Place de l'échocardiographie dans la gestion du remplissage vasculaire

Pr Matthieu BIAIS
Service Anesthésie-Réanimation Tripode
CHU de Bordeaux

TUSAR 25 mars 2025

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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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Cecconi et al
ICM 2015

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

Indication	*n* (%)
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	*n*
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

A global inception cohort study

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Echo variables	45

2 % !!

Mon patient est en insuffisance circulatoire aigüe

Mon patient est en insuffisance circulatoire aigüe

1. Quelle(s) thérapeutique(s) sont indiquées ?
2. Un remplissage vasculaire peut-il être bénéfique ?

=> Va-t-il augmenter le débit cardiaque ?

3. Un remplissage vasculaire peut-il être néfaste ?

=> Risque-t-il d'aggraver une congestion veineuse ?

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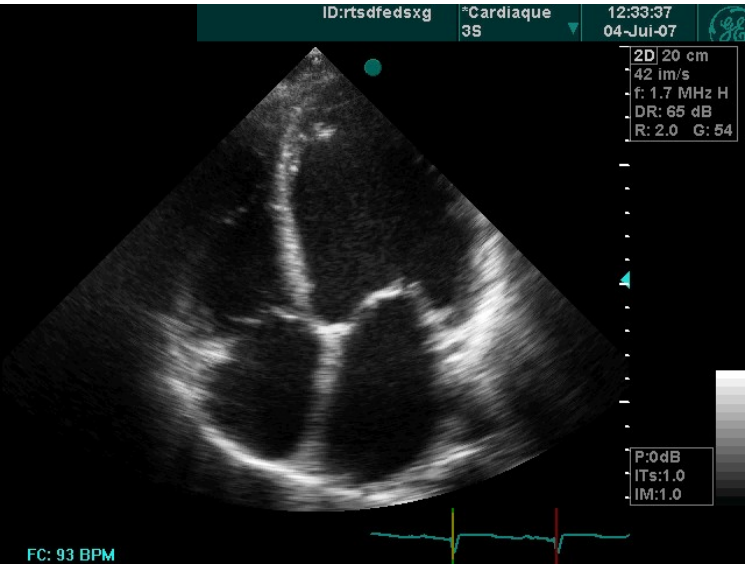
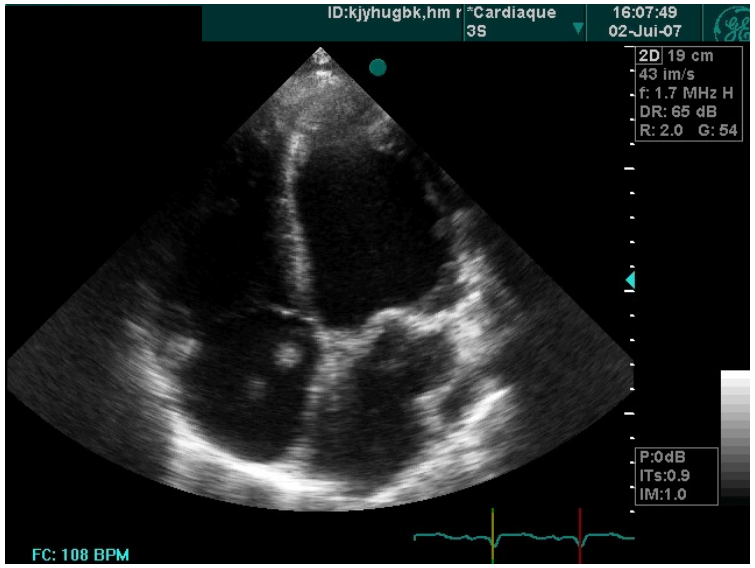
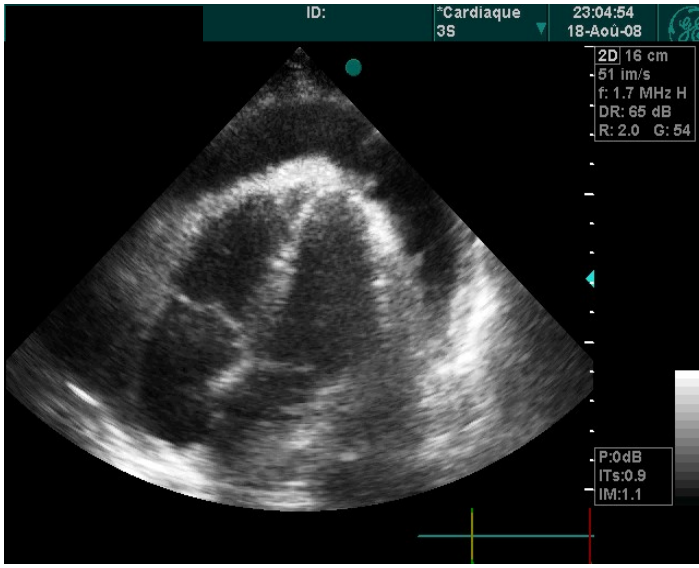
Evaluation de la fonction cardiaque globale



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

Mon patient est en insuffisance circulatoire aigüe

1. Quelle(s) thérapeutique(s) sont indiquées ?
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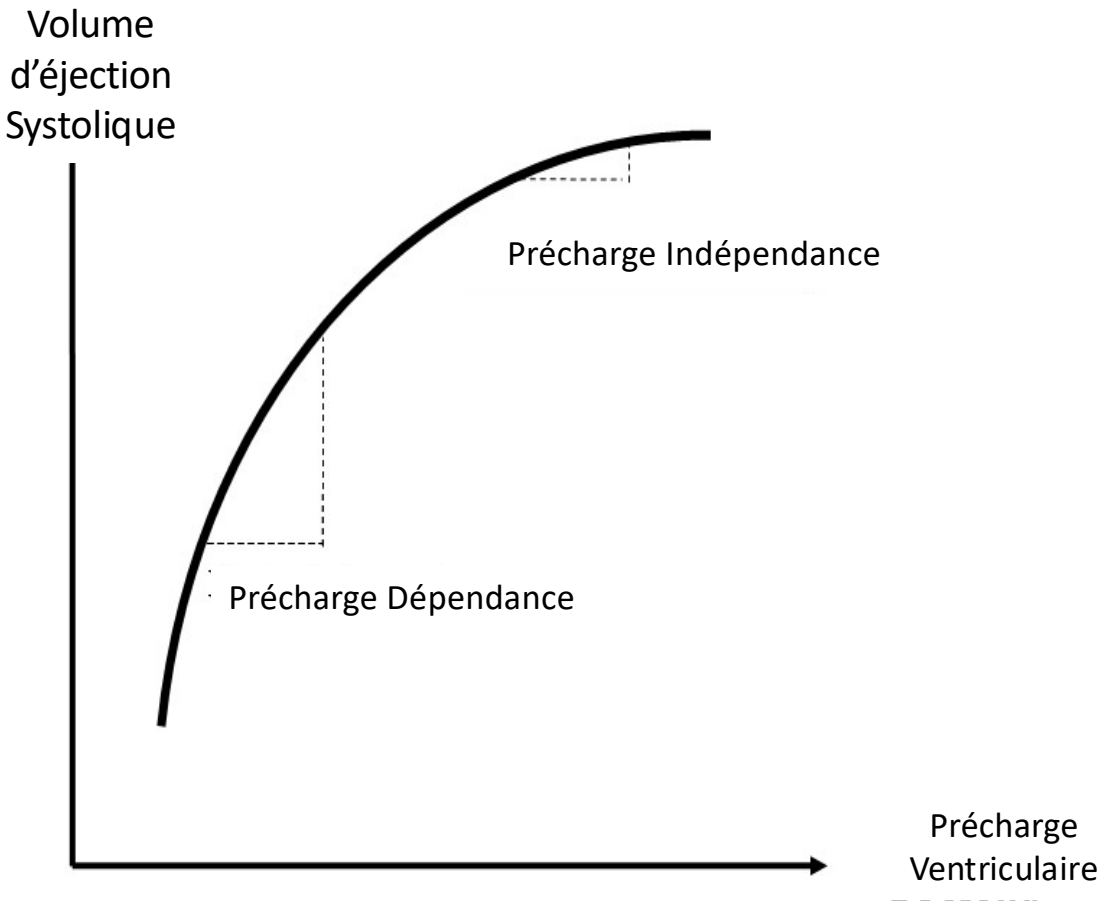
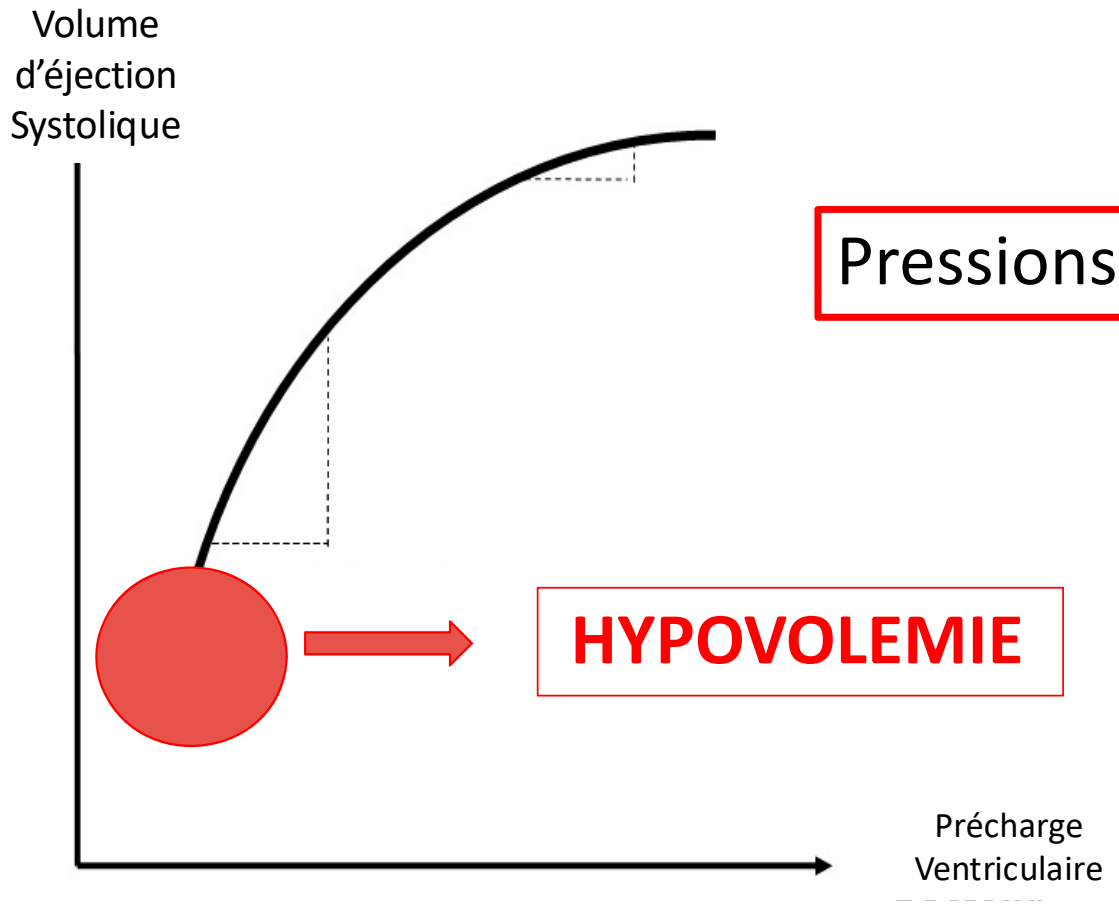
Courbe de Frank-Starling



