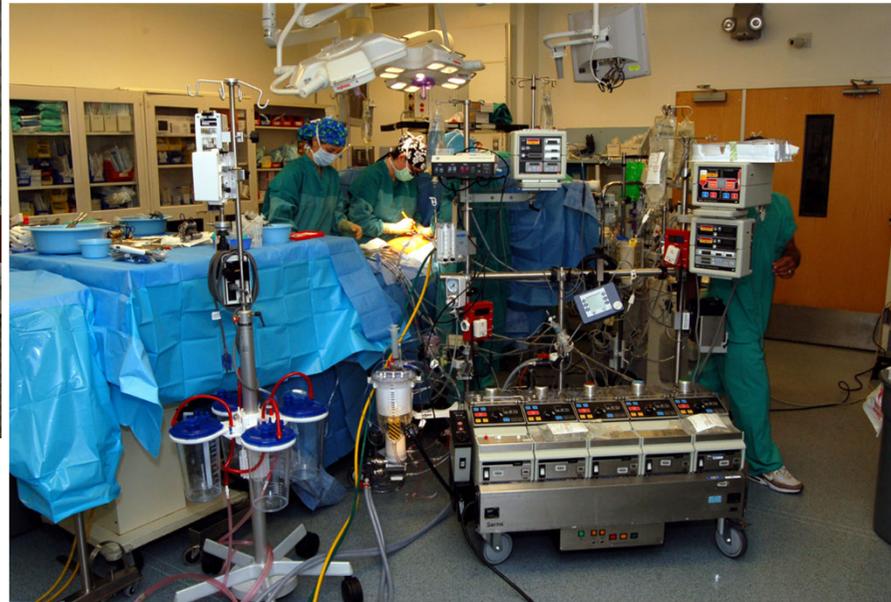
Vigilance si PIA \geq 16 mmHg

Lever de jambe passif

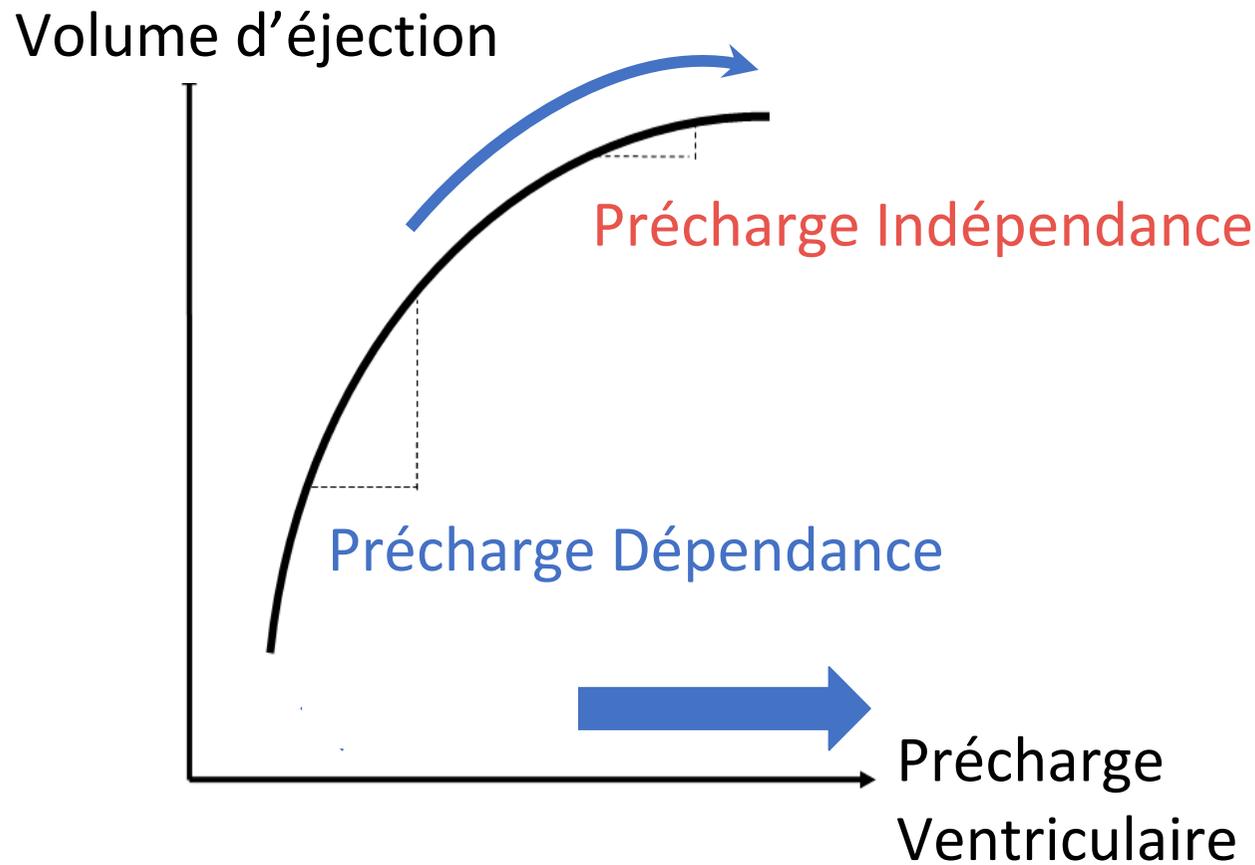


Lever de jambe passif

Pas toujours évident en pratique...



Alternatives aux indices dynamiques



AUGMENTATION DE PRECHARGE

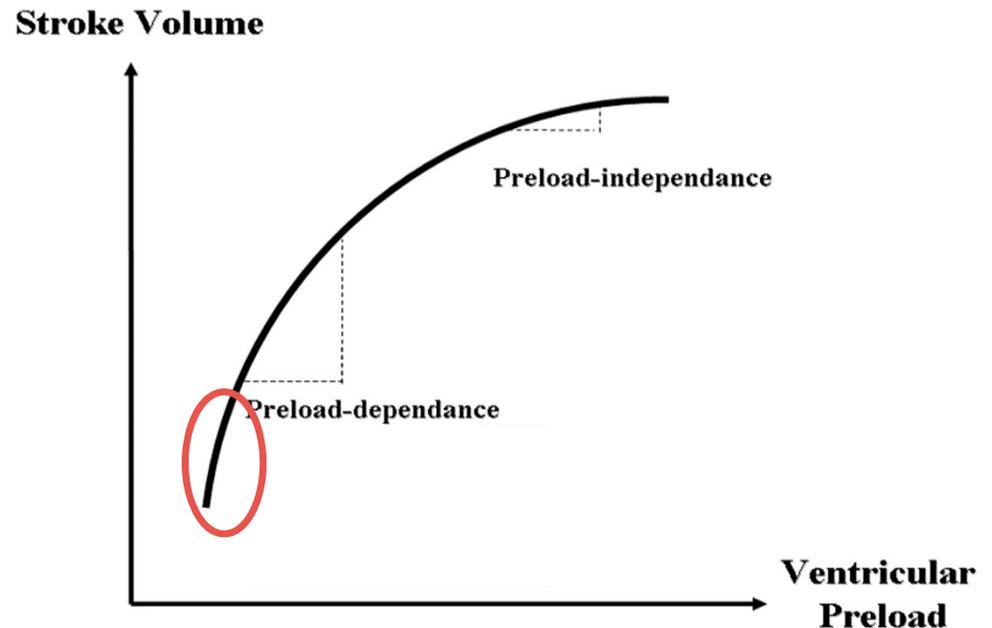
- Lever de jambe passif
- Minifluid Challenge

Mini-fluid Challenge



“The general concept is ... that the response to fluid challenge can be evaluated rapidly after a very limited amount of fluid ...”