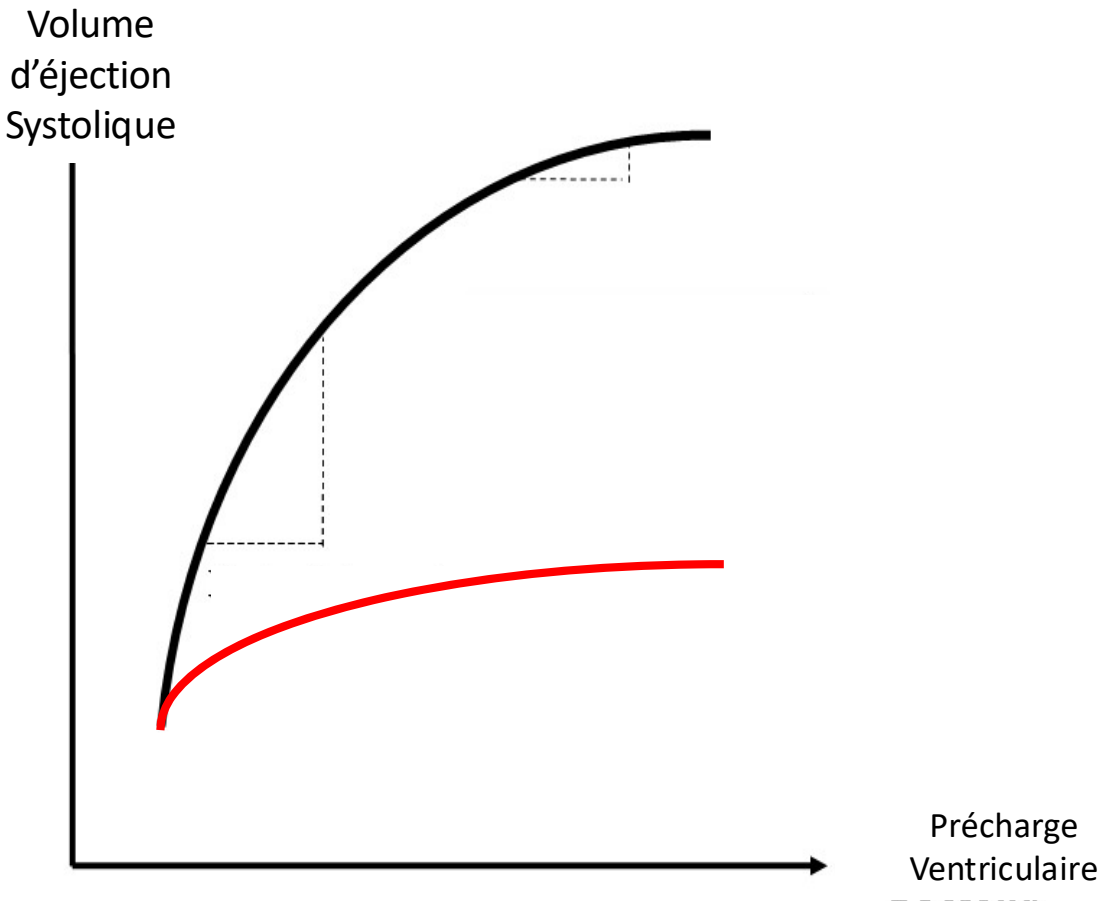
Courbe de Frank-Starling



Pressions basses + débit bas

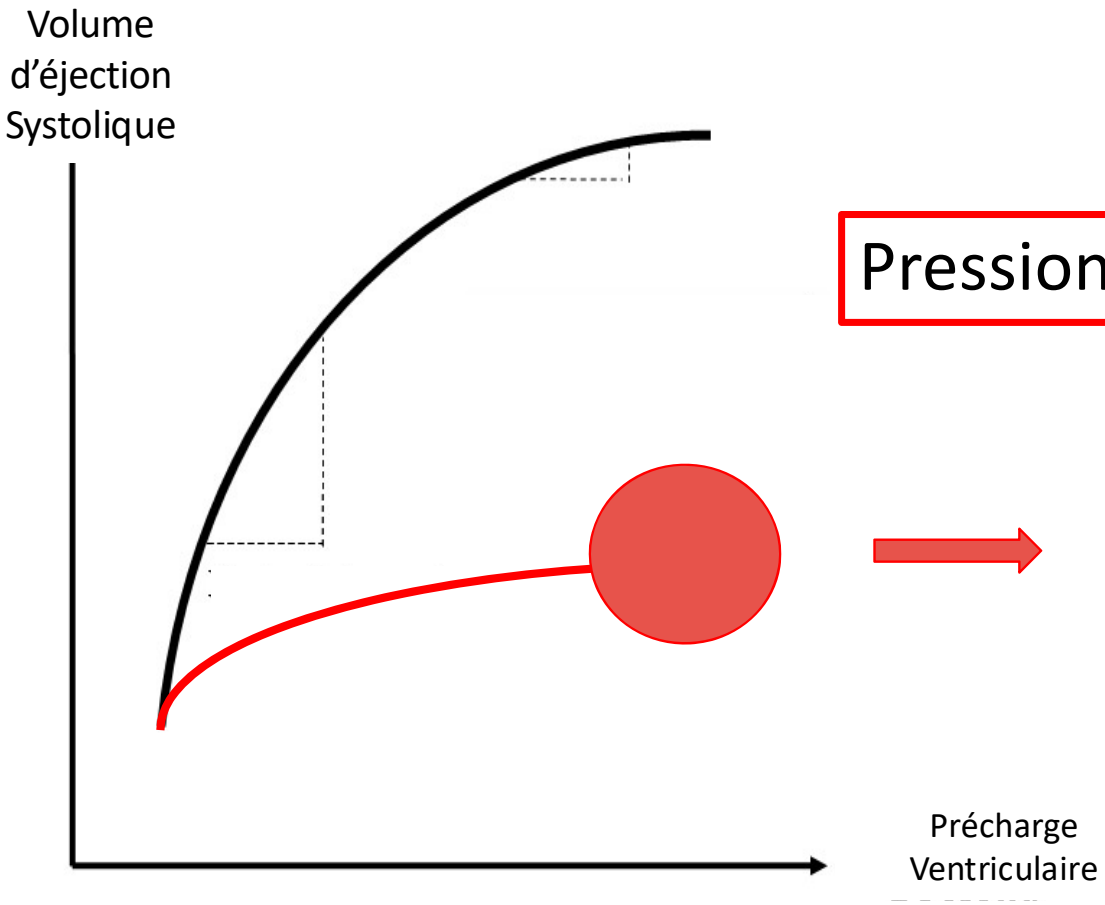
HYPOVOLEMIE

Courbe de Frank-Starling



INSUFFISANCE CARDIAQUE

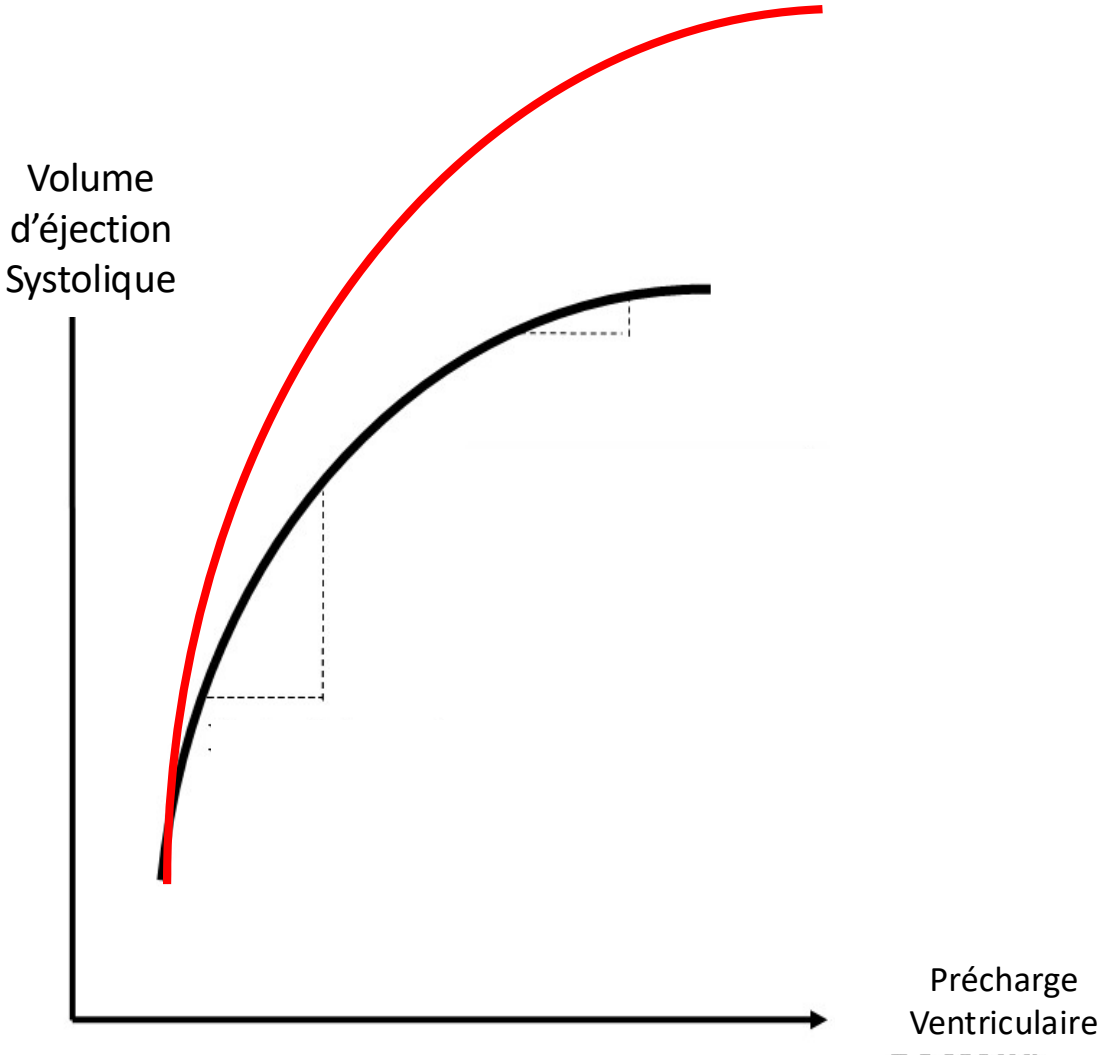
Courbe de Frank-Starling



Pressions hautes + débit bas

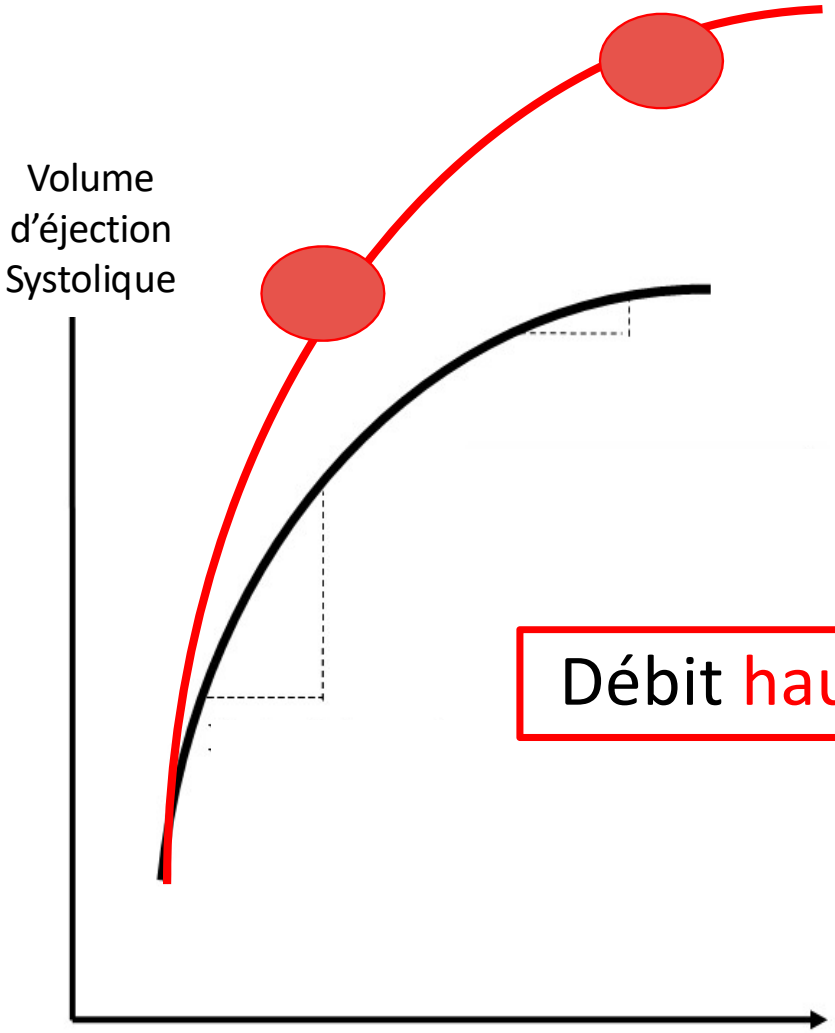
INSUFFISANCE CARDIAQUE

Courbe de Frank-Starling



VASOPLEGIE

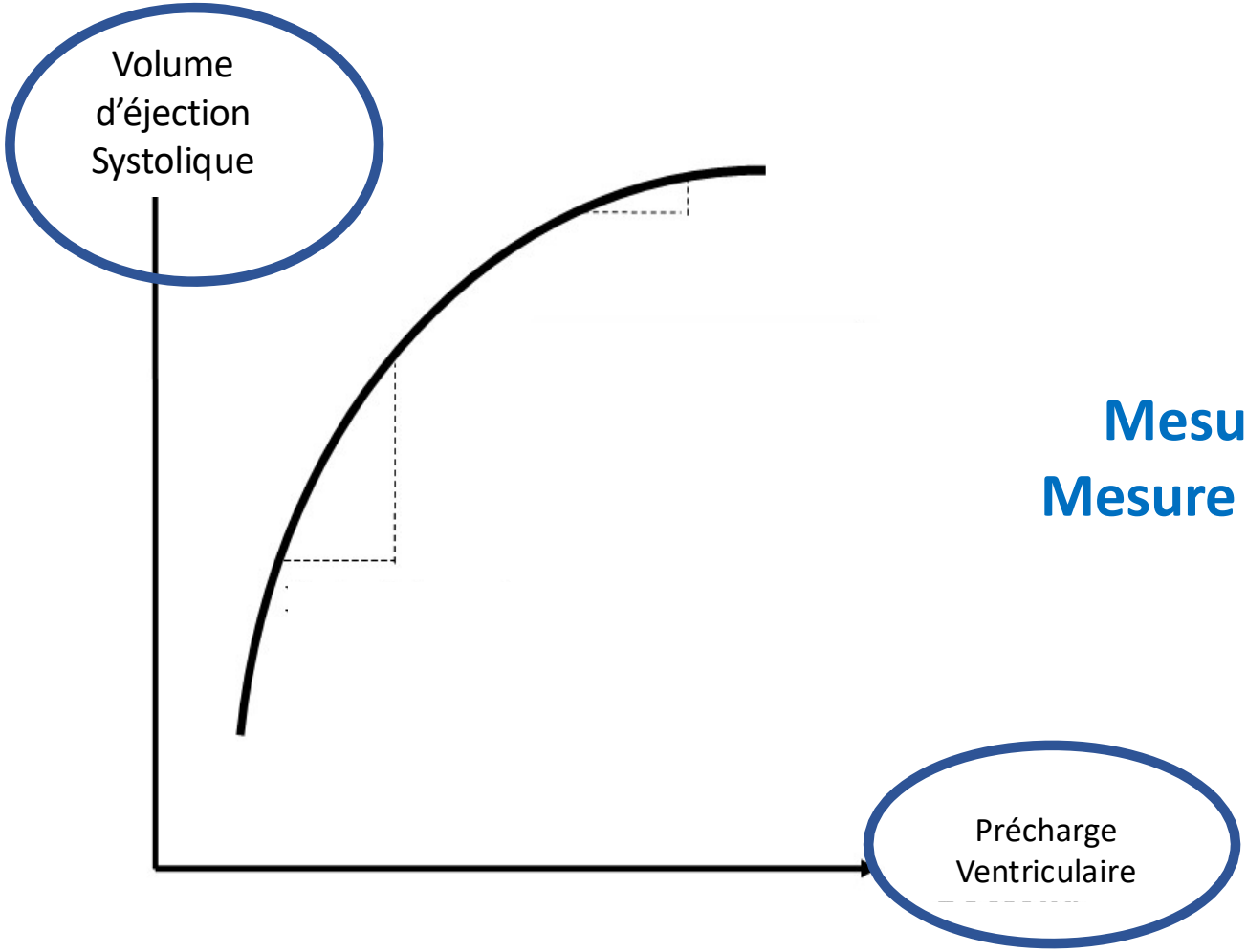
Courbe de Frank-Starling



VASOPLEGIE

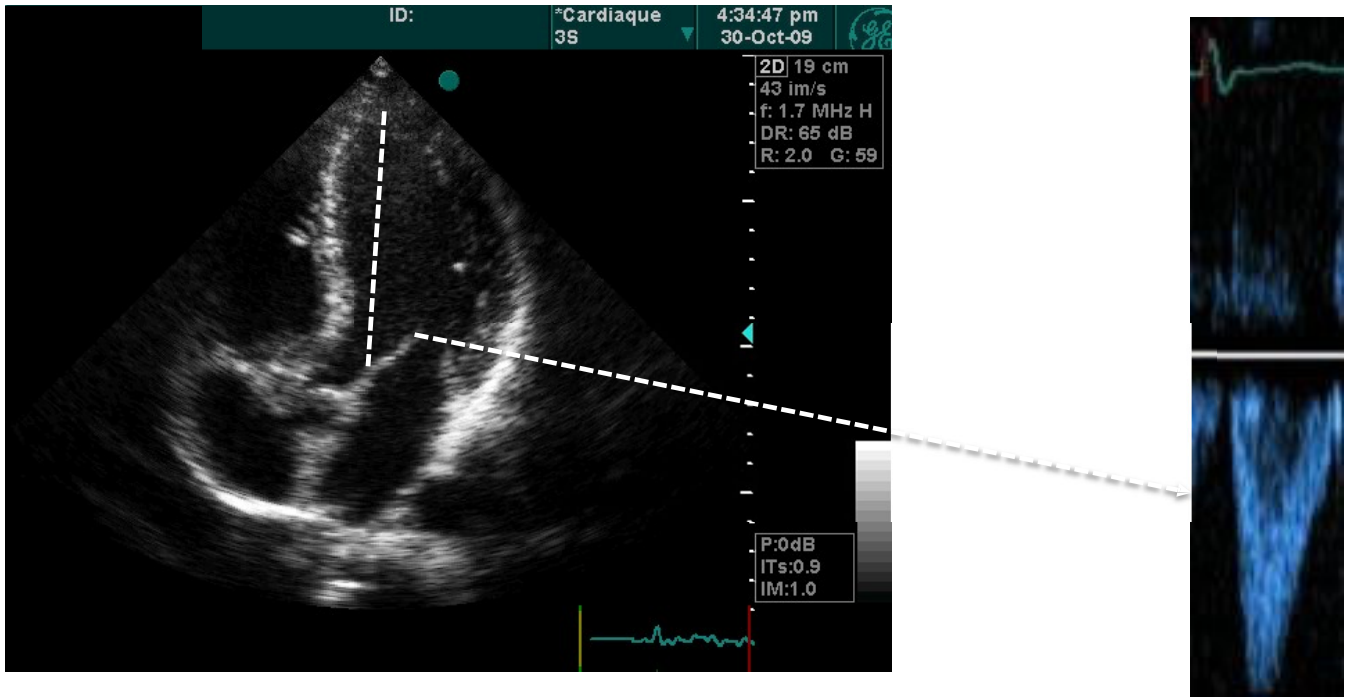
Débit haut + Pressions hautes/basses

Courbe de Frank-Starling



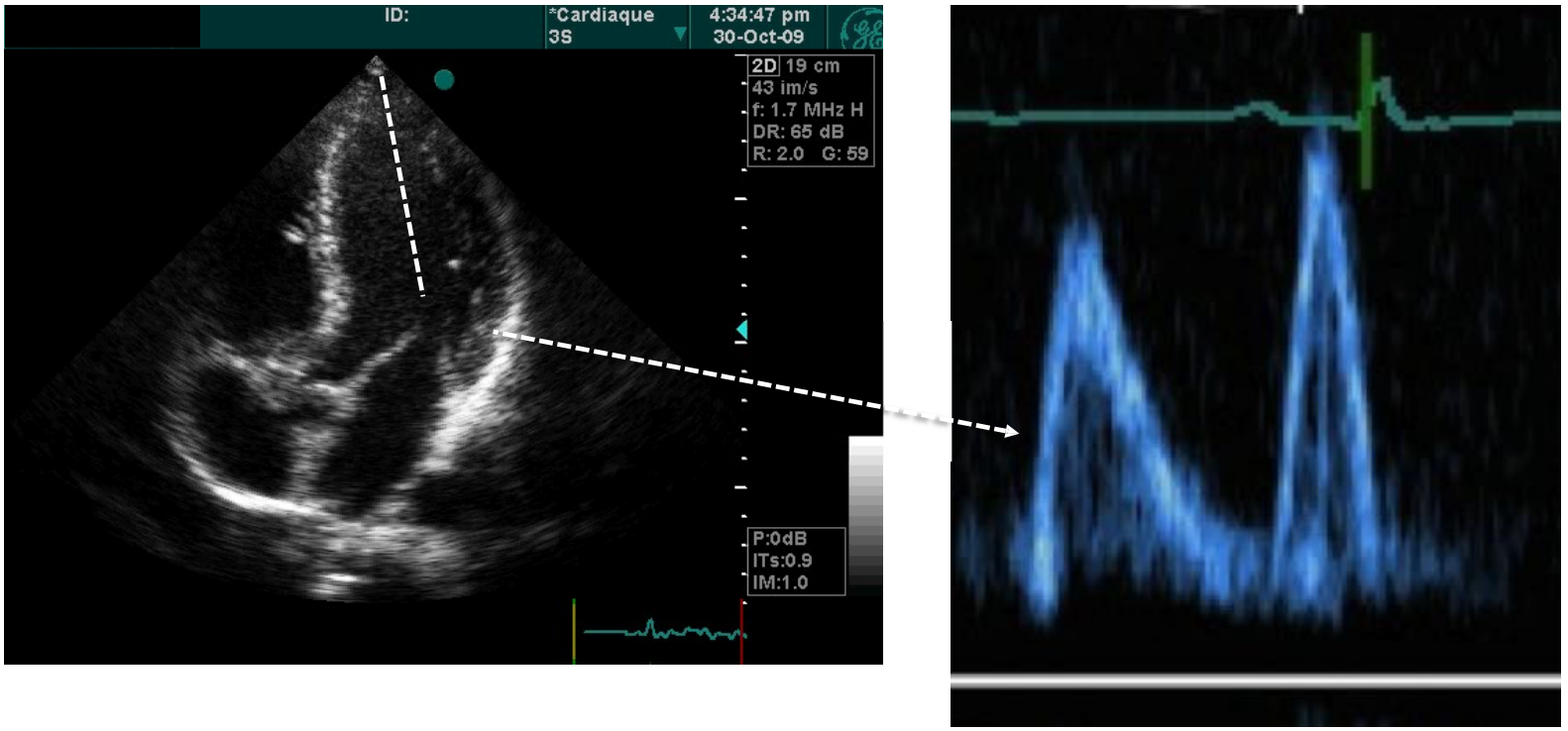
Mesure du Débit
Mesure des Pressions

Mesurer le débit cardiaque



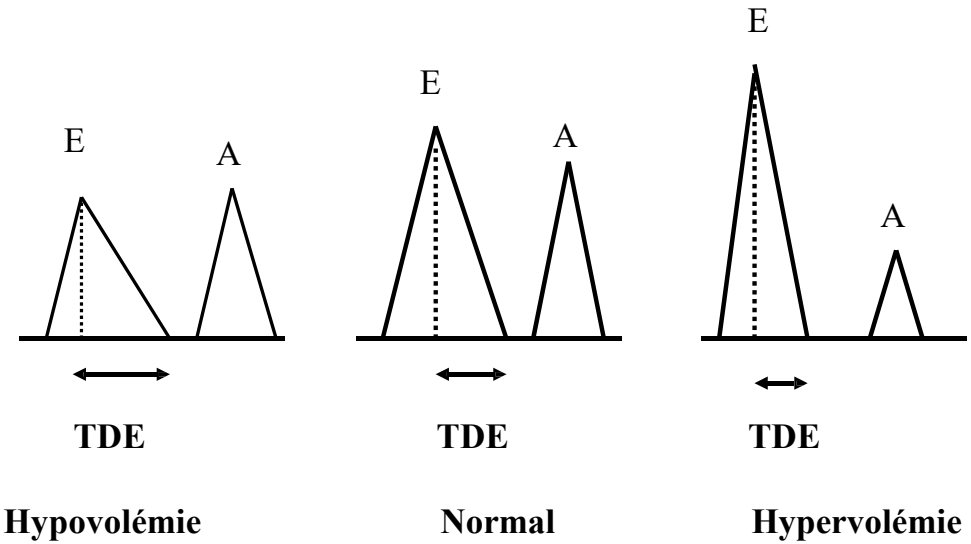
L'ITV sous-aortique suffit !
Normale : 14 – 20 cm

Mesurer les pressions: profil mitral



Le flux doppler mitral = évalue grossièrement les pressions de remplissage

Mesurer les pressions: profil mitral

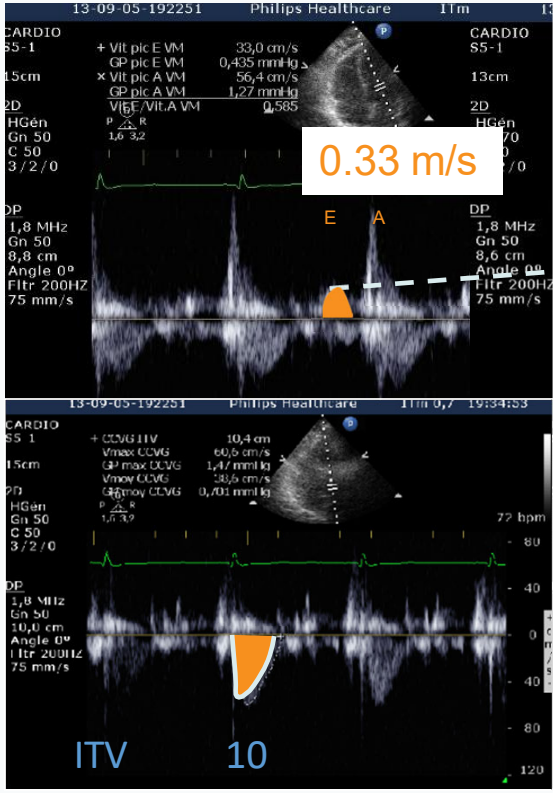


L'onde E varie avec la volémie

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

Mesurer les pressions: profil mitral

Femme de 72 ans, choc, péritonite



Avant remplissage

Mesurer les pressions: profil mitral

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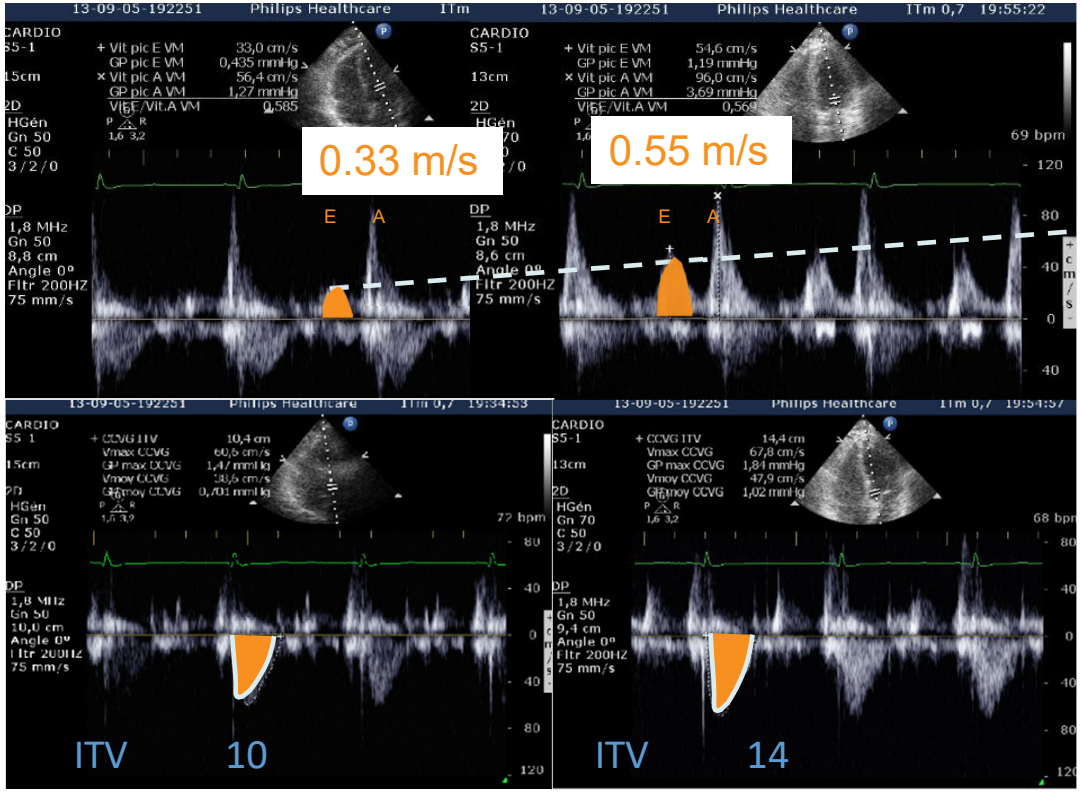
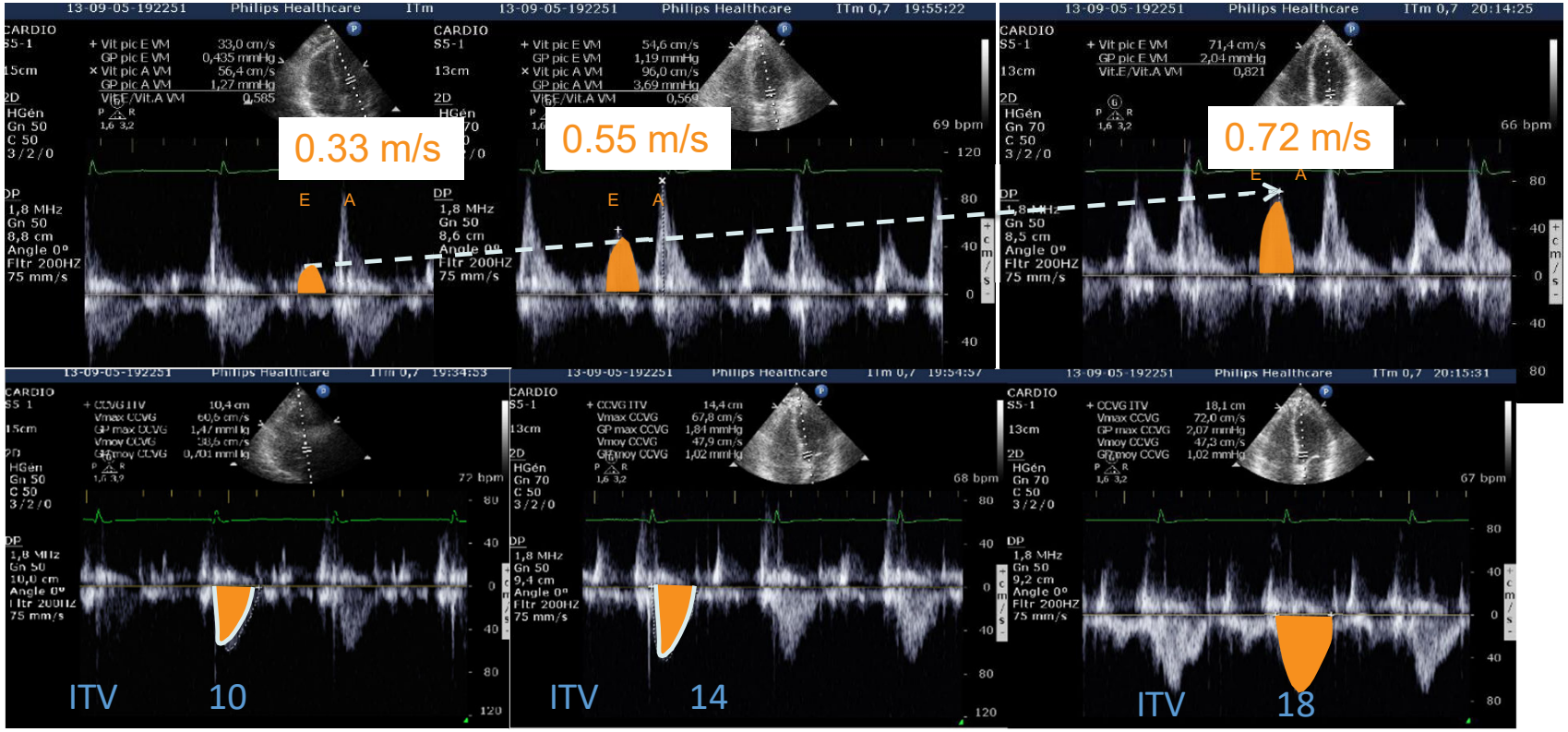


Avant remplissage

500 mL

Mesurer les pressions: profil mitral

Femme de 72 ans, choc, péritonite

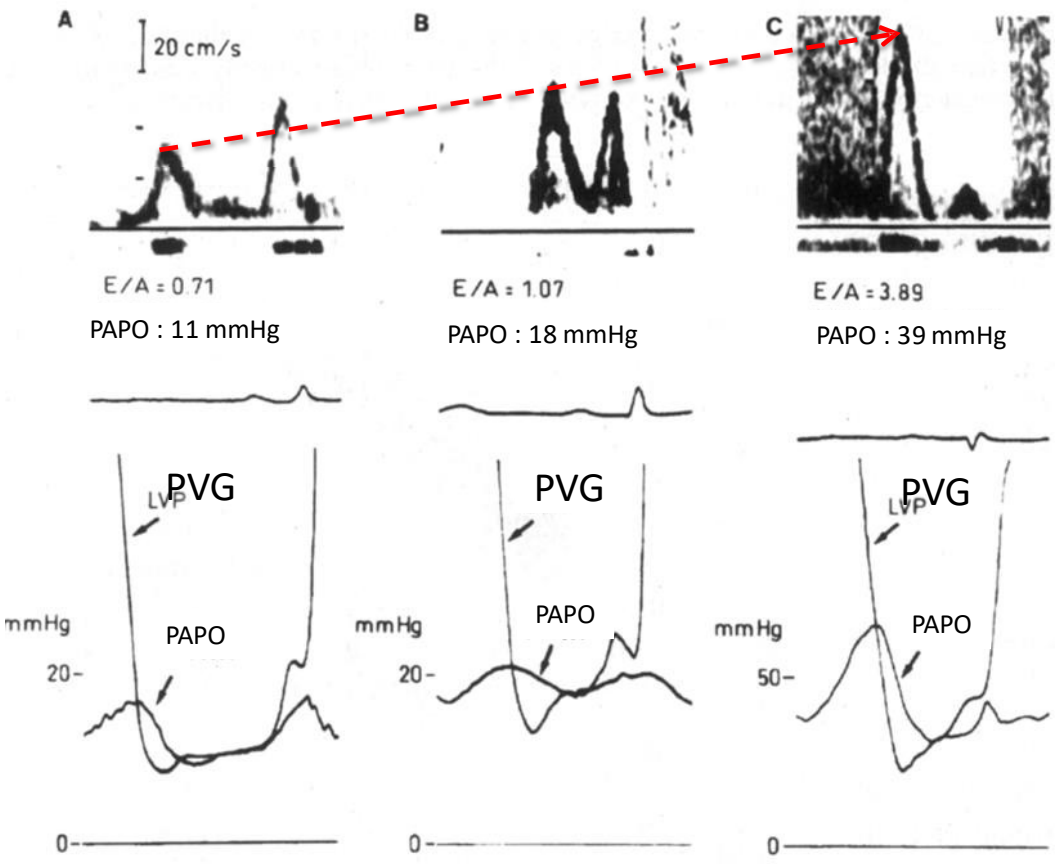


Avant remplissage

500 mL

1000 mL

Mesurer les pressions: profil mitral

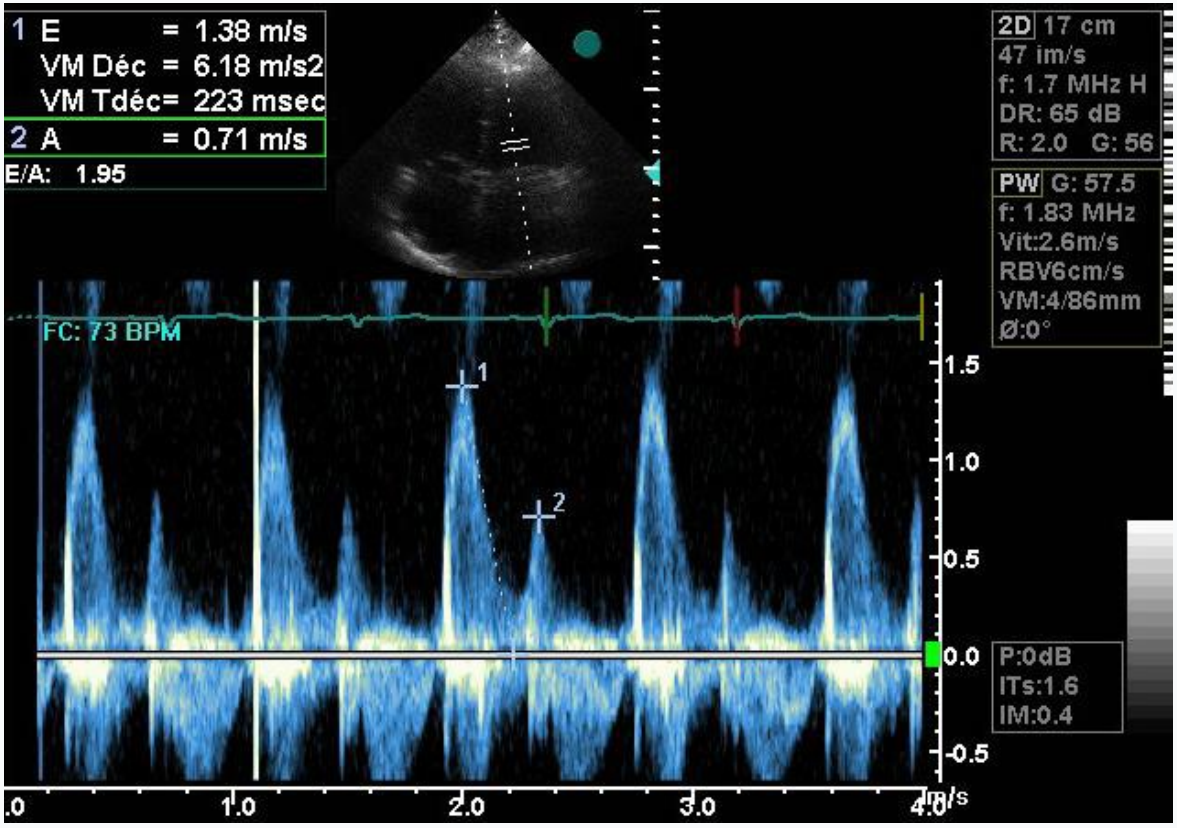


Rapport E/A

Le profil mitral est corrélé à la PTDVG

Vanoverschelde et al Am J Cardiol 1995

Mesurer les pressions: profil mitral



E/A ratio > 2

=

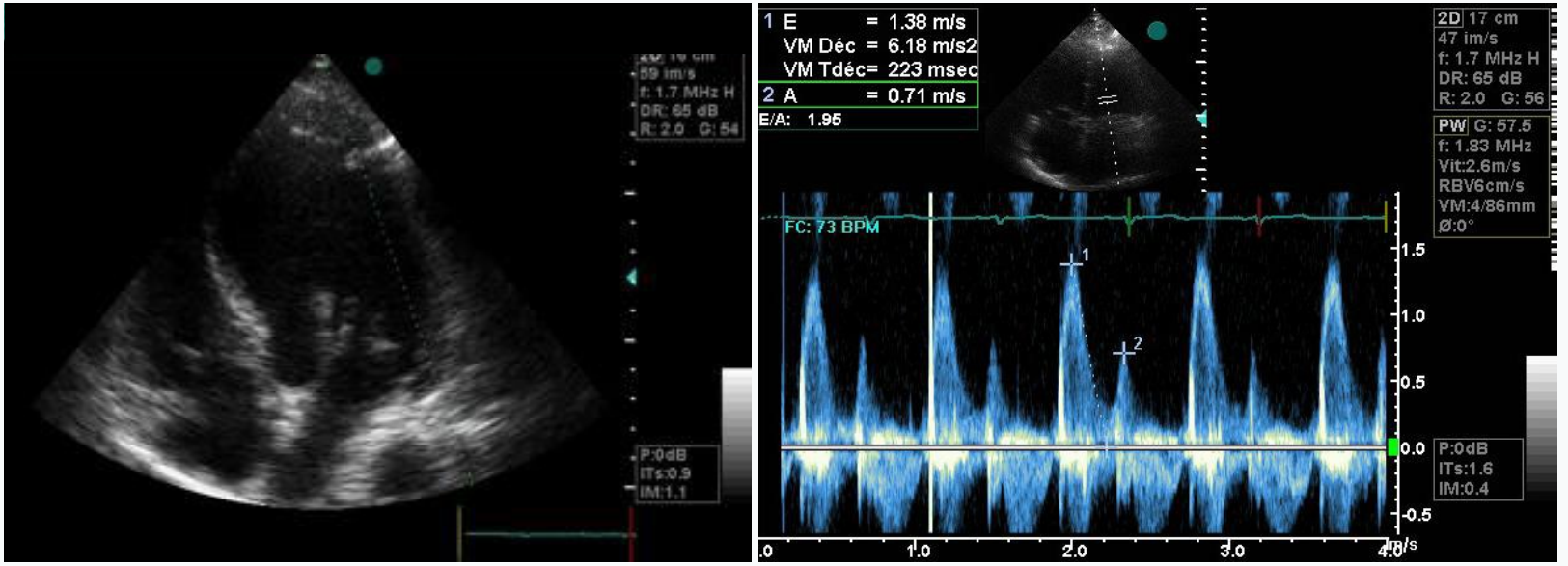
PAPO > 18 mmHg

PP value = 100 %

Boussuges et al Critical Care Med 2002

Mesurer les pressions: profil mitral

Homme 72 ans, T°=38,5°, toux, PA= 130/80 mmHg
Est-ce seulement une pneumopathie ?



Amélioration clinique après diurétiques !

Mesurer les pressions: profil mitral

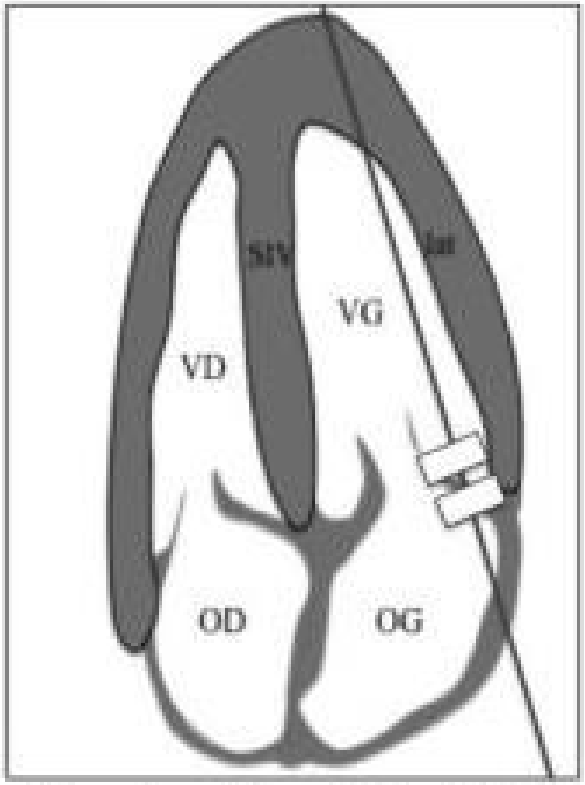
Chez un sujet jeune et sportif :

- 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

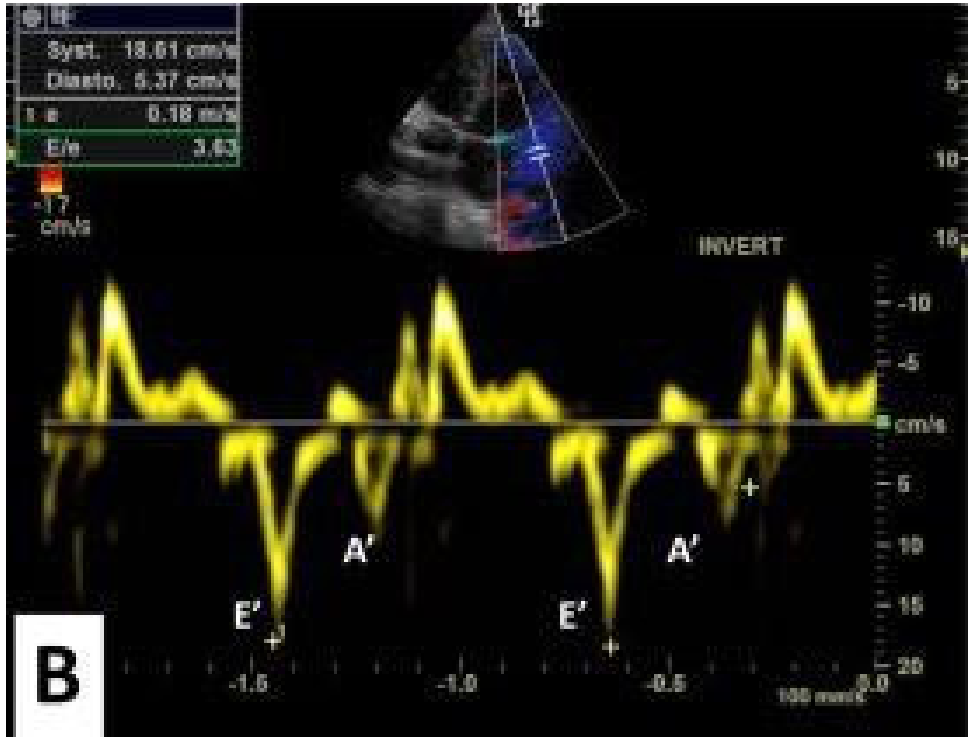
Doppler Tissulaire Anneau Mitral (Paroi latérale)

Mesure de E'



Doppler Tissulaire (DTI)

Rapport E/E'



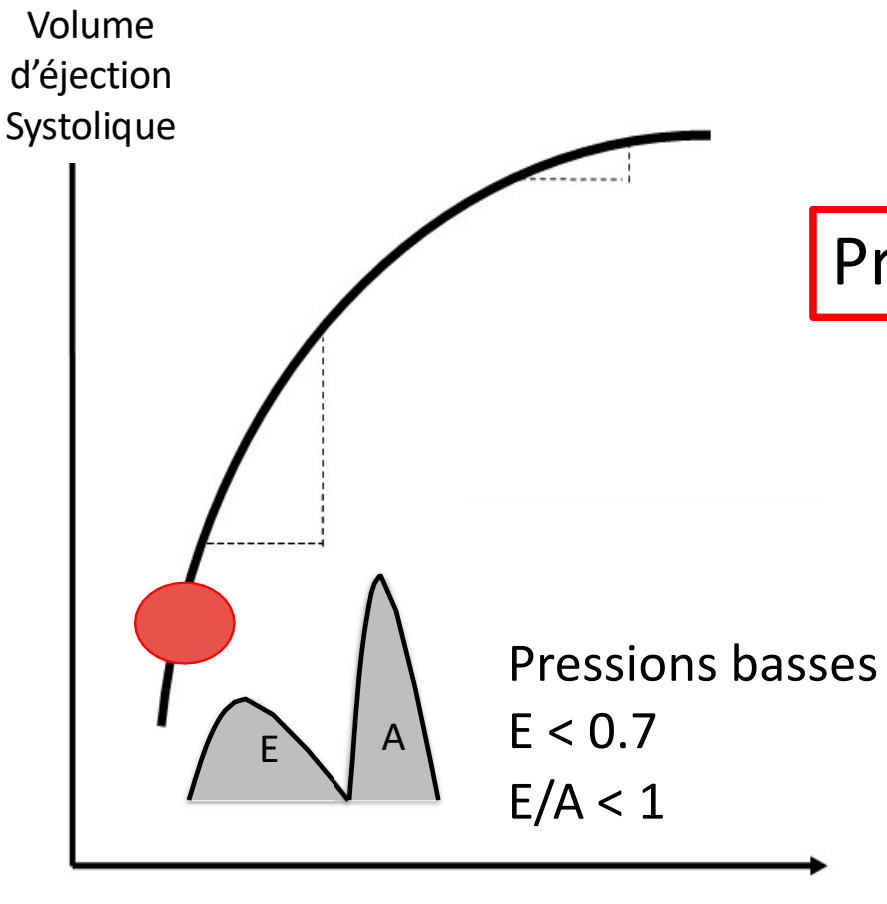
Doppler Tissulaire Anneau Mitral (Paroi latérale)

Rapport E/E'

Paramètres Doppler	Valeur seuil	Pression de remplissage VG prédite (mmHg)	Sensibilité	Spécificité	Valeur prédictive positive
E/E'	> 15	> 15	86 %	88 %	- [27][c]
	> 7	≥ 13	86 %	92 %	- [21][b,c]
	> 7,5	> 15	86 %	81 %	- [22][b,c]
	> 9,5	> 18	100 %	86 %	- [23][b,c]