“Let’s Give Some Fluid and See What Happens” *versus* the “Mini-fluid Challenge”



Vincent JL et al. Anesthesiology 2011

Mini-fluid Challenge

An Increase in Aortic Blood Flow after an Infusion of 100 ml Colloid over 1 Minute Can Predict Fluid Responsiveness

The Mini-fluid Challenge Study

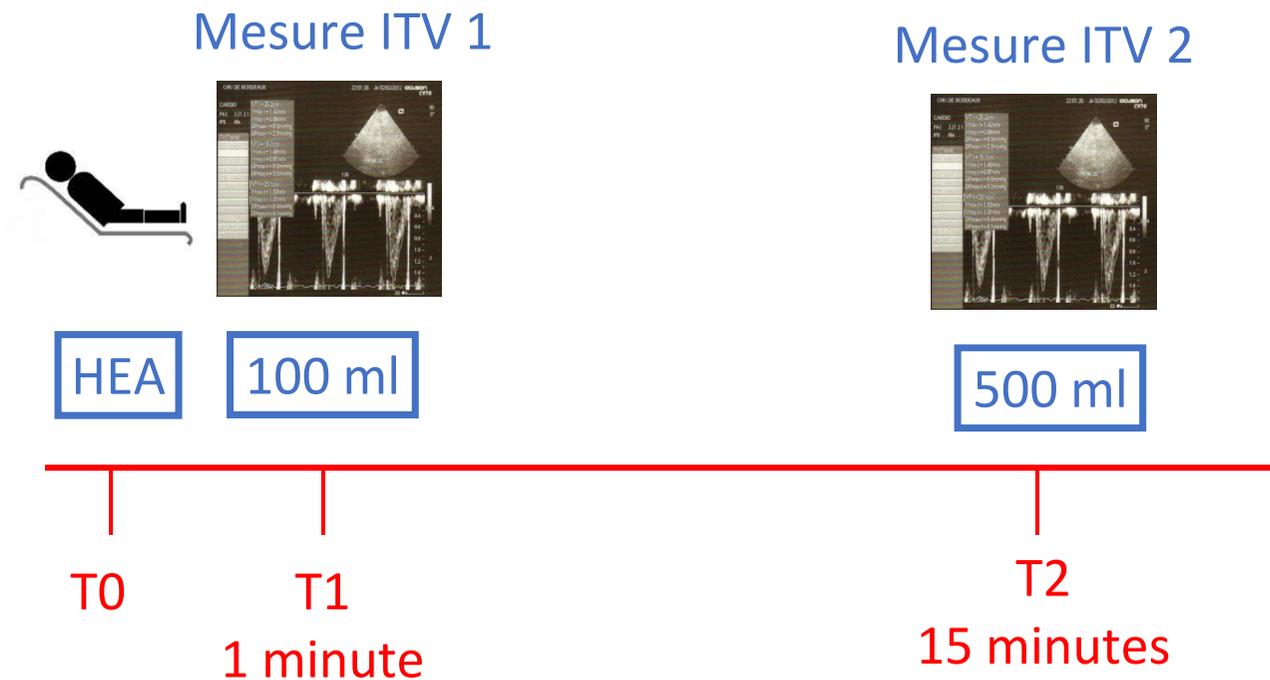
- Administration d'une faible quantité de fluide
- Monitoring de la réponse
- Prédiction de la réponse à l'administration d'une plus grande quantité de fluide

Muller et al. Anesthesiology 2011

Mini-fluid Challenge

An Increase in Aortic Blood Flow after an Infusion of 100 ml Colloid over 1 Minute Can Predict Fluid Responsiveness

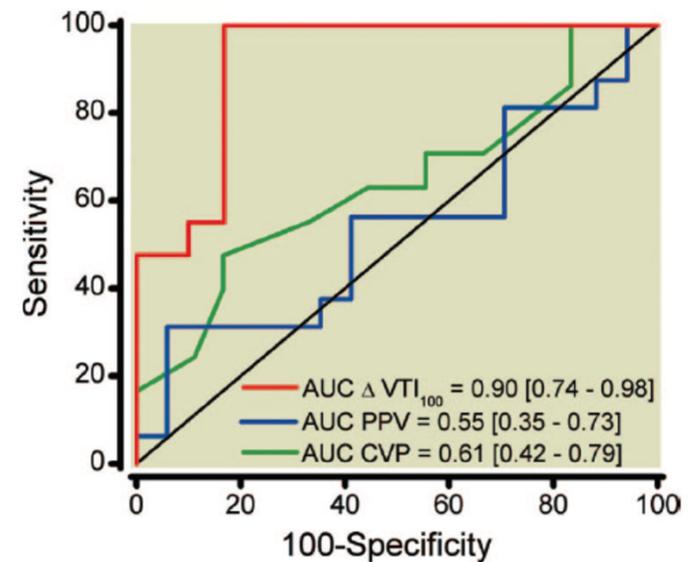
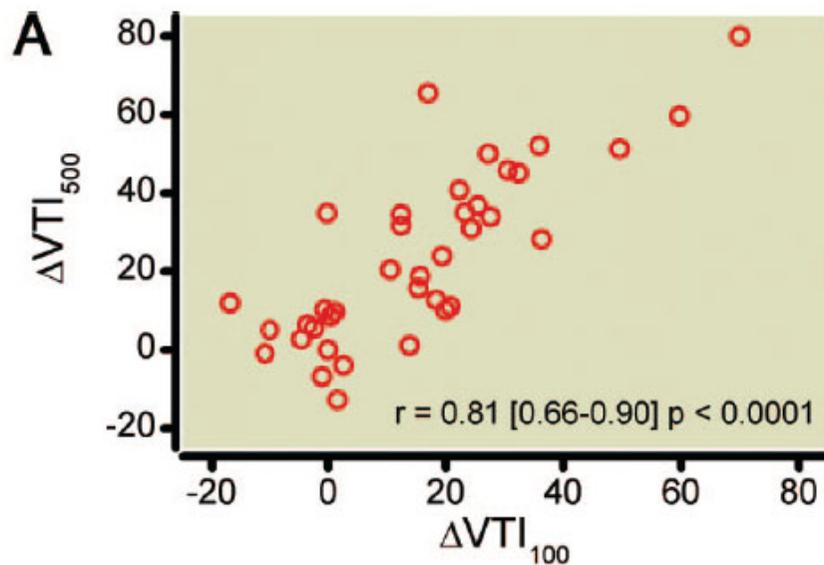
The Mini-fluid Challenge Study



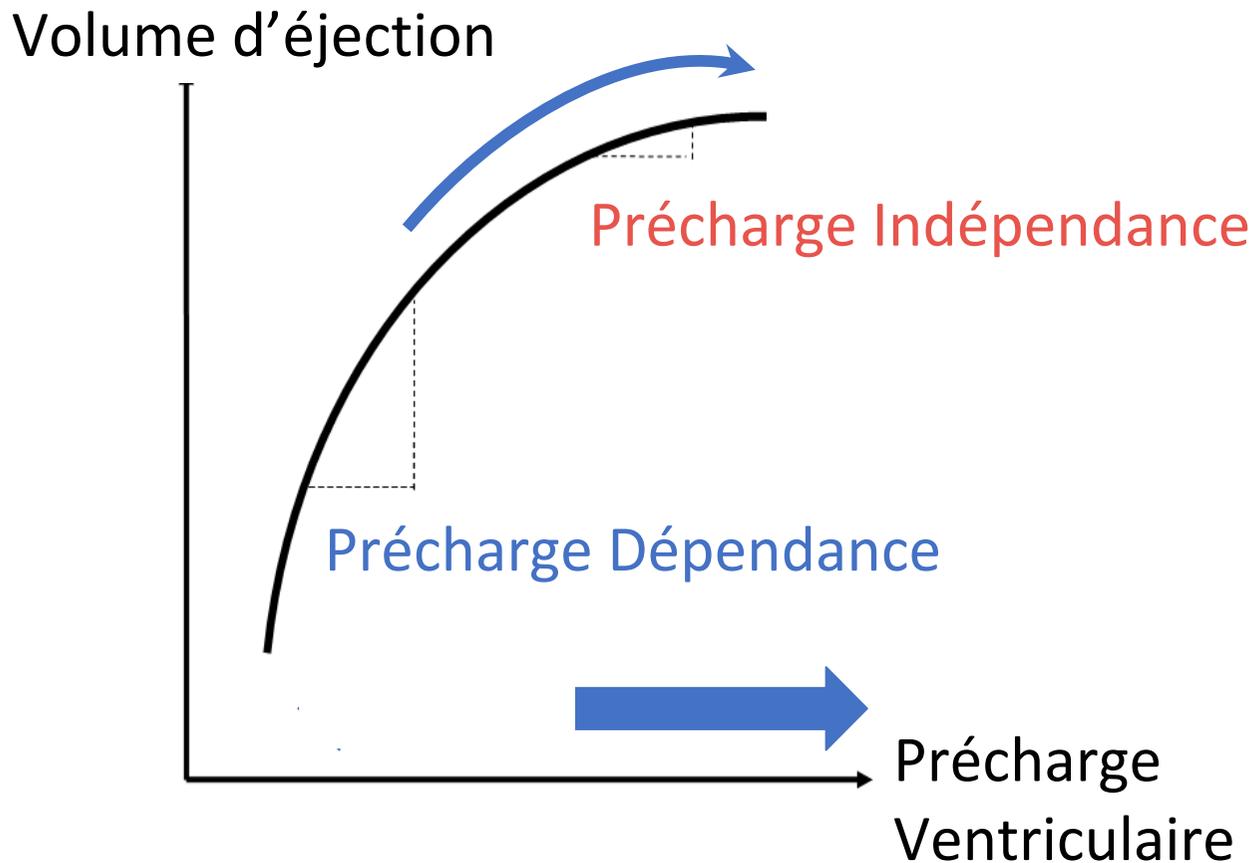
Muller et al. Anesthesiology 2011

Mini-fluid Challenge

Une augmentation >10% de l'ITVAo après 100ml de colloïde sur 1 minute prédit la réponse à un expansion volémique de 500 ml



Alternatives aux indices dynamiques

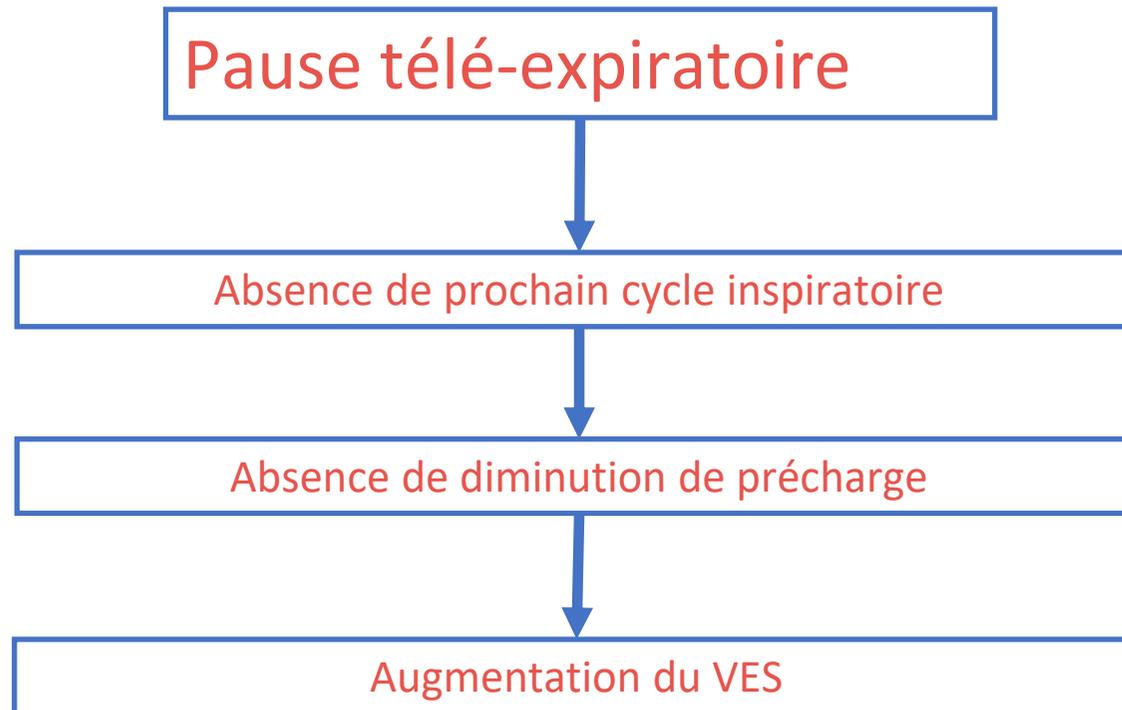


AUGMENTATION DE PRECHARGE

- Lever de jambe passif
- Minifluid Challenge
- Occlusion expiratoire

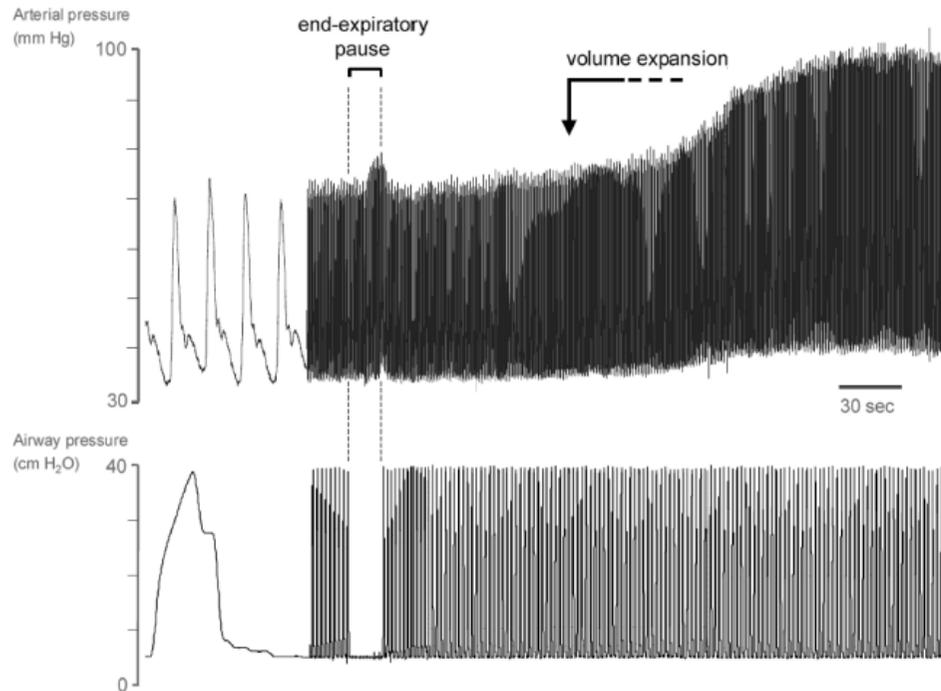
Occlusion télé-expiratoire

Predicting volume responsiveness by using the end-expiratory occlusion in mechanically ventilated intensive care unit patients