Vignon et al. Réanimation 2007

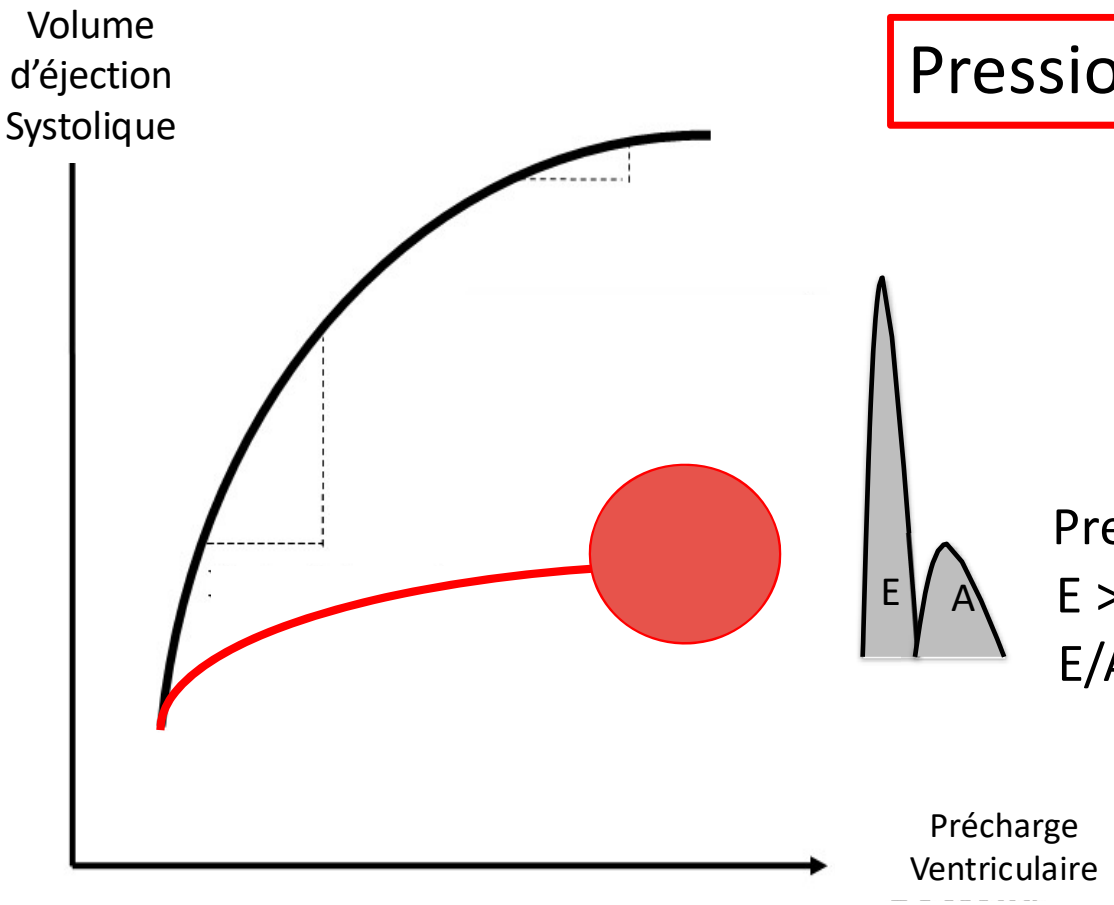
Courbe de Frank-Starling



Pressions basses + débit bas

HYPOVOLEMIE

Courbe de Frank-Starling



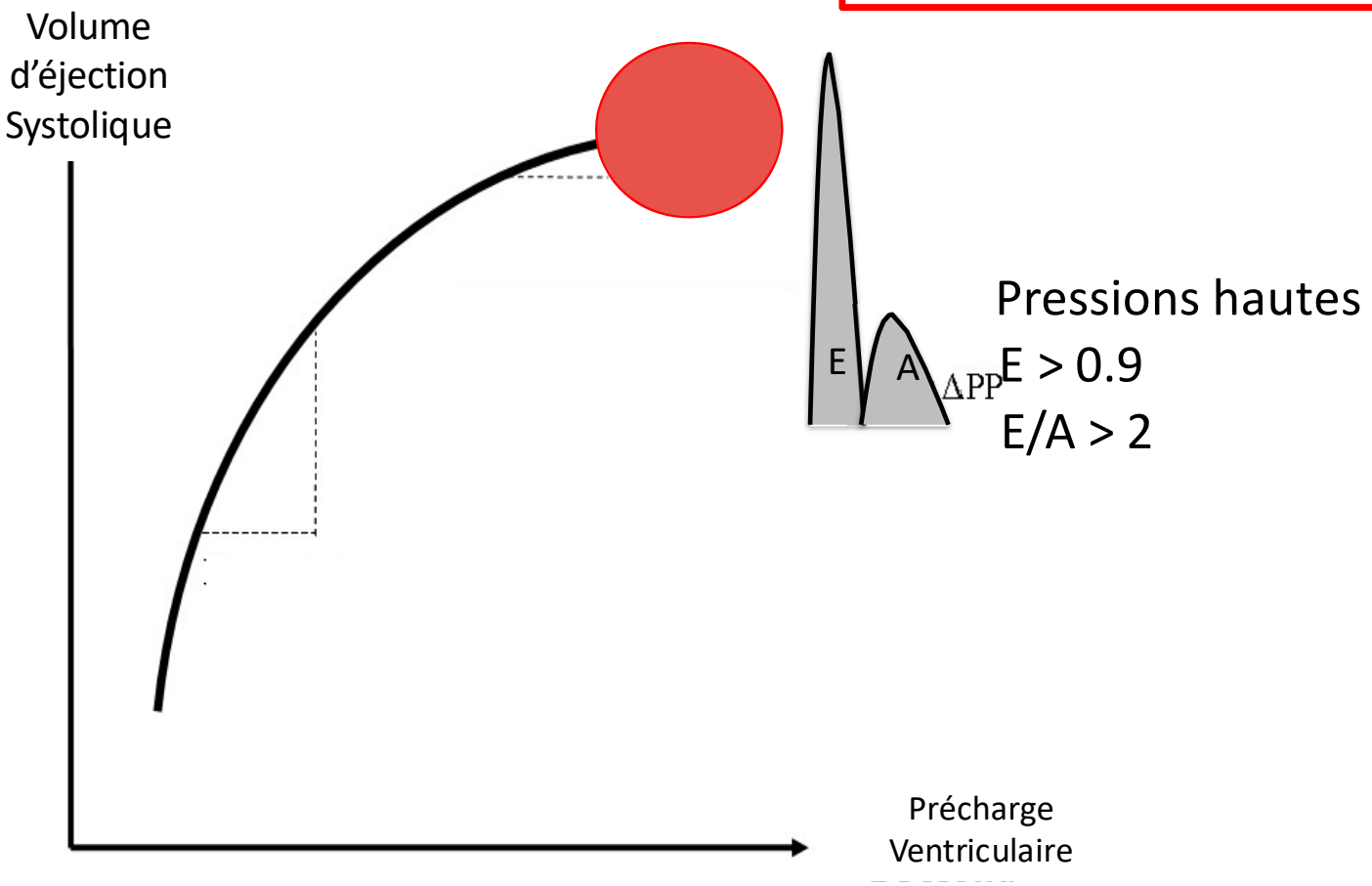
Pressions hautes + débit bas

INSUFFISANCE CARDIAQUE

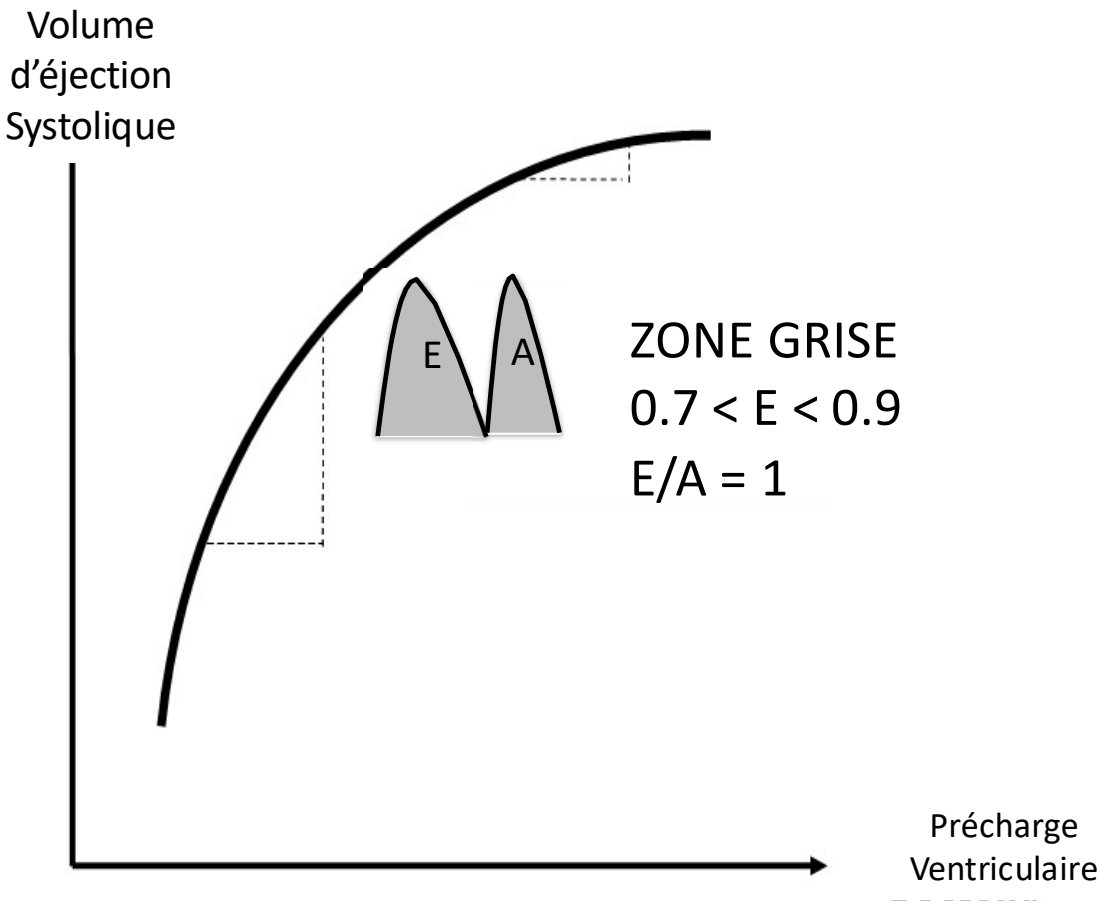
Pressions hautes
E > 0.9
E/A > 2

Courbe de Frank-Starling

Pressions hautes + débit haut

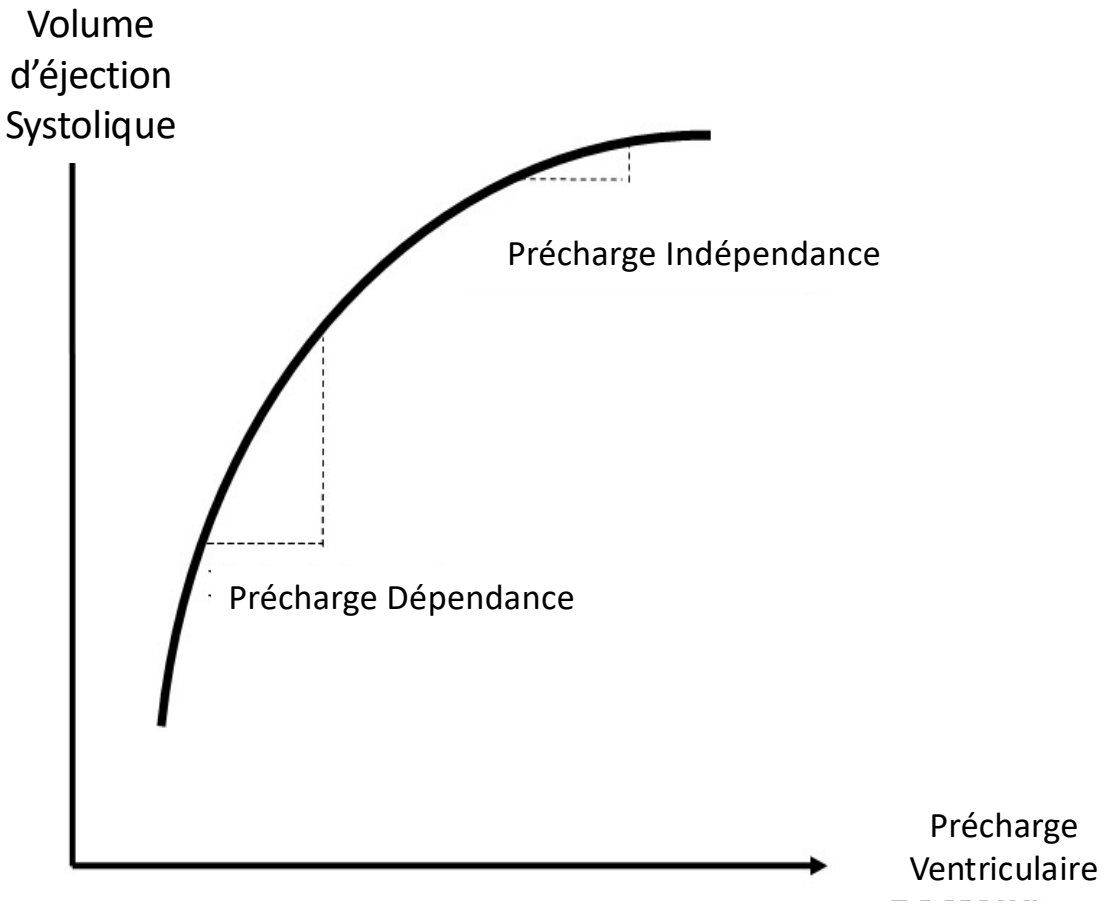


Courbe de Frank-Starling

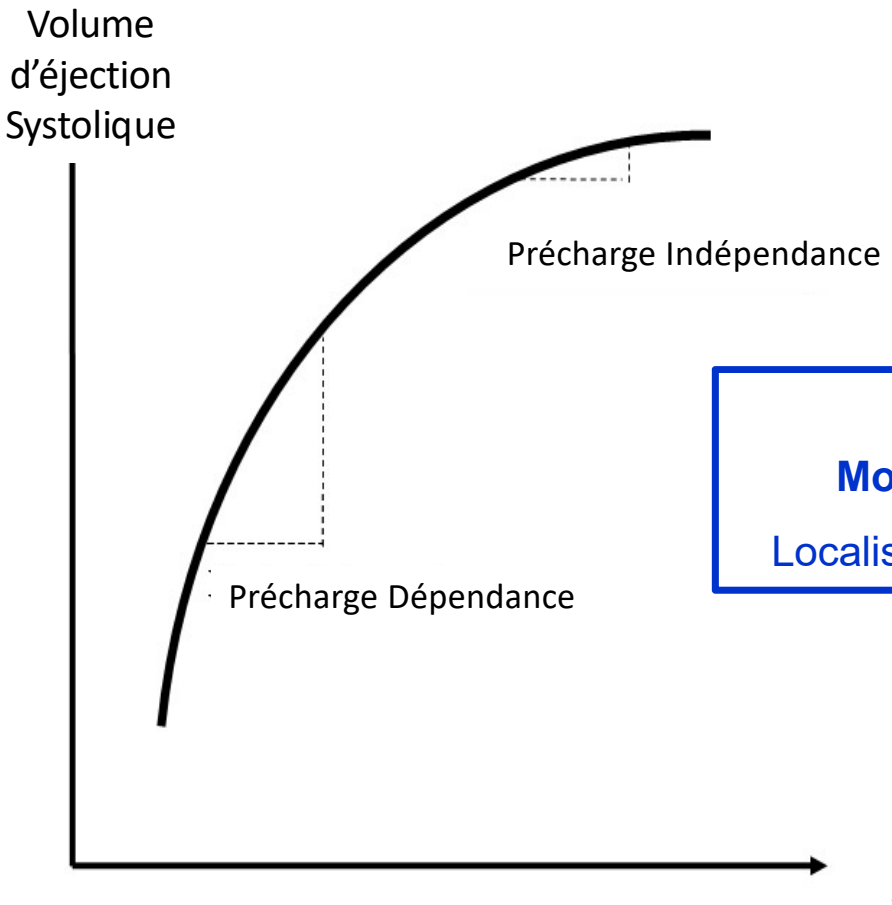


INDICES DYNAMIQUES

Indices Dynamiques



Indices Dynamiques



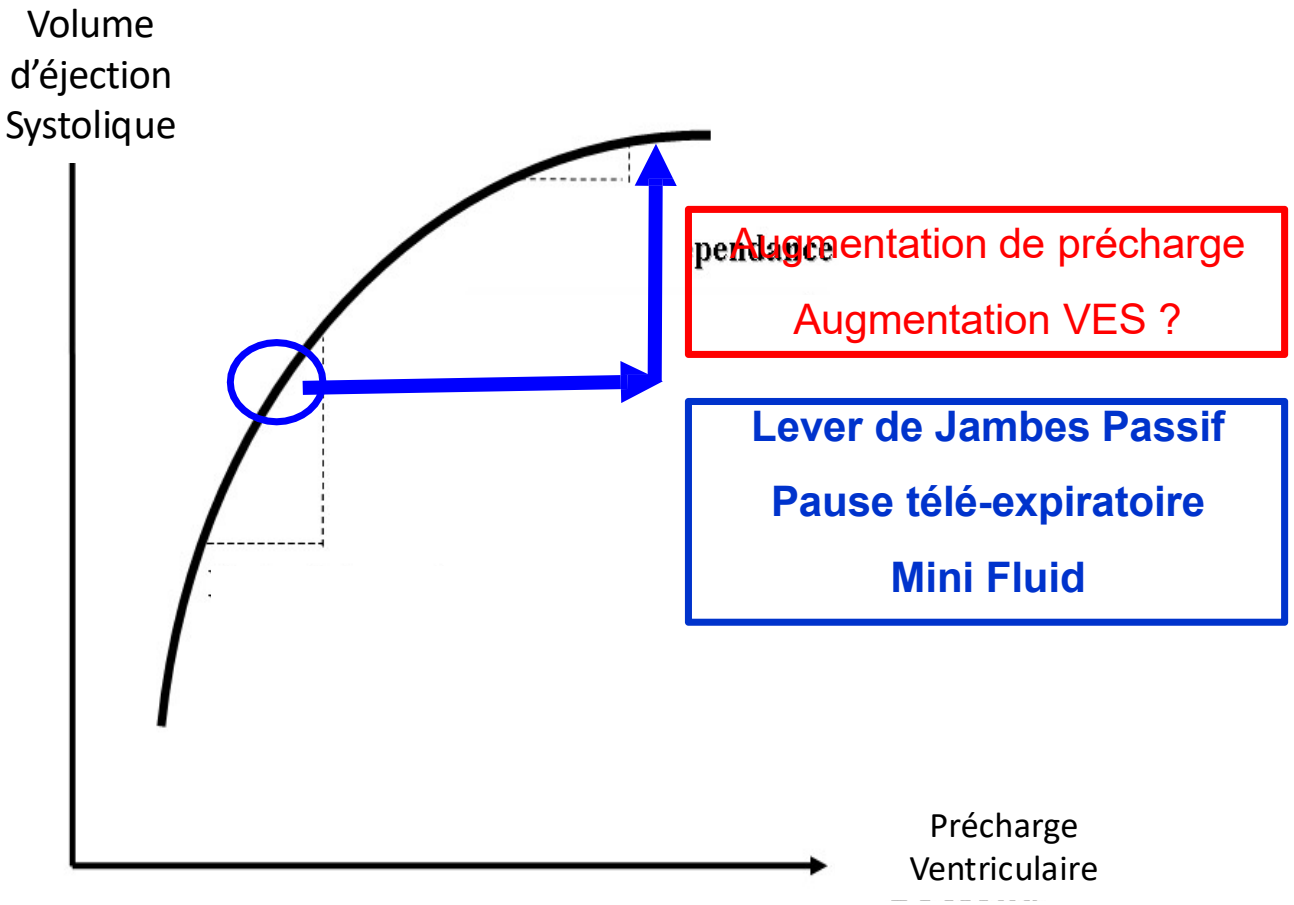
Low APR

Faire Varier la précharge

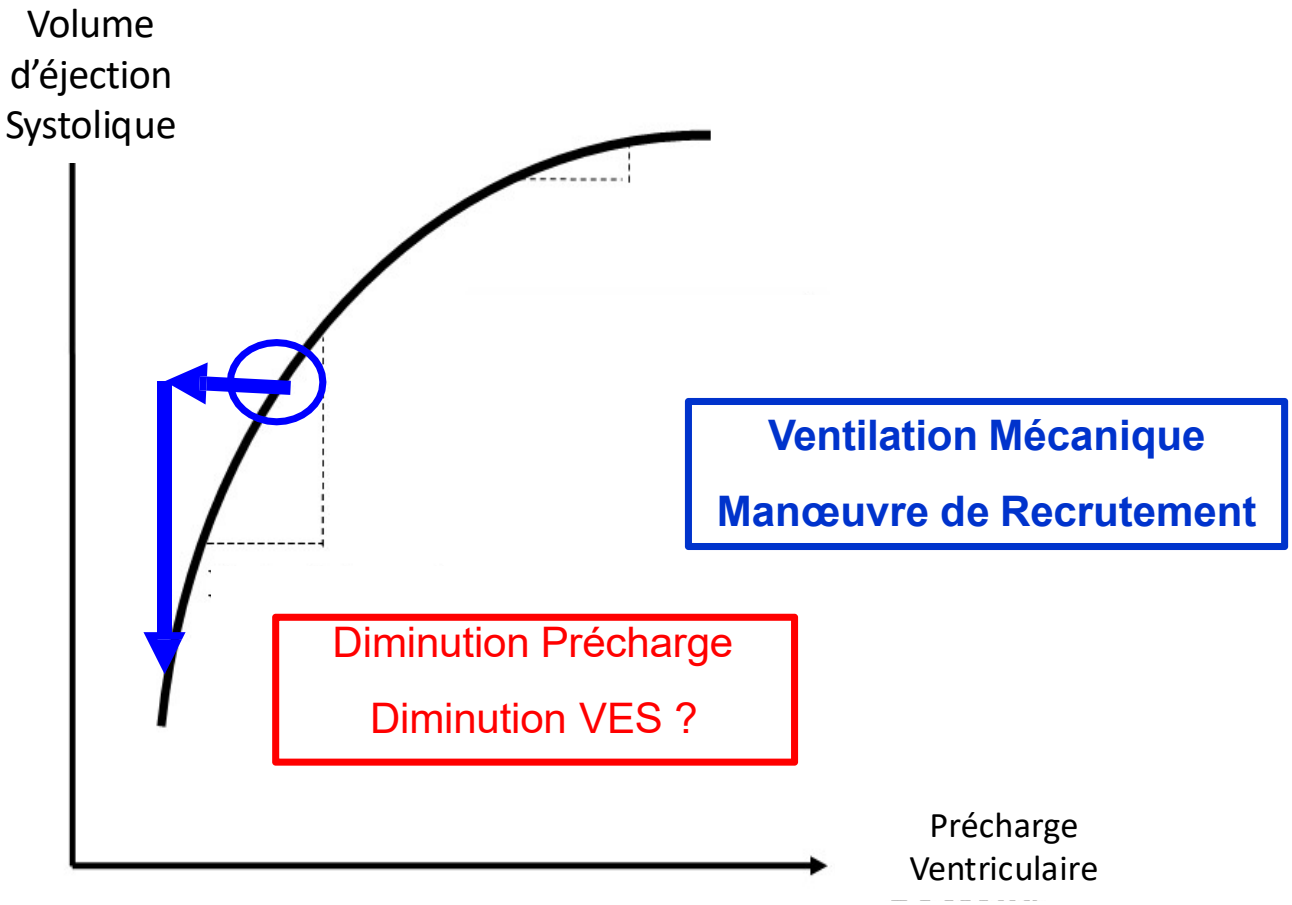
Monitorer le VES ou un dérivé

Localiser le patient sur la courbe de FS

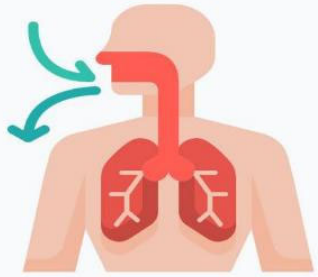
Indices Dynamiques



Indices Dynamiques



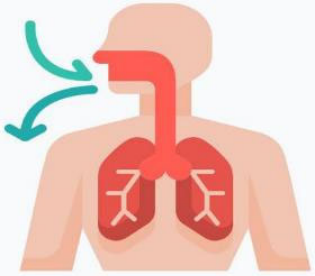
Effet de la ventilation mécanique



Effet de la ventilation mécanique

↗ Ejection VG

Inspiration



↘ Ejection VD

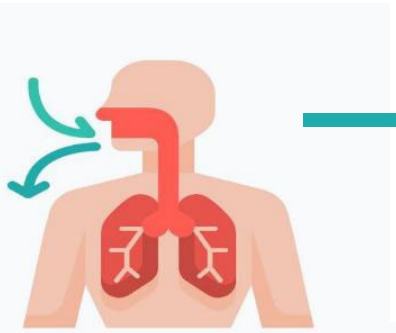
- ↘ retour veineux
- ↗ postcharge VD

Effet de la ventilation mécanique

↗ Ejection VG

Inspiration

Expiration



↘ Ejection VD
- ↘ retour veineux
- ↗ postcharge VD

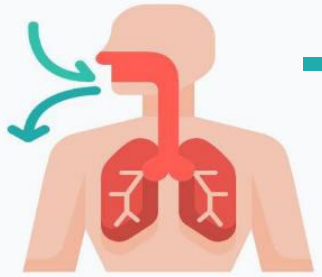
↘ Précharge VG

↘ Ejection VG

Effet de la ventilation mécanique

↗ Ejection VG

Inspiration



Expiration

↘ Ejection VD
- ↘ retour veineux
- ↗ postcharge VD

↘ Précharge VG

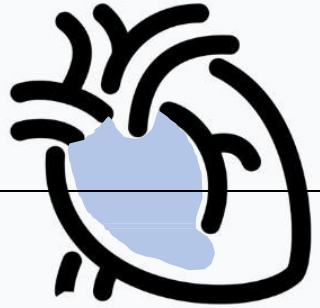
↓

↘ Ejection VG

<u>Cœur droit :</u>
Analyse VCS et VCI

<u>Cœur gauche :</u>
Analyse de la vélocité aortique

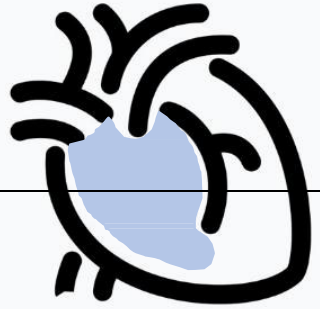
Variations respiratoires des veines caves



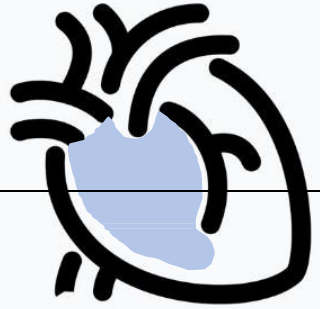
Variations respiratoires des veines caves

Veine cave **supérieure** :

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



Variations respiratoires des veines caves

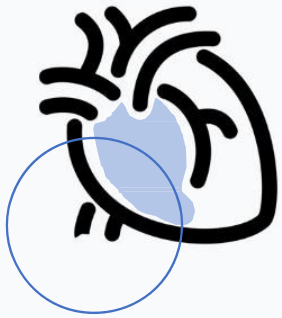


Veine cave **supérieure** :

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

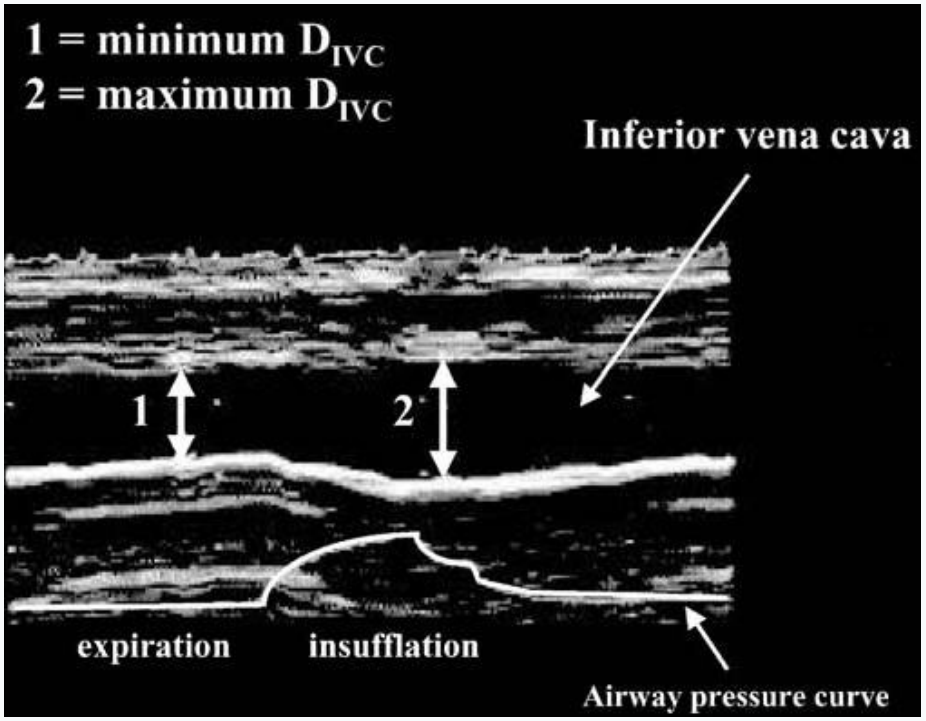
Veine cave **inférieure** :

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



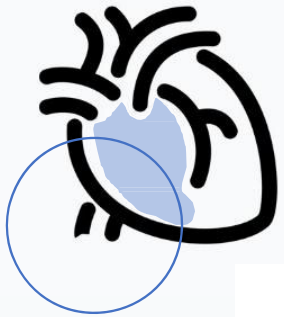
Veine cave inférieure

39 patients sous VM, choc septique



$$\text{Index de distensibilité de la VCI} = \frac{Diamètre\ \max - Diamètre\ min}{(Diamètre\ \max + Diamètre\ \min)/2}$$

Feissel al. ICM 2004



Veine cave inférieure

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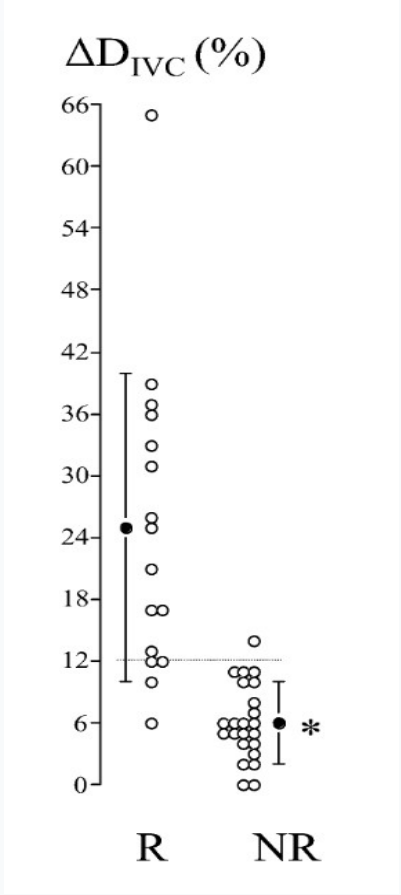
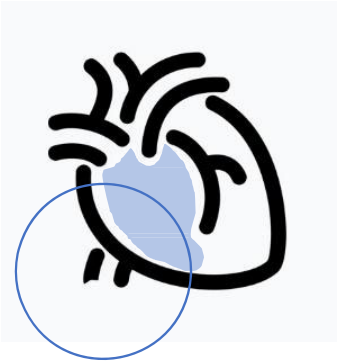


Therefore, the threshold ΔD_{IVC} value of 12% allowed discrimination between responders and non-responders with a positive predictive value of 93% and a negative predictive value of 92%.

Excellentes performances diagnostiques !

Feissel al. ICM 2004



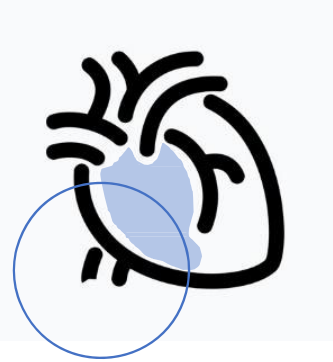
Veine cave inférieure

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

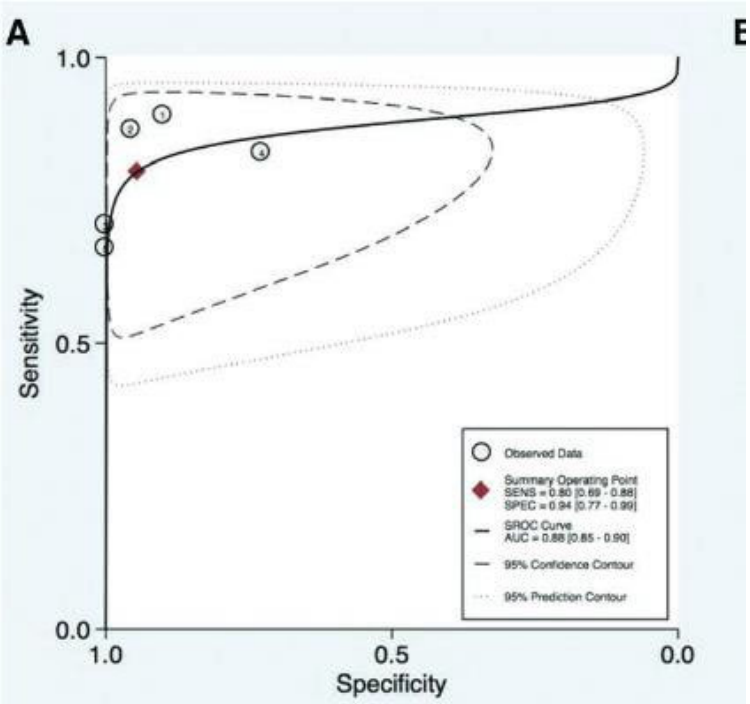
Xiang Si, MD,* Hailin Xu, PhD,* Zimeng Liu, MD,* Jianfeng Wu, PhD, MD,* Daiyin Cao, MD,† Juan Chen, MD,* Minying Chen, MD,* Yongjun Liu, MD,* and Xiangdong Guan, PhD, MD*

12 études, 753 patients

Si et al. Anesth Analg 2018



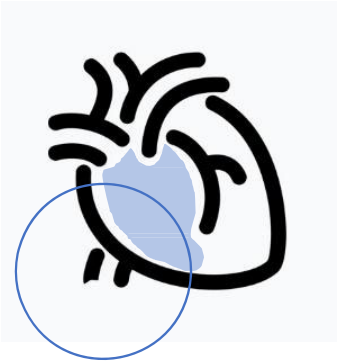
Veine cave inférieure



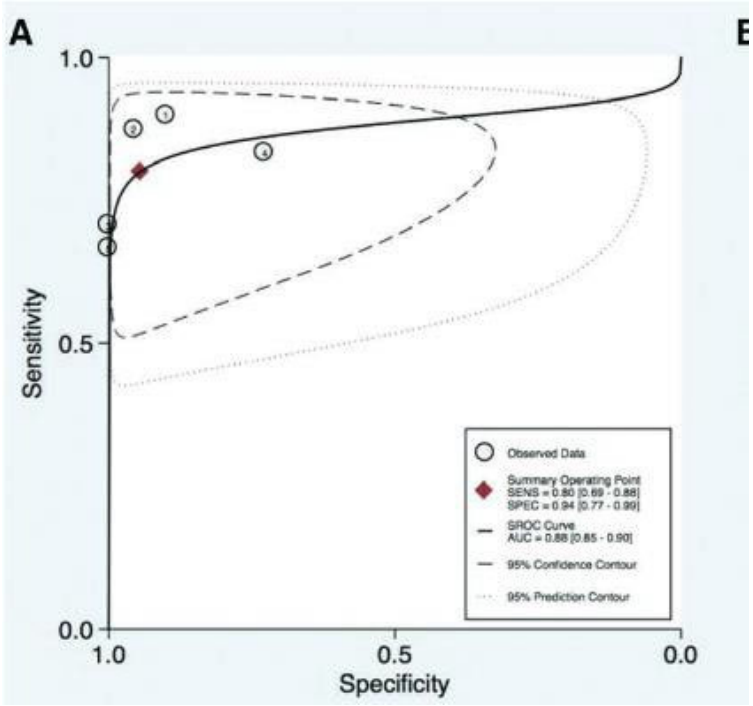
Vt > 8ml/kg et

PEP < 5 cmH_2O

Si et al. Anesth Analg 2018



Veine cave inférieure



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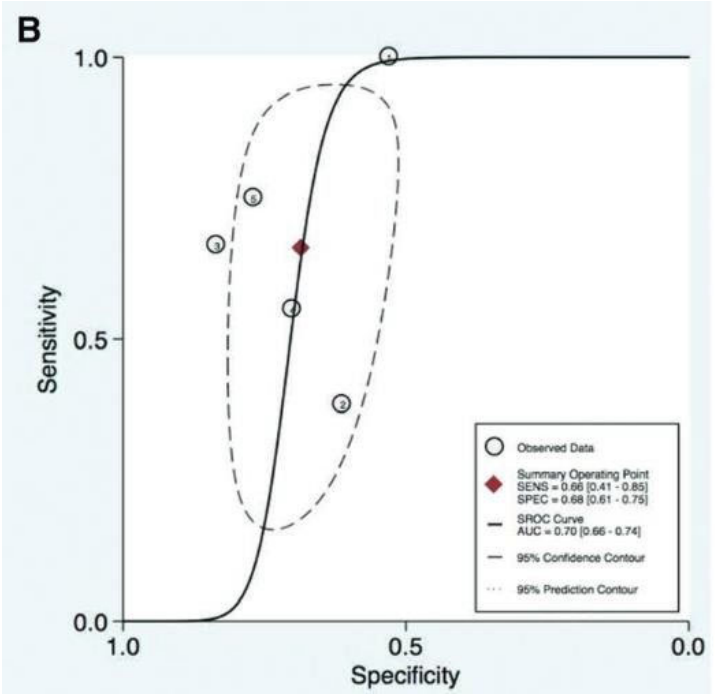
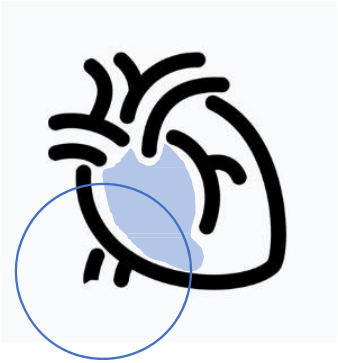
PEP < 5 cmH_2O

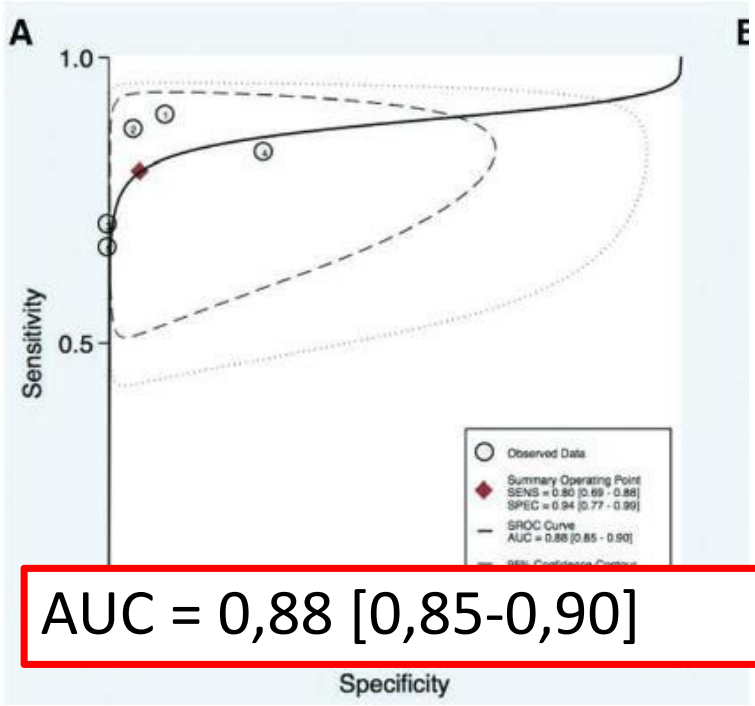


Vt < 8ml/kg ou
PEP > 5 cmH_2O

Si et al. Anesth Analg 2018

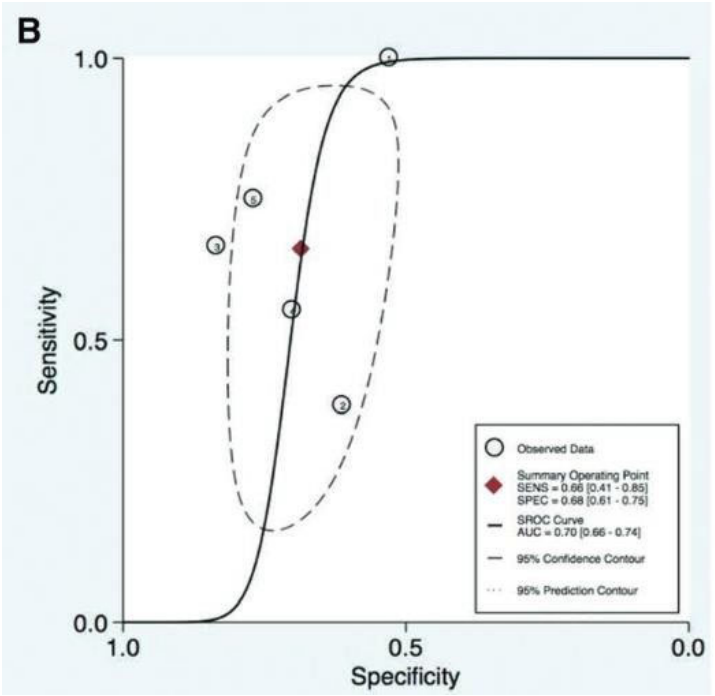


Veine cave inférieure



AUC = 0,88 [0,85-0,90]

Vt > 8ml/kg et
PEP < 5 cmH_2O



Vt < 8ml/kg ou
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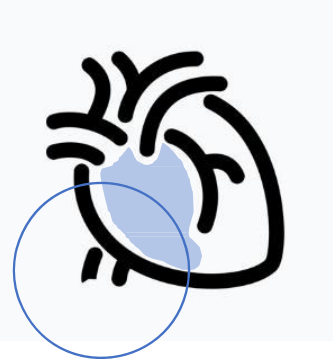
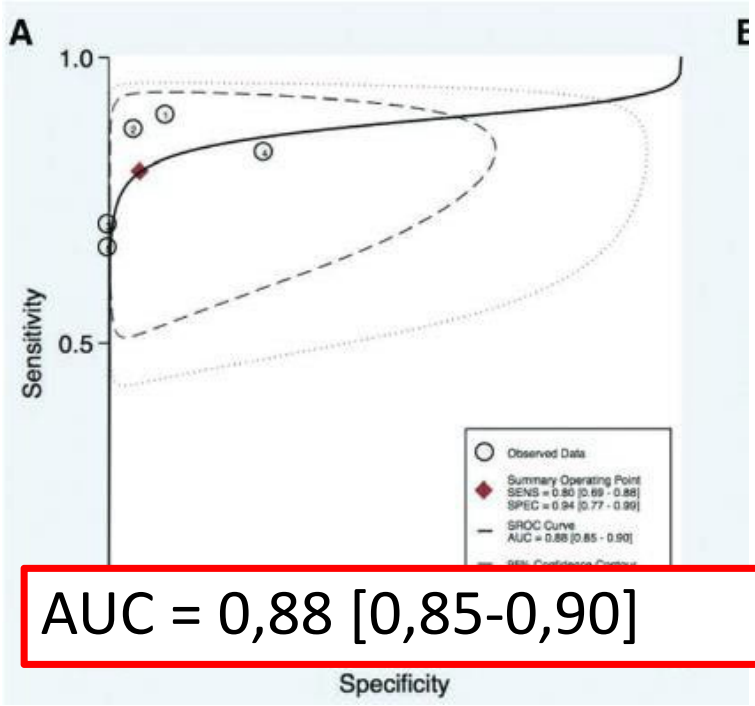
Si et al. Anesth Analg 2018



Veine cave inférieure



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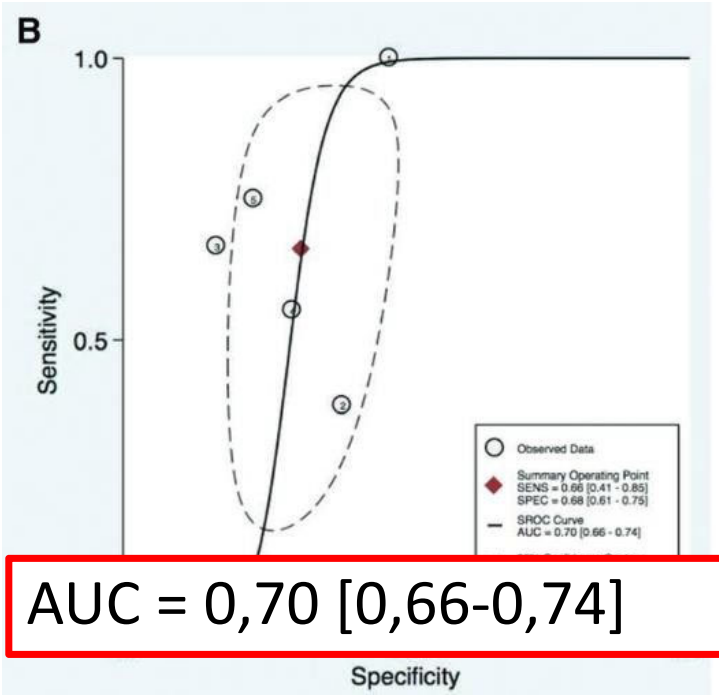
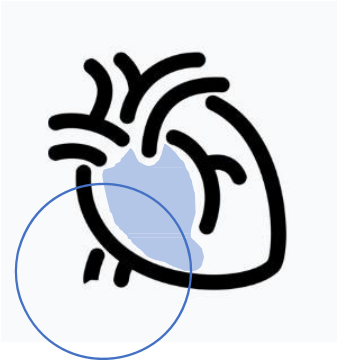


AUC = 0,70 [0,66-0,74]

Vt < 8ml/kg ou
PEP > 5 cmH_2O

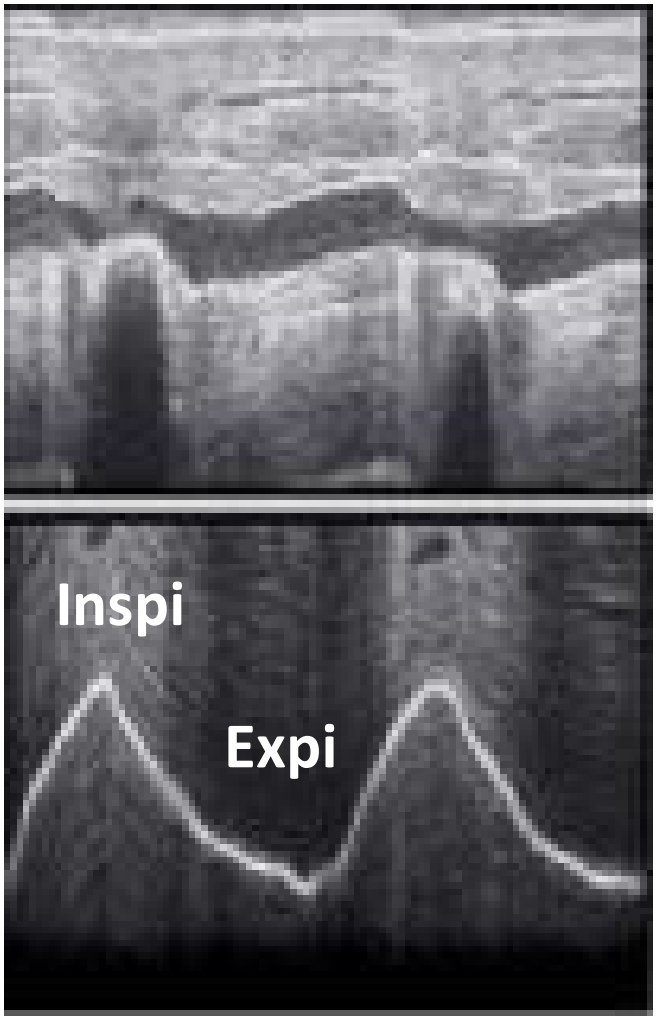
Si et al. Anesth Analg 2018



Veine cave inférieure

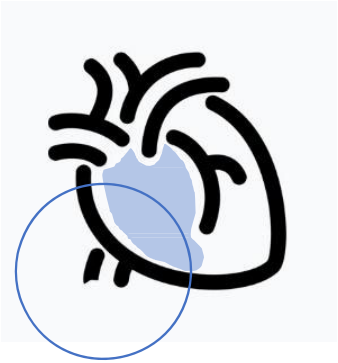
VCI

Diaphragme



<u>Ventilation spontanée</u> :

- Pression négative intra-thoracique à l'inspiration
- <u>Collapsus inspiratoire de la VCI</u>



Veine cave inférieure

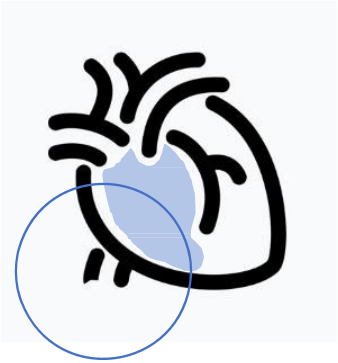
8 études, 497 patients, hétérogénéité +++

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.