Occlusion télé-expiratoire

Predicting volume responsiveness by using the end-expiratory occlusion in mechanically ventilated intensive care unit patients



Augmentation

$\geq 5\%$ IC

Prédit la réponse

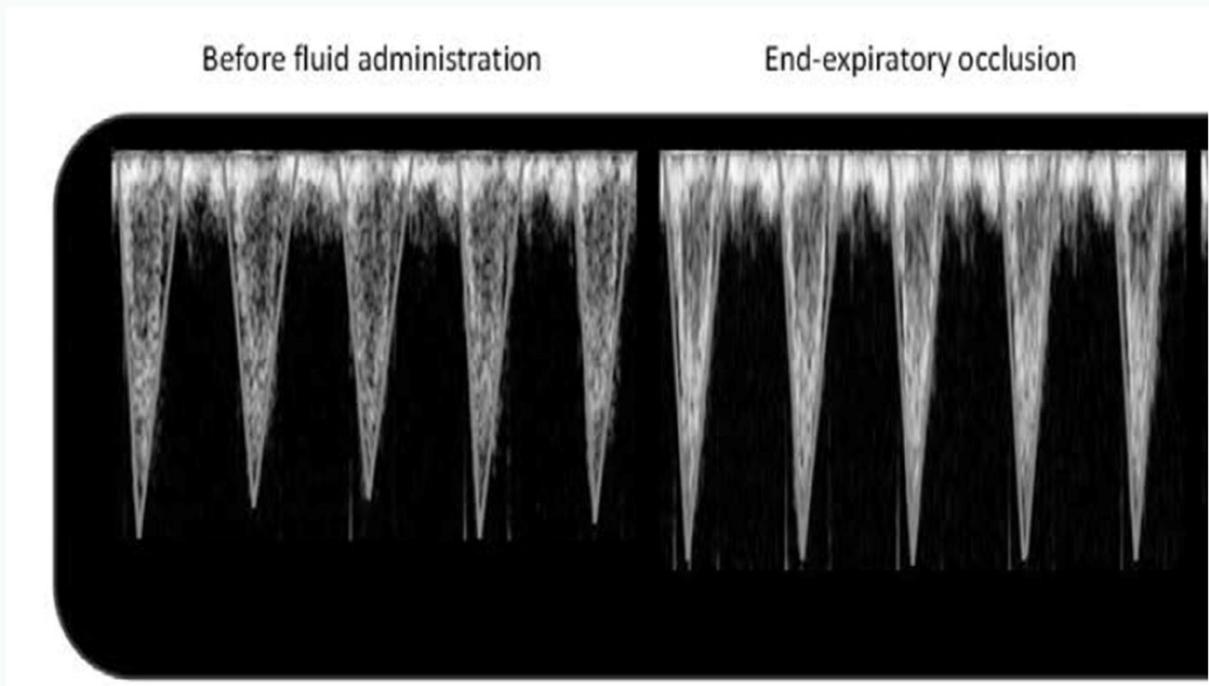
au RV

Monnet et al. CCM 2009

Occlusion télé-expiratoire

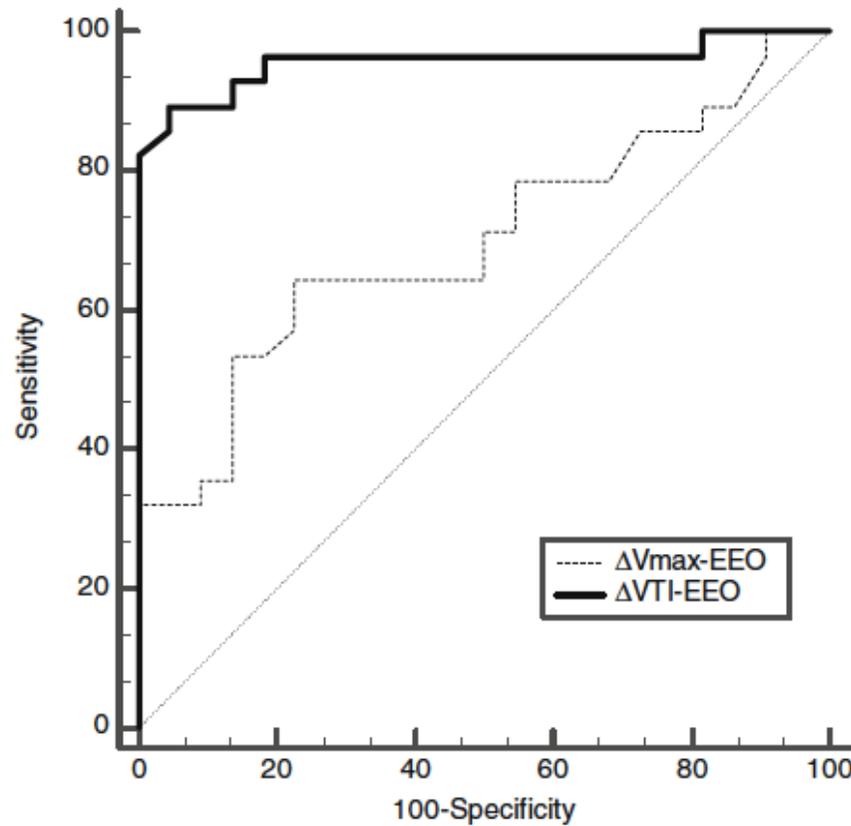
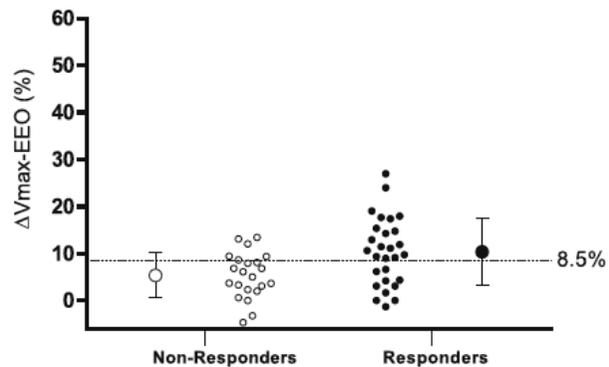
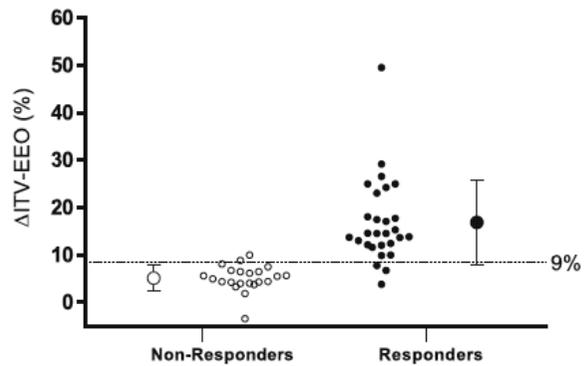
End-expiratory occlusion maneuver to predict fluid responsiveness in the intensive care unit: an echocardiographic study