LCM Cardozo Jnr et al. Med Int 2023



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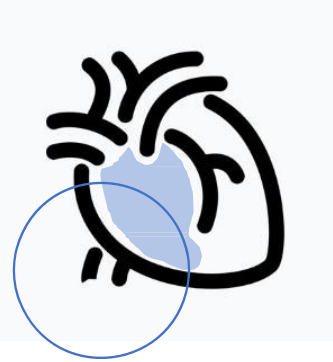
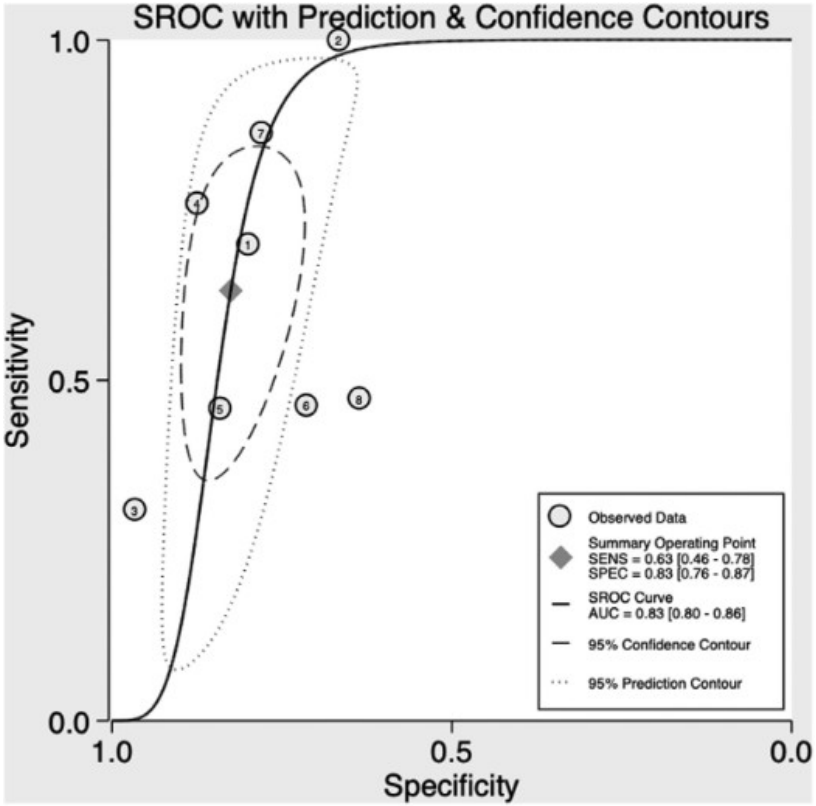
Legend – IVCc: inferior vena cava collapsibility; AUC: *area under curve*; 95% CI: 95% confidence interval; NA: not available.

40% : seuil conservateur

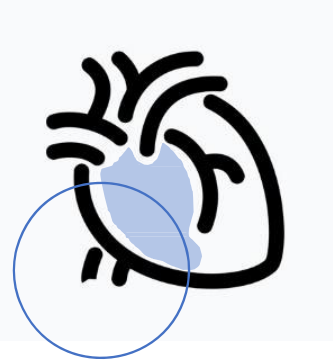
LCM Cardozo Jnr et al. Med Int 2023



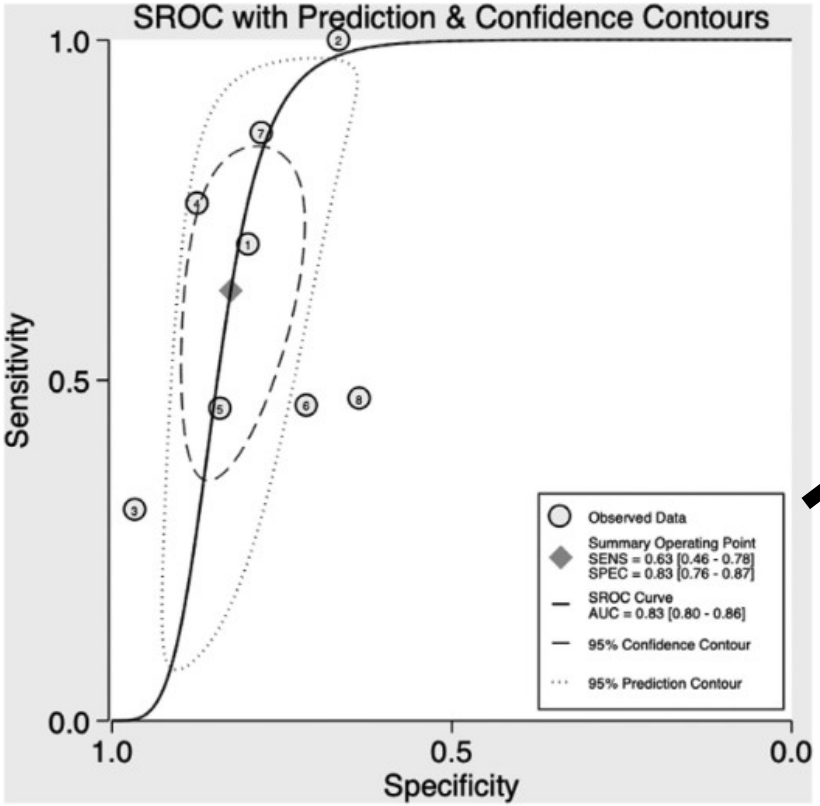
Veine cave inférieure

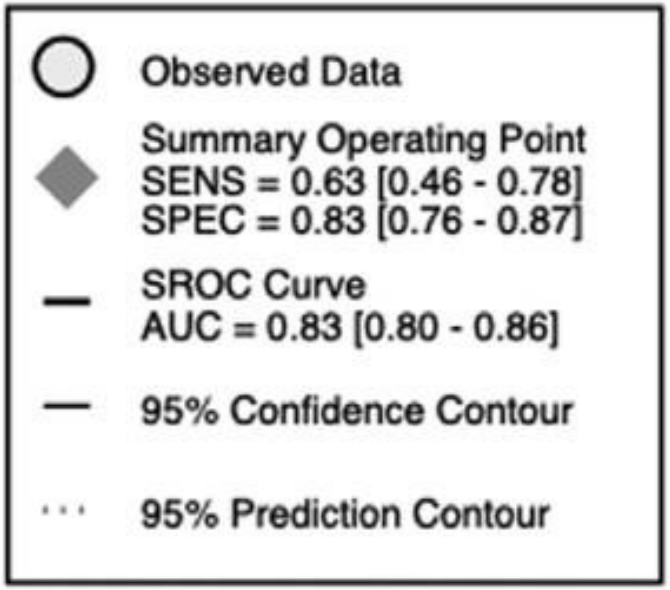


LCM Cardozo Jnr et al. Med Int 2023



Veine cave inférieure



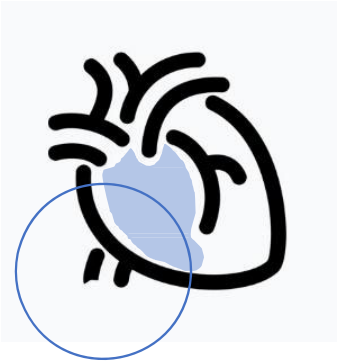


Proba post-test

si + : 80 %

si - : 30 %

LCM Cardozo Jnr et al. Med Int 2023

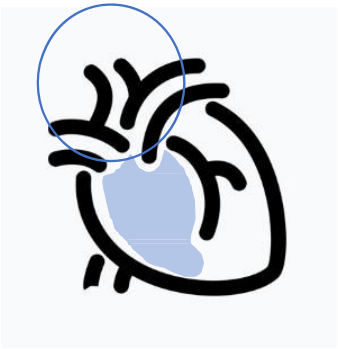


Veine cave inférieure

En conclusion :

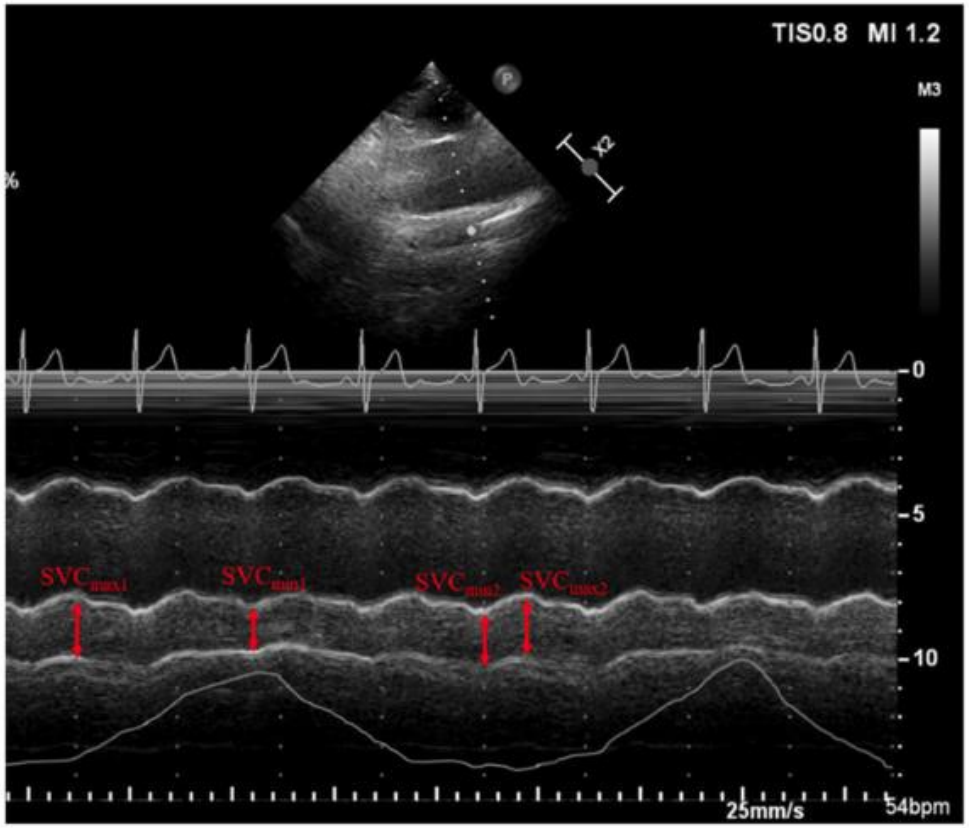
- Sous ventilation mécanique :
  - Dist VCI > 12 % (max-min/(max+min/2)) = hypovolémie
  - Dist VCI < 12 % = pas d'hypovolémie

- En ventilation spontanée :
  - Coll VCI > 40 % (max-min/max)= hypovolémie
  - Coll VCI < 40 % = on ne sait pas

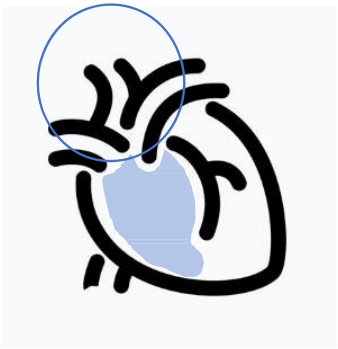


Veine cave supérieure

VCI intra-thoracique , si collapsibilité = retour veineux insuffisant



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

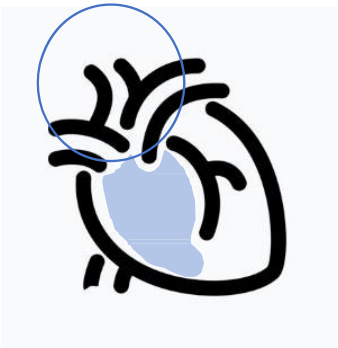


Veine cave supérieure

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

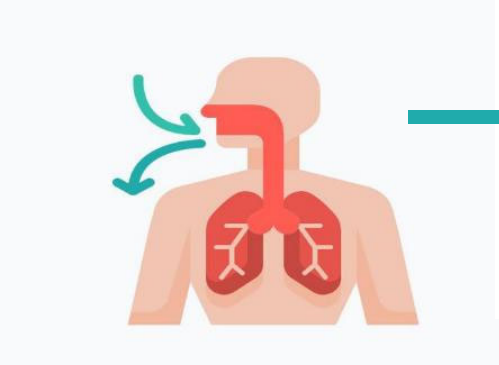
SVCCi > 19 %
Se : 93,3 % / Sp = 75 %
AUC = 0,885

Ma et al. BMC anesthesio 2022

Effet de la ventilation mécanique

<u>Cœur gauche :</u>

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

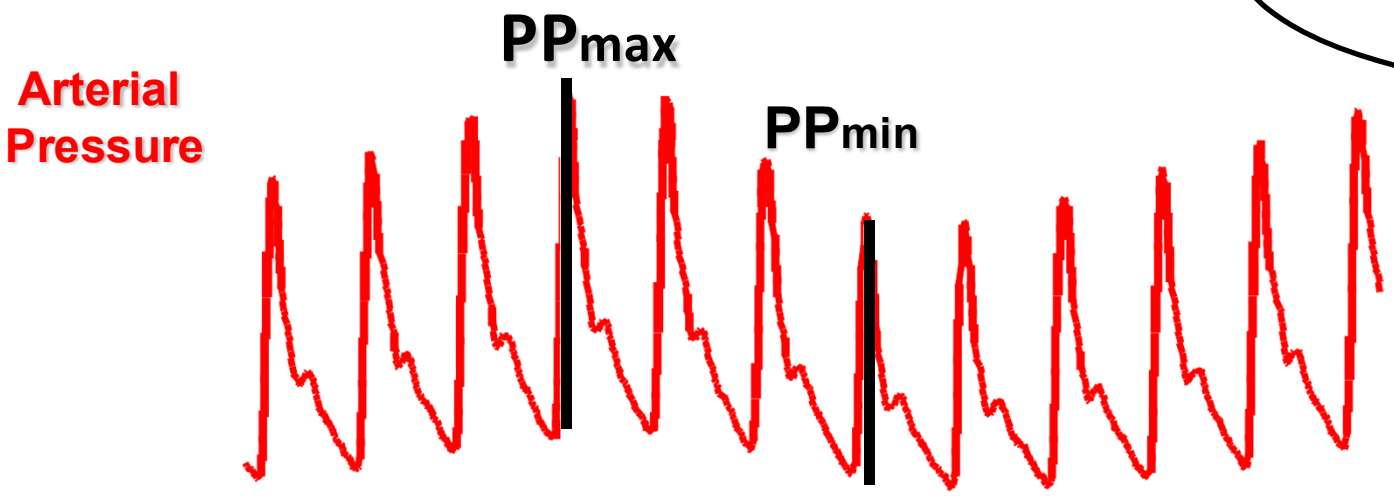
FRÉDÉRIC MICHARD, SANDRINE BOUSSAT, DENIS CHEMLA, NADIA ANGUEL, ALAIN MERCAT, YVES LECARPENTIER, CHRISTIAN RICHARD, MICHAEL R. PINSKY, and JEAN-LOUIS TEBOUL

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

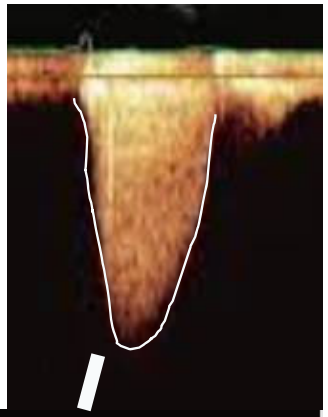
PP = VES / compliance

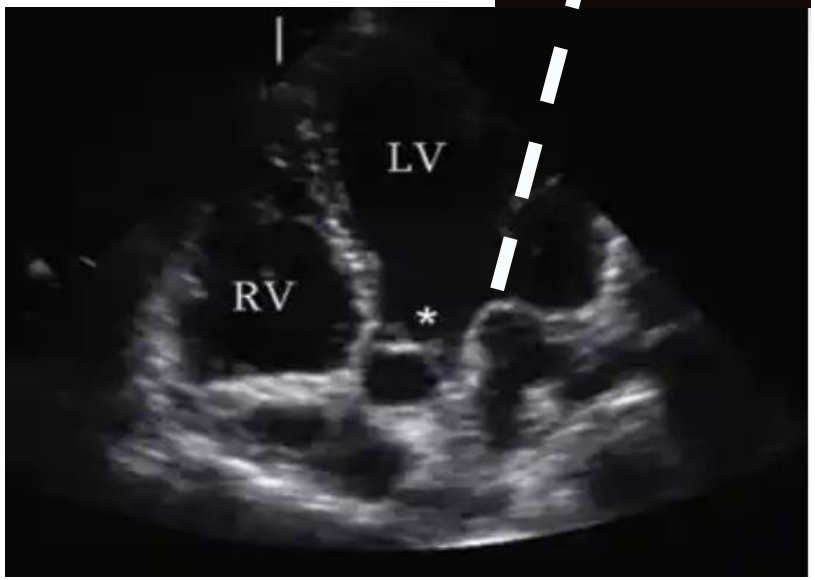
ΔVES = valeur physiologique à approcher

$$\Delta PP = \frac{PPmax - PPmin}{(PPmax + PPmin)/2}$$

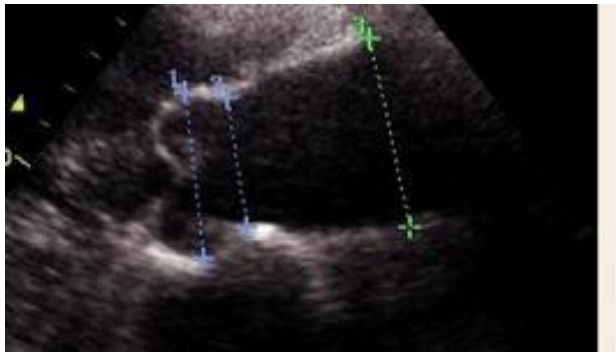


Variations respiratoires du VES

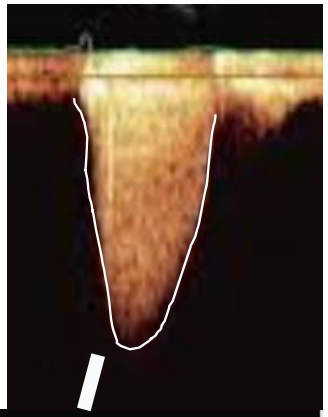


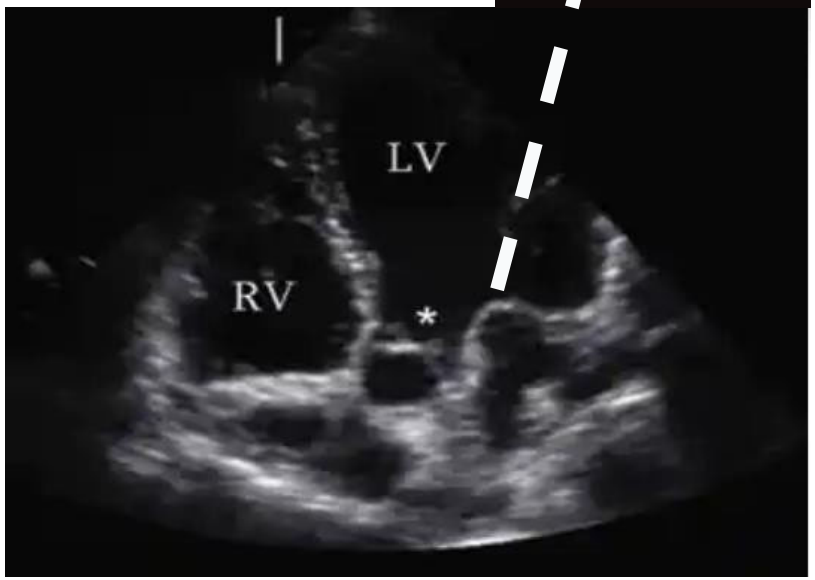


VES =
ITV x SAo



Variations respiratoires du VES





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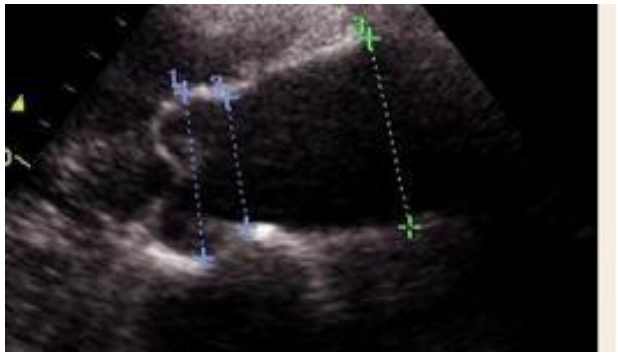
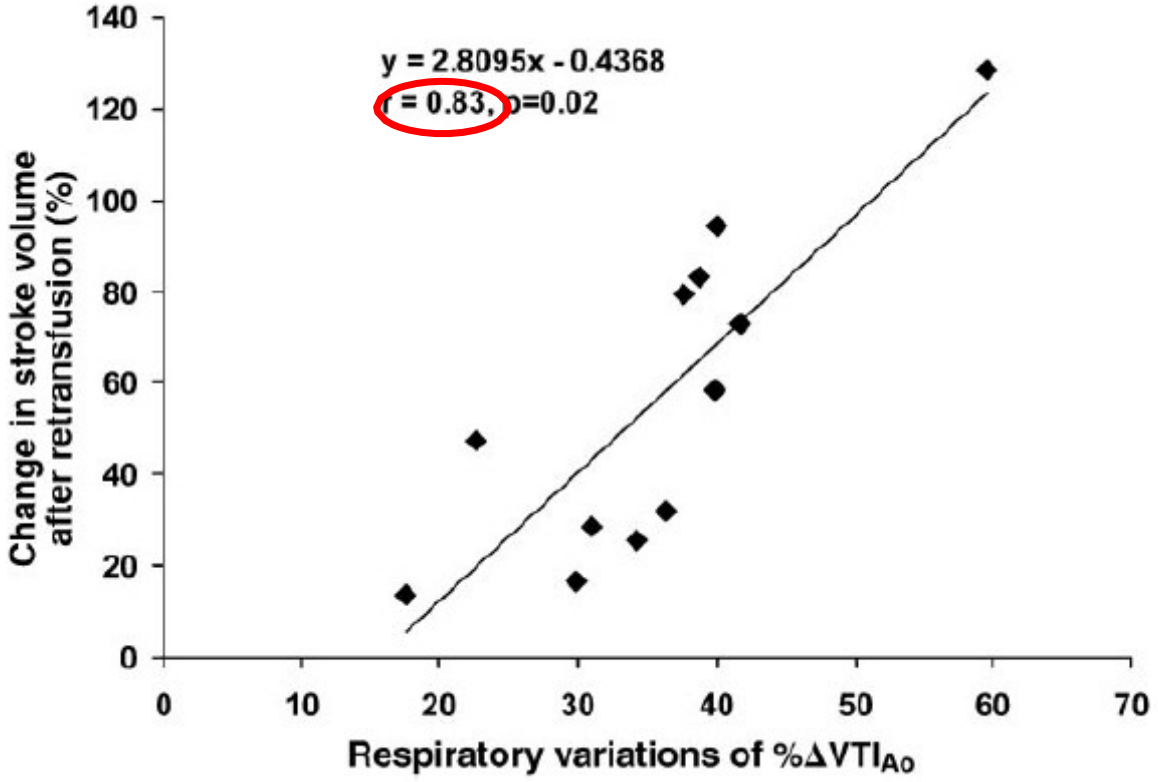


Surface aortique stable au cours du cycle respiratoire

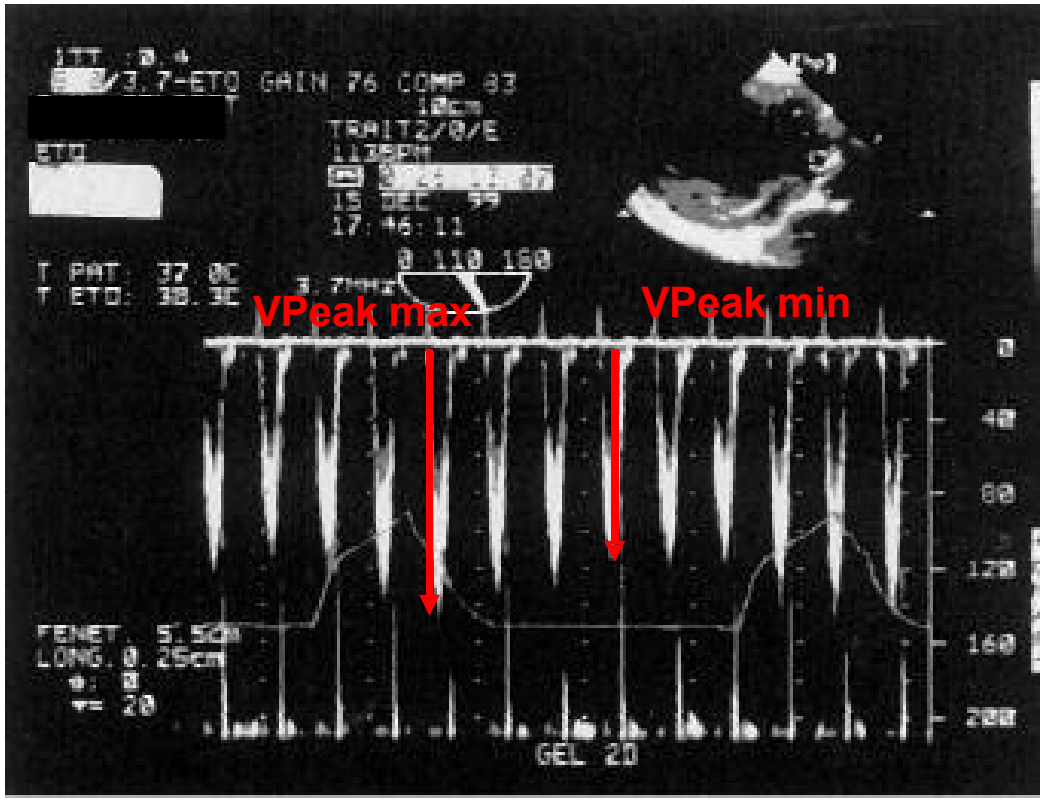
Donc : ΔVES = ΔITV

Variations respiratoires du VES



Slama et al. AJP 2002

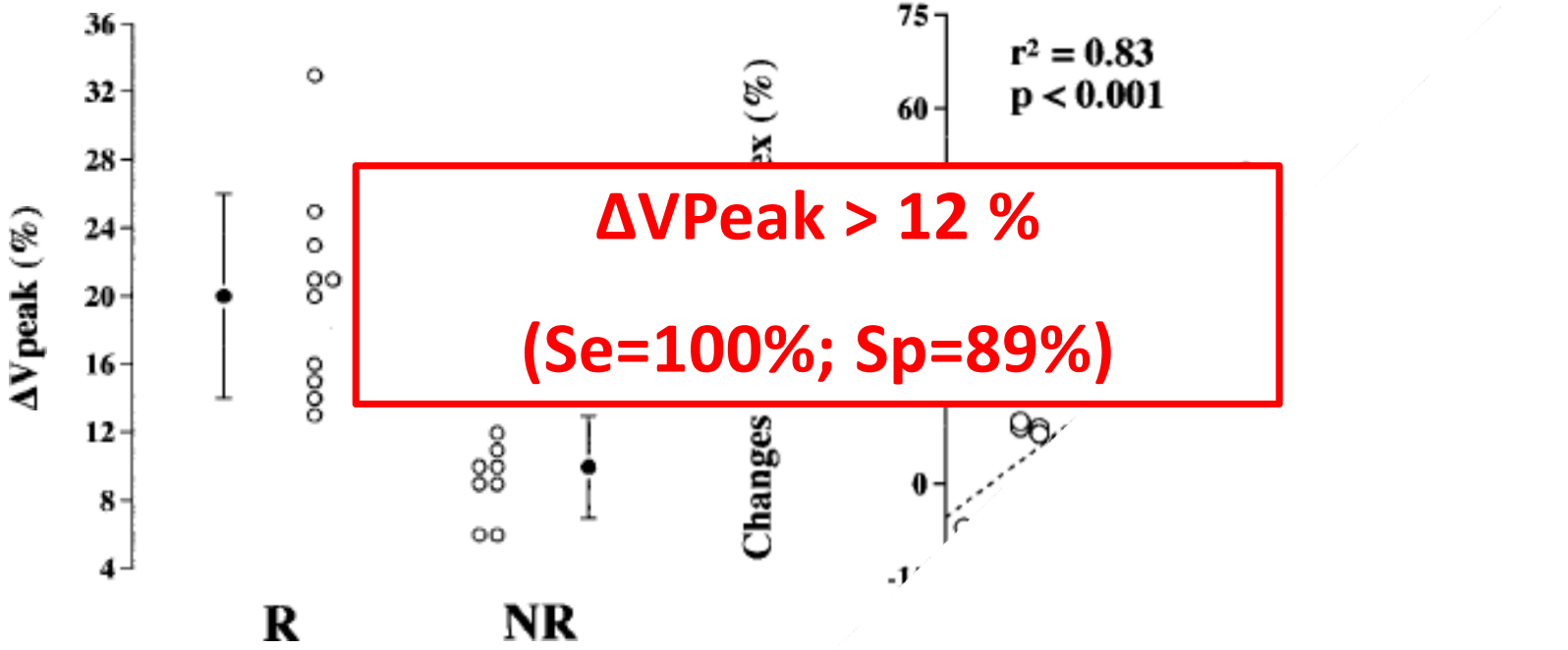
Variations respiratoires du VES



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

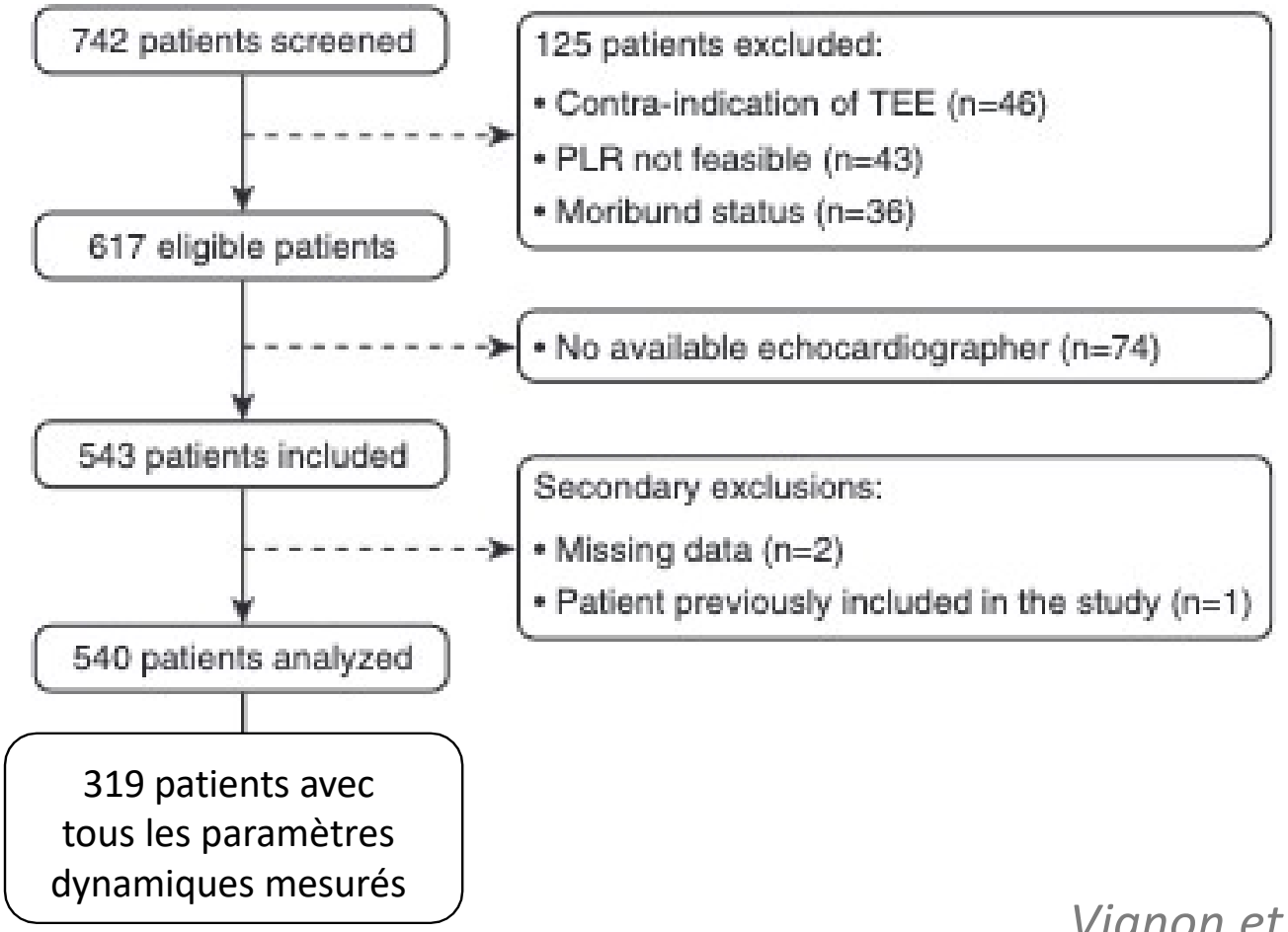
Feissel et al. Chest 2001

Variations respiratoires du VES



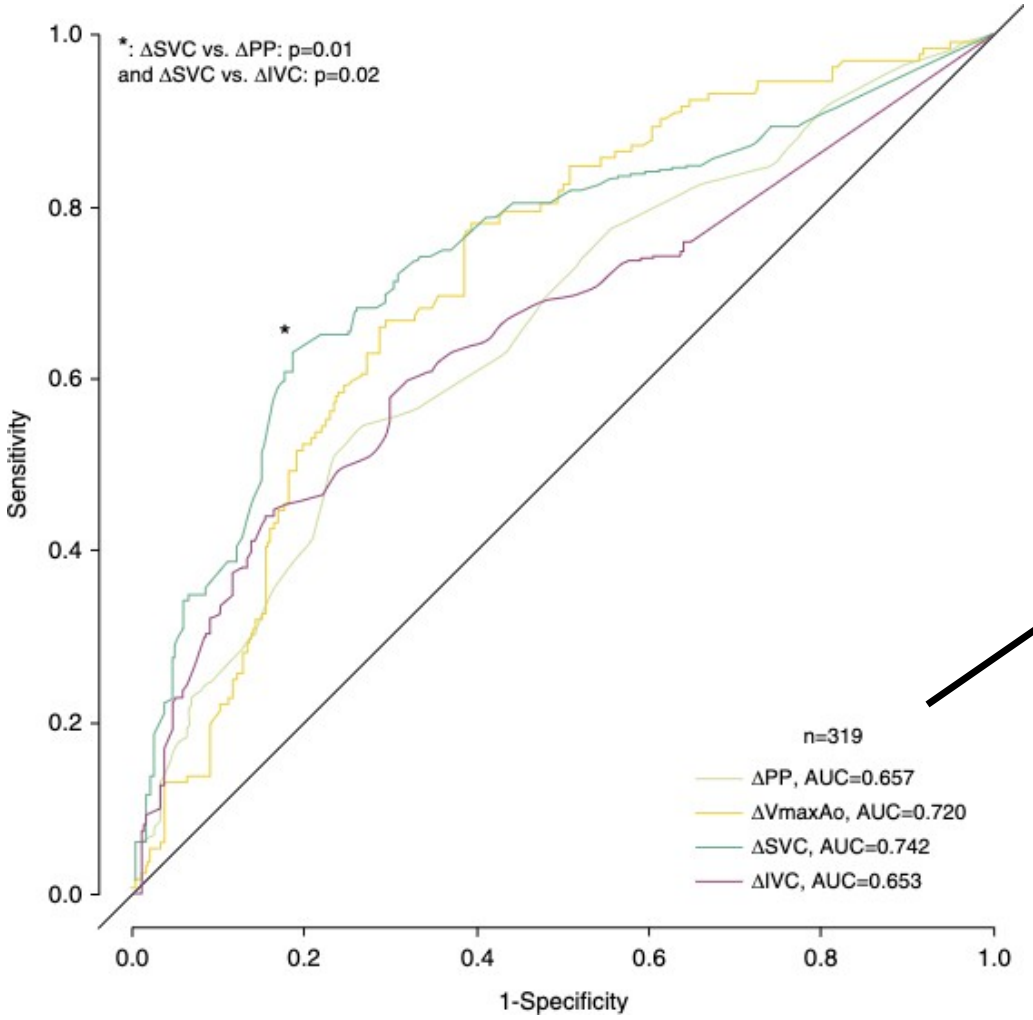
Feissel et al. Chest 2001

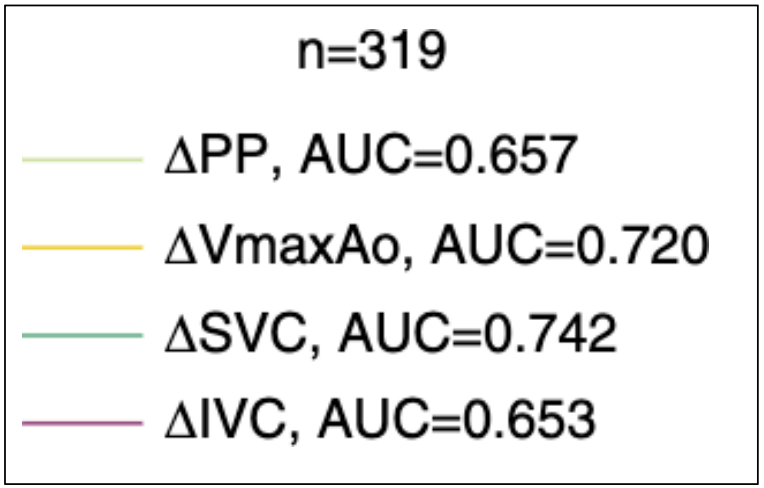
Variations respiratoires du VES



Vignon et al. AJRCCM 2016

Variations respiratoires du VES





Toutes AUC < 0,75

Vignon et al. AJRCCM 2016

Les indices dynamiques

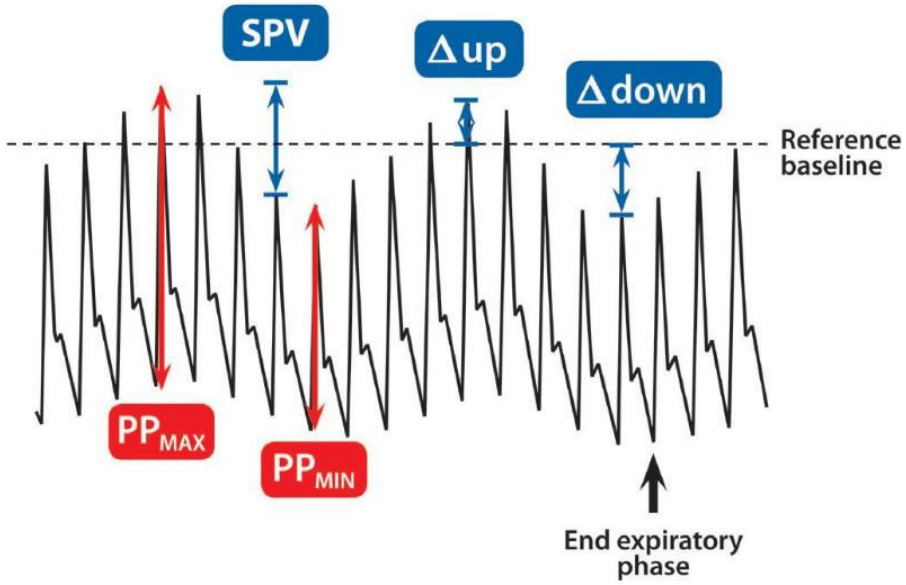
Ca fonctionne bien !

Les indices dynamiques

Ca fonctionne bien !