Critical Care (2018) 22:32



Georges et al. Crit Care 2018

Occlusion télé-expiratoire

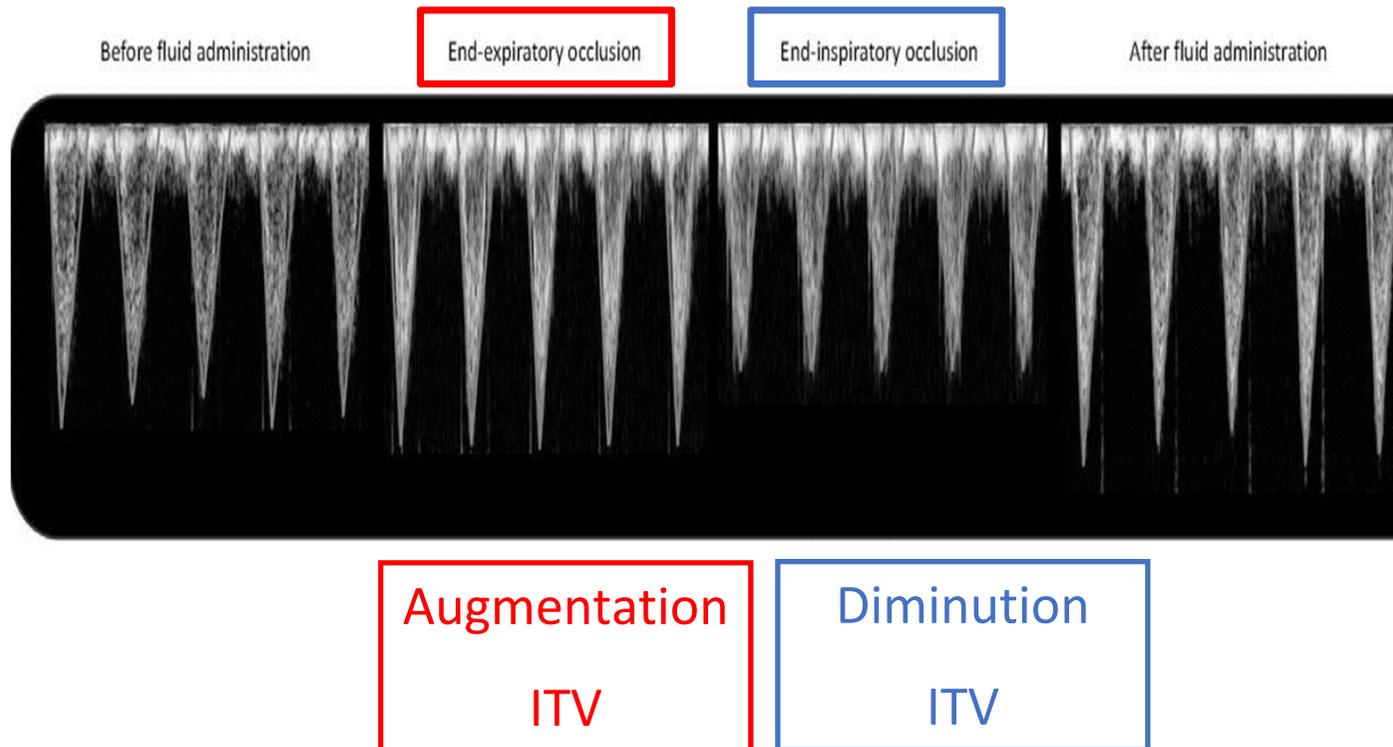


Augmentation
>9% ITV

AUC = 0,96 ±
0,03

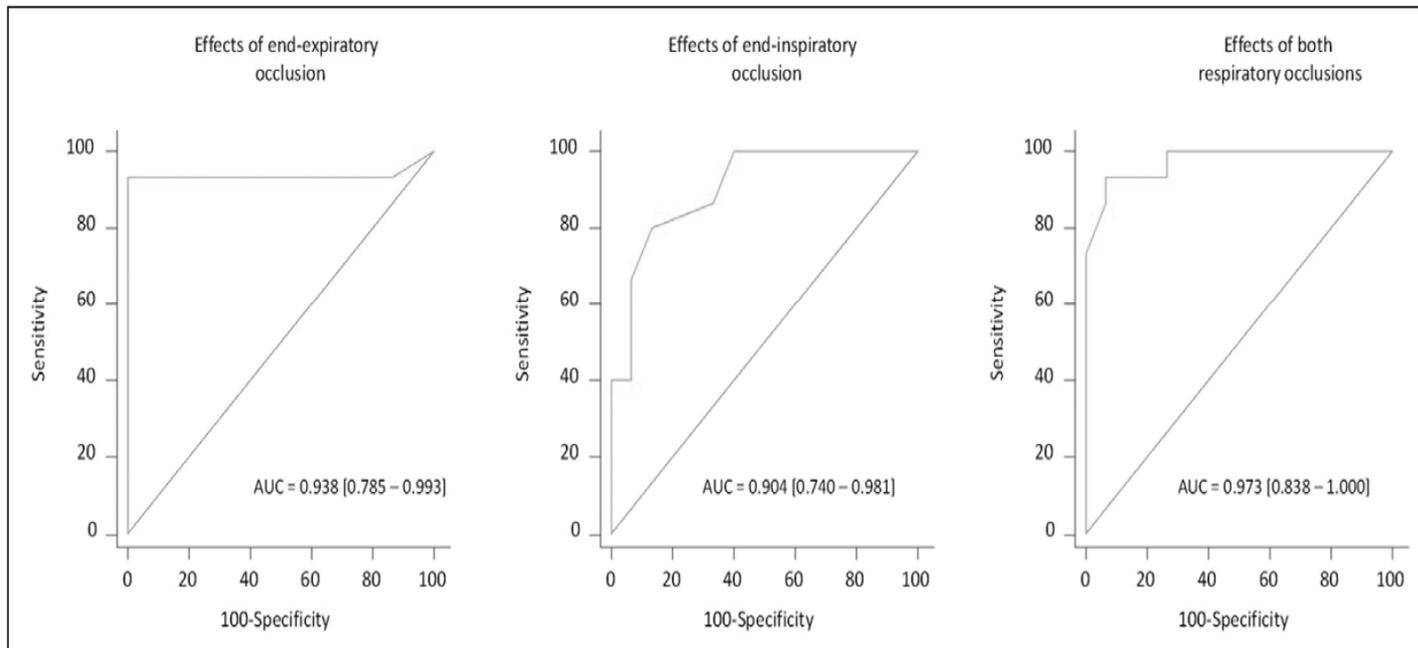
Occlusion télé-expiratoire

Predicting Fluid Responsiveness in Critically Ill Patients by Using Combined End-Expiratory and End-Inspiratory Occlusions With Echocardiography



Occlusion télé-expiratoire

Predicting Fluid Responsiveness in Critically Ill Patients by Using Combined End-Expiratory and End-Inspiratory Occlusions With Echocardiography



Combinaison
des effets > 13%

Occlusion télé-expiratoire

Occlusion télé-expi 15 sec



↗ ITV > 9%

Occlusion télé-expiratoire

Occlusion télé-expi 15 sec



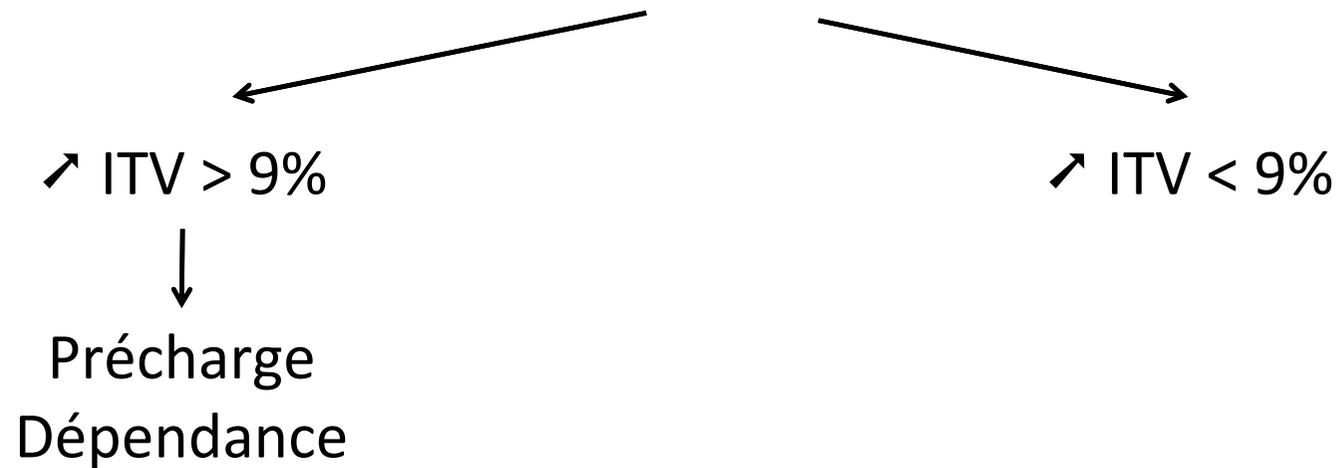
↗ ITV > 9%



Précharge
Dépendance

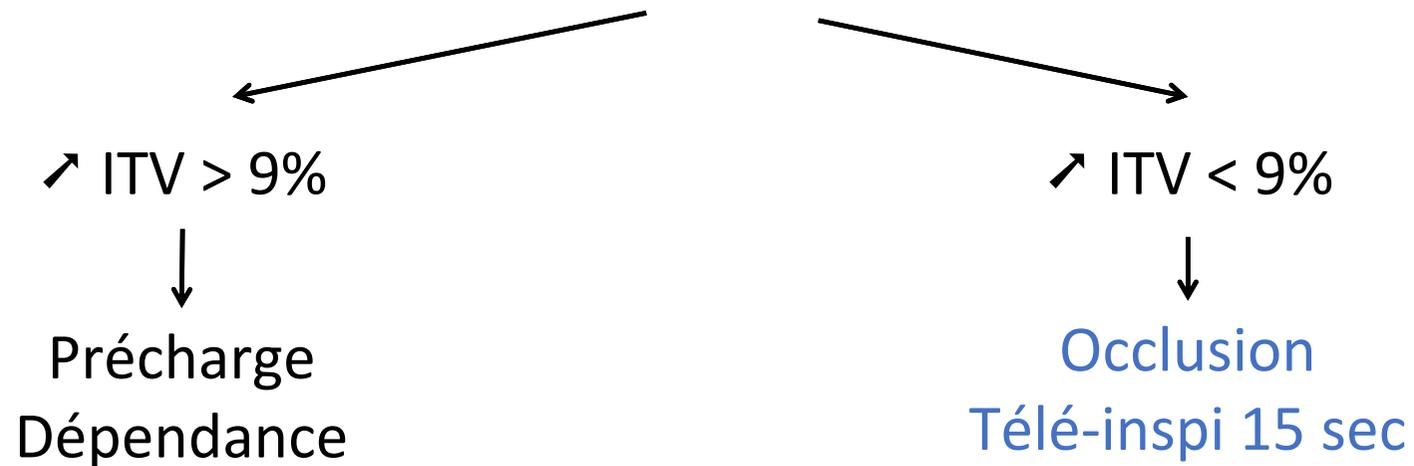
Occlusion télé-expiratoire

Occlusion télé-expi 15 sec



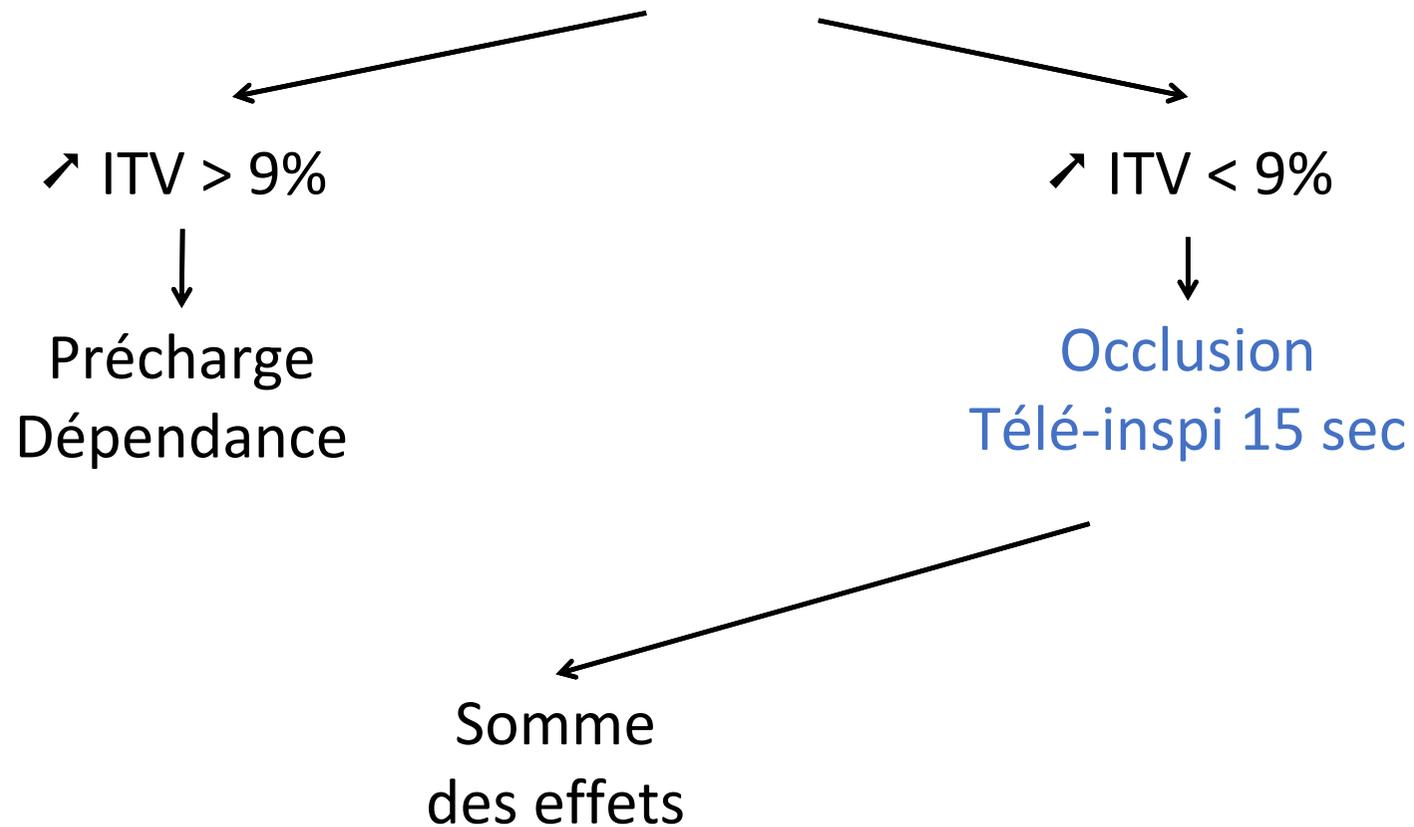
Occlusion télé-expiratoire

Occlusion télé-expi 15 sec



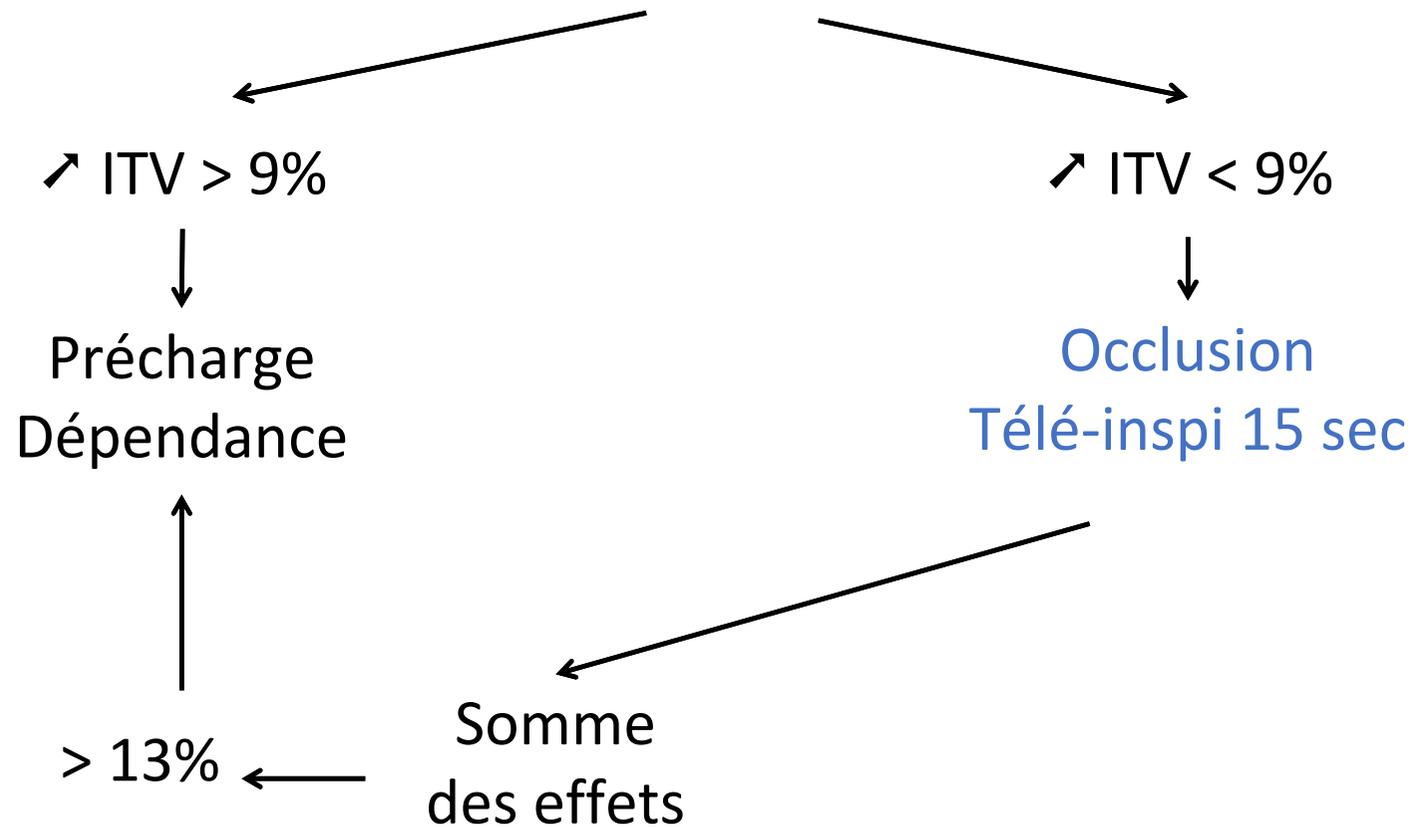
Occlusion télé-expiratoire

Occlusion télé-expi 15 sec



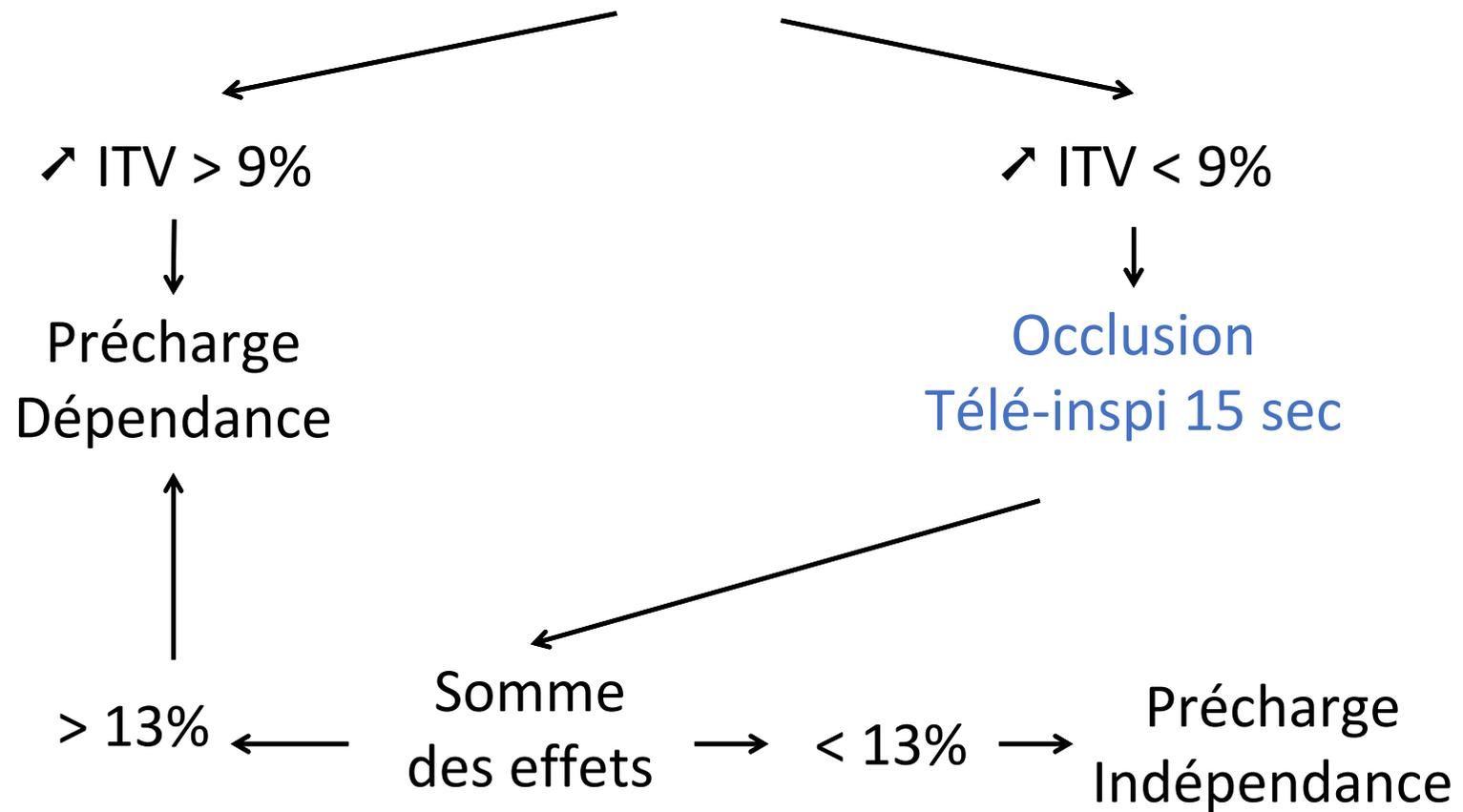
Occlusion télé-expiratoire

Occlusion télé-expi 15 sec



Occlusion télé-expiratoire

Occlusion télé-expi 15 sec



Place de l'échographie dans la gestion du remplissage vasculaire

- Etape 1 : évaluation de la fonction cardiaque globale
- Etape 2 : les bases de l'hémodynamique
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- Etape 5 : fluid challenge (et dérivés)
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Quid de la vasoplégie

Vasopresseurs sans monitoring ?

organisée conjointement par
la Sfar et la SRLF

Prise en charge hémodynamique du
sepsis sévère (nouveau-né exclu)

« Lorsque l'hypotension engage le pronostic vital (par exemple lorsque la PAD est < 40 mmHg), le recours aux agents vasopresseurs doit être immédiat, quelle que soit la volémie. »

Les bases de l'hémodynamique

Pressions **basses** + débit **bas**



HYPOVOLEMIE

Pressions **hautes** + débit **bas**



INSUFFISANCE
CARDIAQUE

Pressions **hautes/basses** + débit **haut**



VASOPLEGIE

Les bases de l'hémodynamique

Pressions **basses** + débit **bas**



HYPOVOLEMIE

Pressions **hautes** + débit **bas**



INSUFFISANCE
CARDIAQUE

Pressions **hautes/basses** + débit **haut**

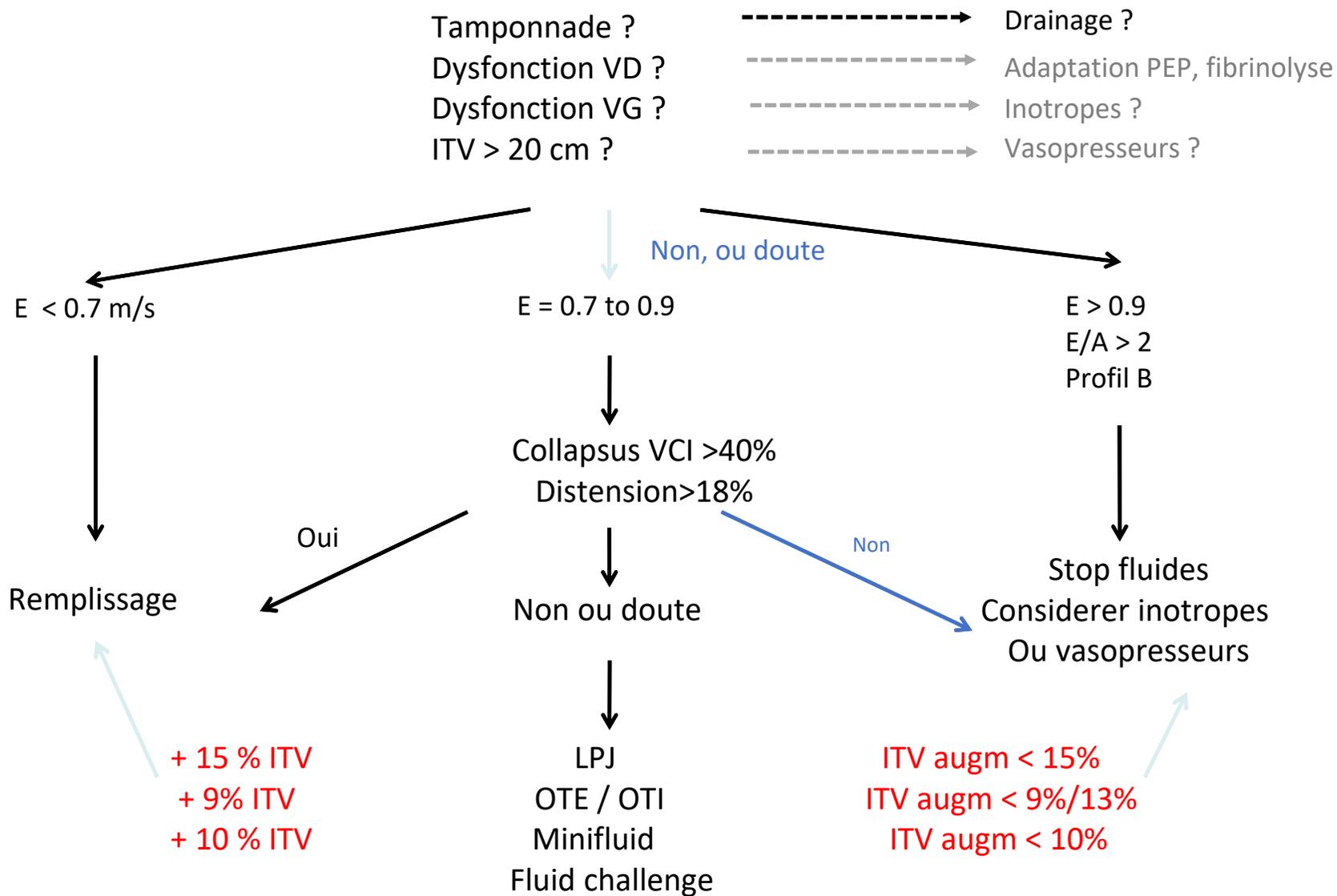


VASOPLÉGIE

En résumé

Etat de choc

Objectifs : PAM > 65 mmHg, diurèse > 0,5 ml/Kg/h et lactates < 2 mmol/l



Merci de votre attention