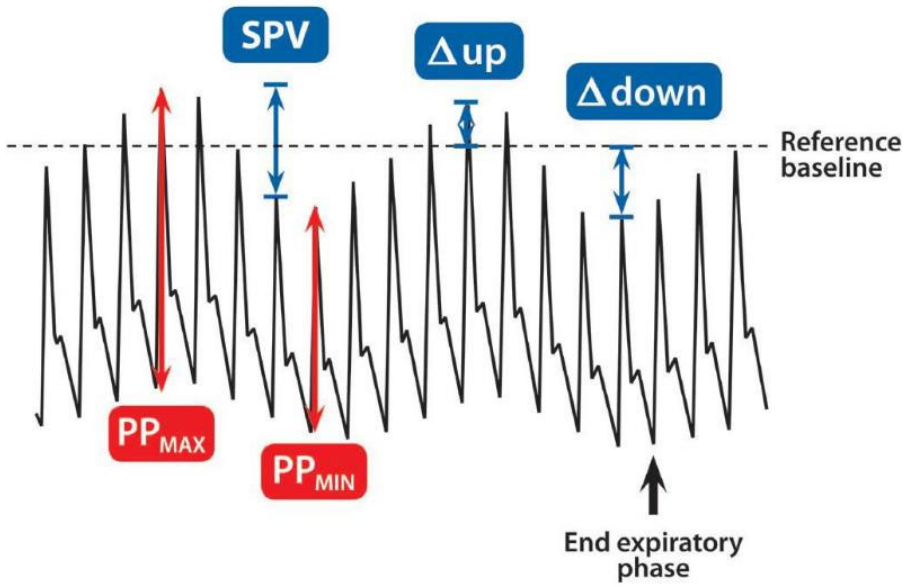
Mais pas souvent…

Les indices dynamiques : limites



Les indices dynamiques : limites

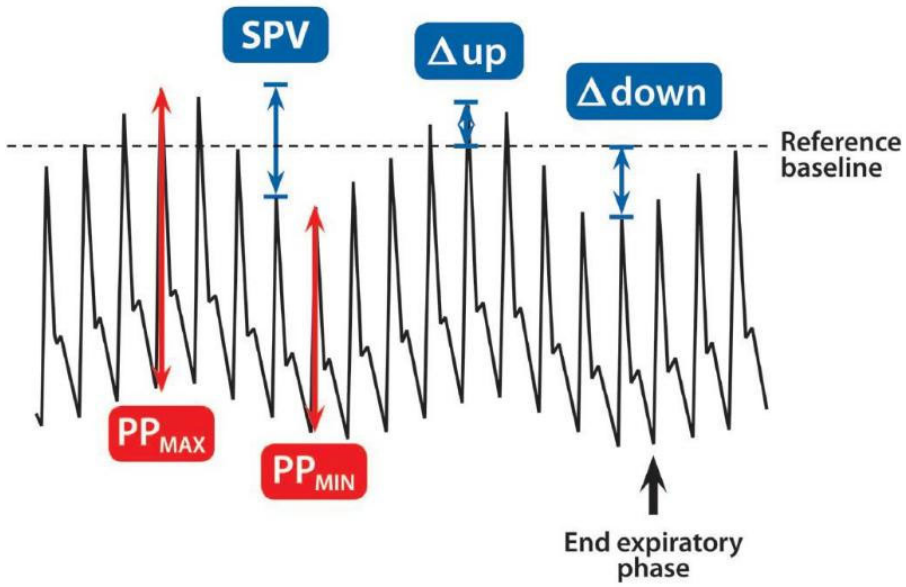
Arythmie



Les indices dynamiques : limites

Arythmie

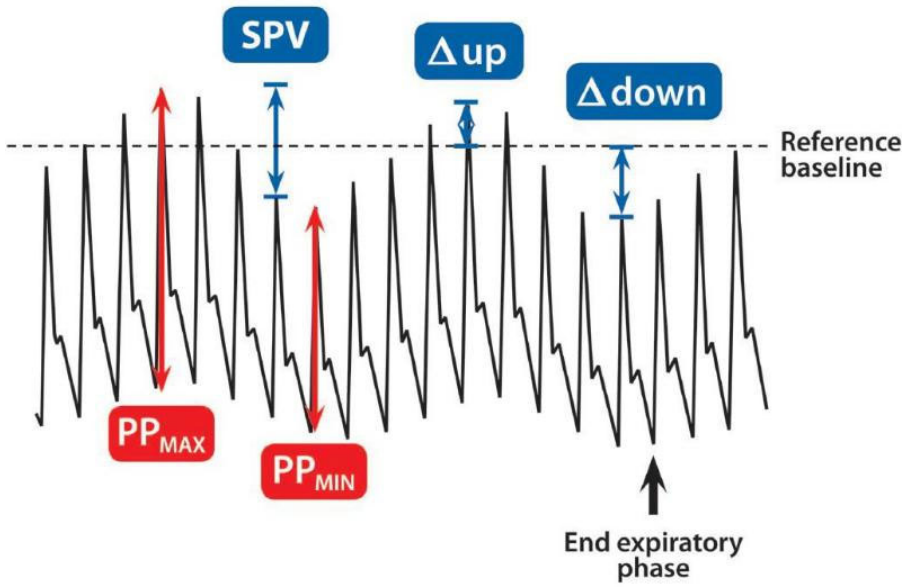
Respiration spontanée



Les indices dynamiques : limites

Arythmie

Respiration spontanée

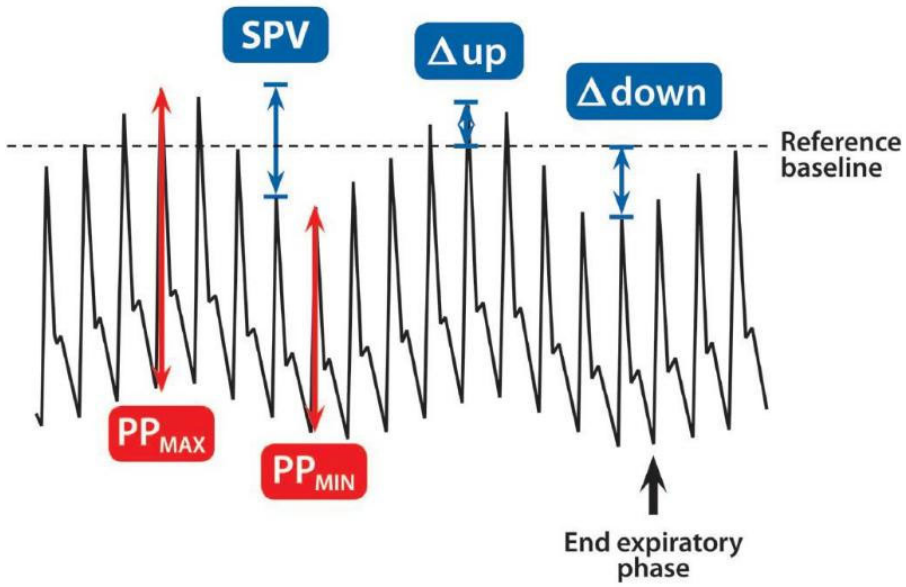


Transmission de pression faible : Faible Vt

Les indices dynamiques : limites

Arythmie

Respiration spontanée

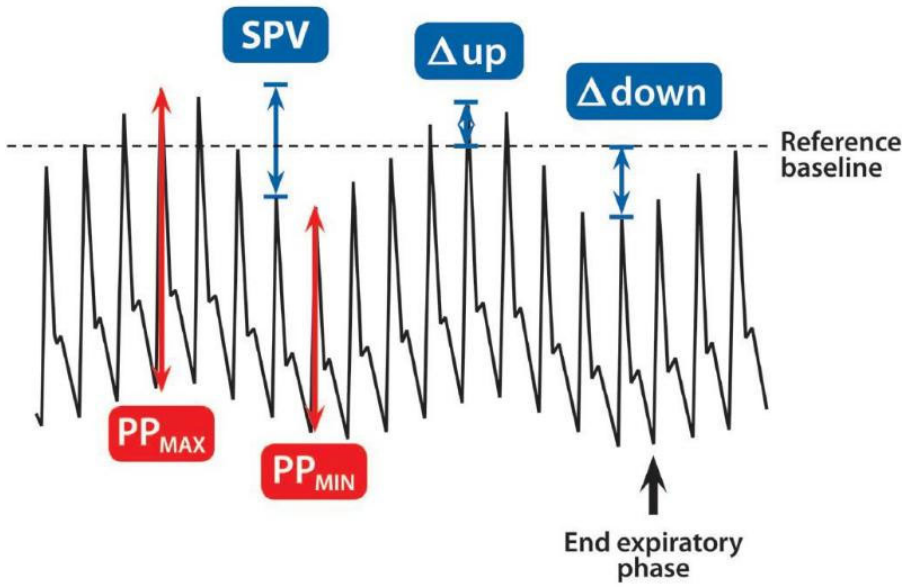


Transmission de pression faible :
Faible Vt

Les indices dynamiques : limites

Arythmie

Respiration spontanée



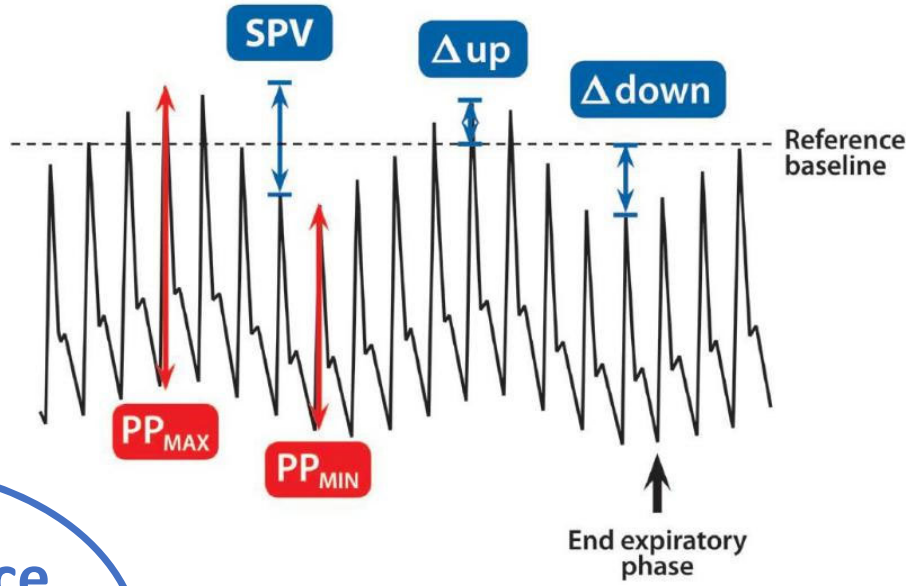
Transmission de pression faible : Faible Vt

Temps de transit pulmonaire trop court

Les indices dynamiques : limites

Arythmie

Respiration spontanée



Transmission de pression faible : Faible Vt

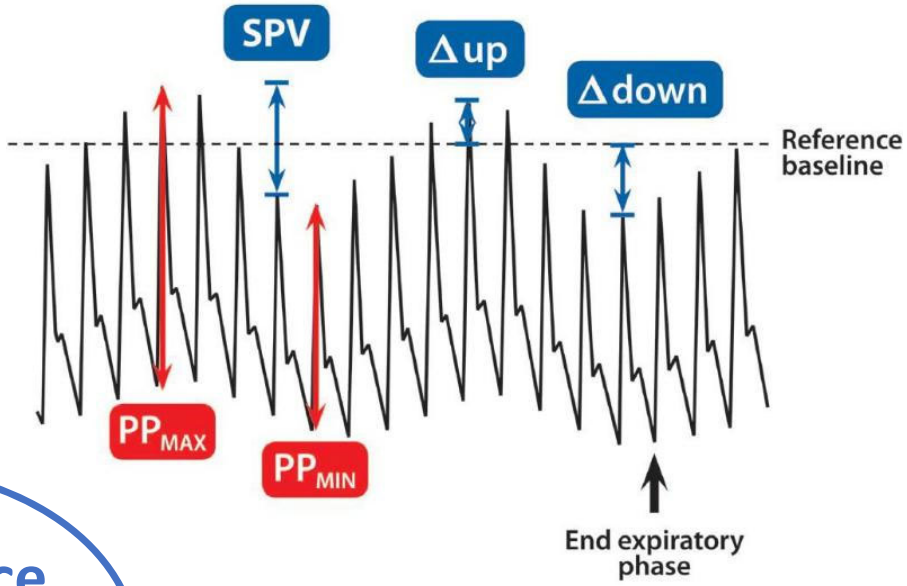
Insuffisance cardiaque droite

Temps de transit pulmonaire trop court

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

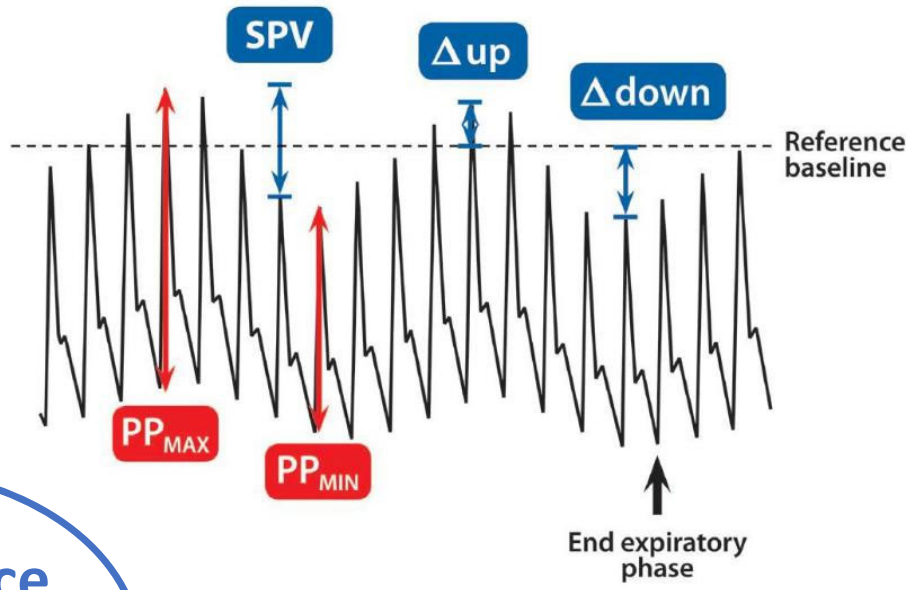
Les indices dynamiques : limites

Arythmie

Décubitus ventral

Hypertension intra-abdo

Insuffisance cardiaque droite



Respiration spontanée

Transmission de pression faible : Faible Vt

Temps de transit pulmonaire trop court

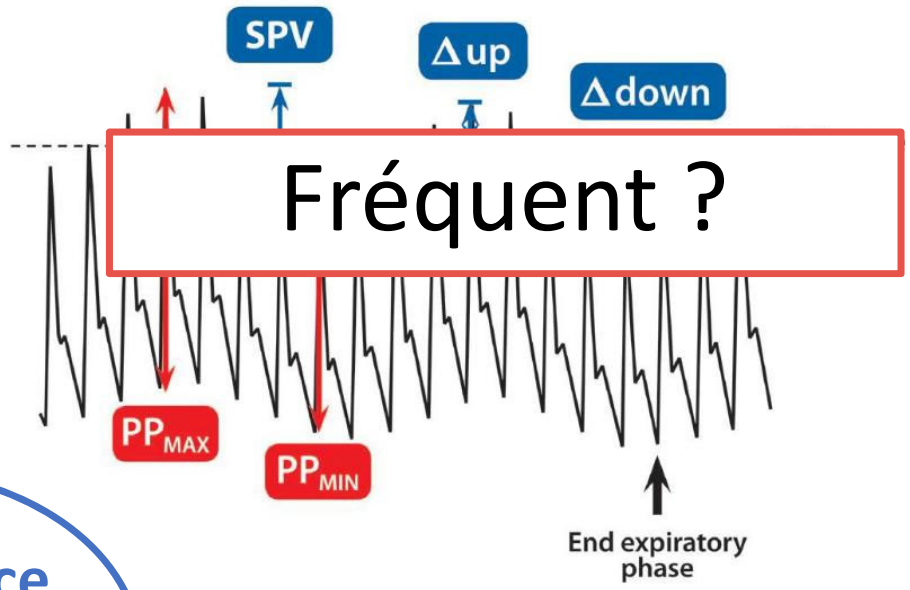
Les indices dynamiques : limites

Arythmie

Décubitus ventral

Hypertension intra-abdo

Insuffisance cardiaque droite

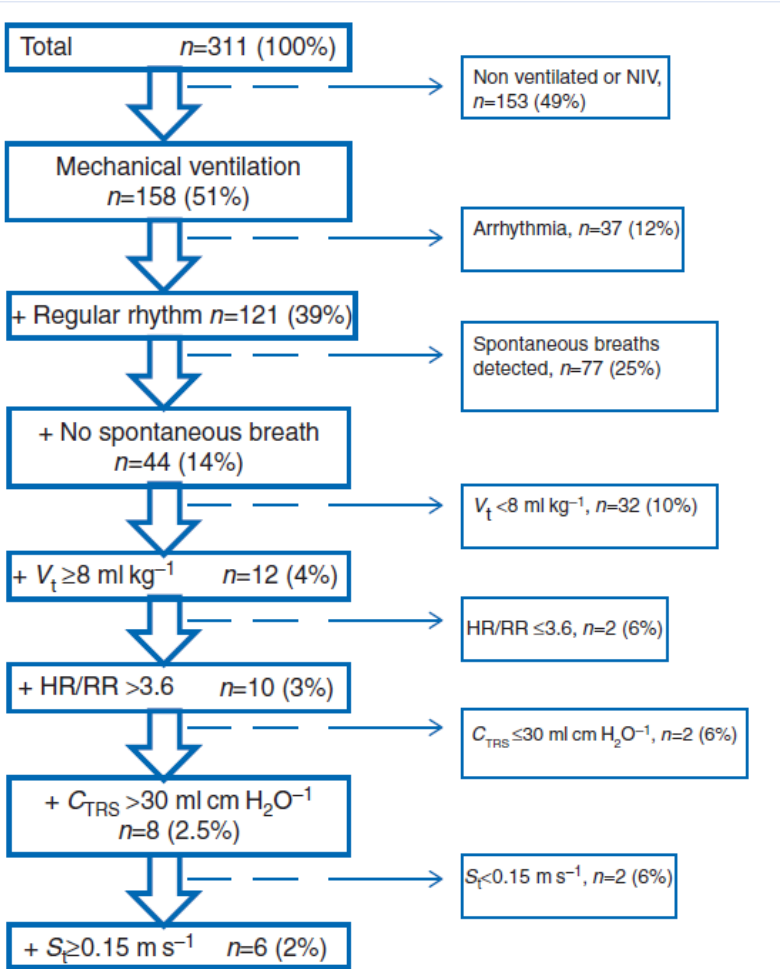


Respiration spontanée

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†

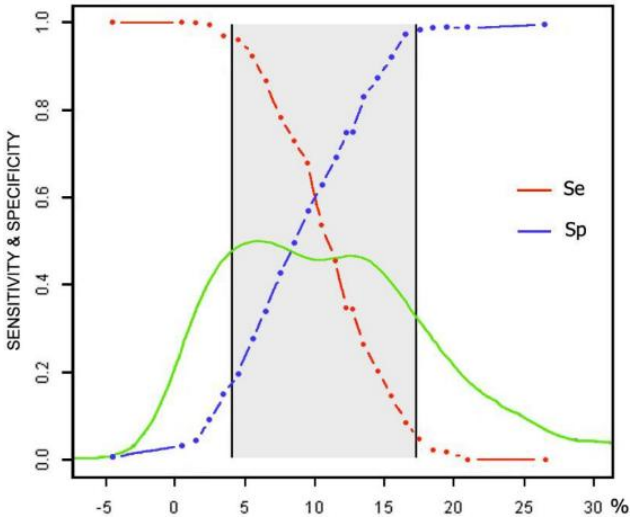
Total	n=311 (100%)

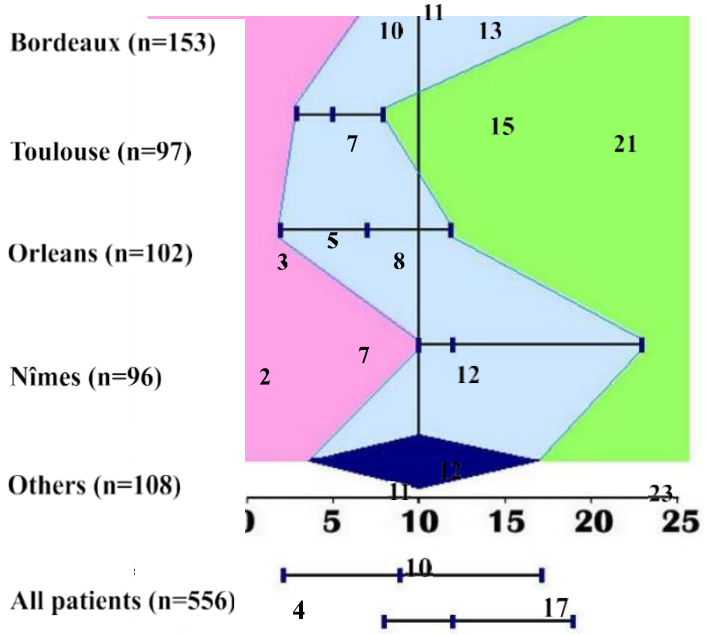
PPV utilisable chez 4% des patients ventilés

Mahjoub et al. BJA 2014

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





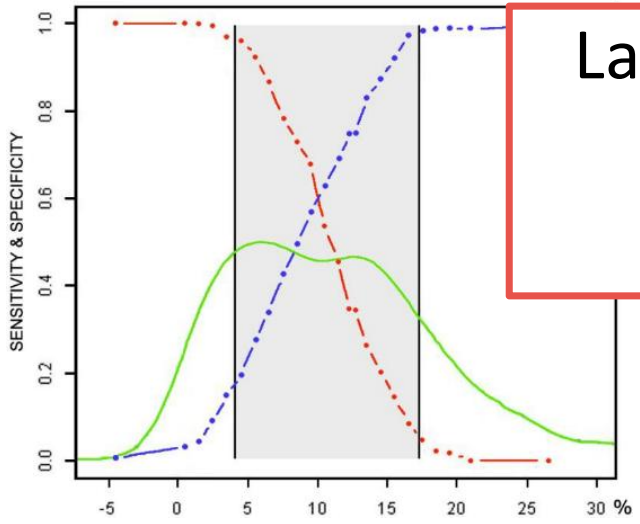
Analyse rétrospective

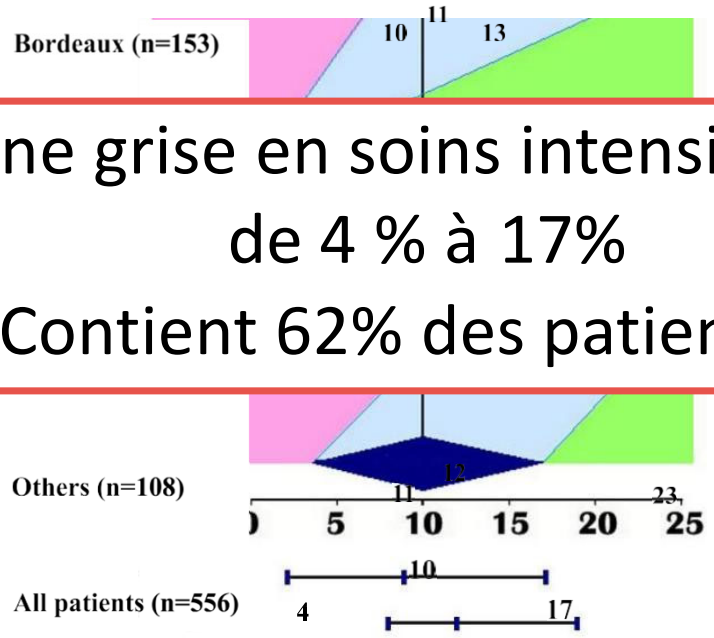
556 patients

Biais et al. Crit Care 2014

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





La zone grise en soins intensifs s'étend de 4 % à 17%

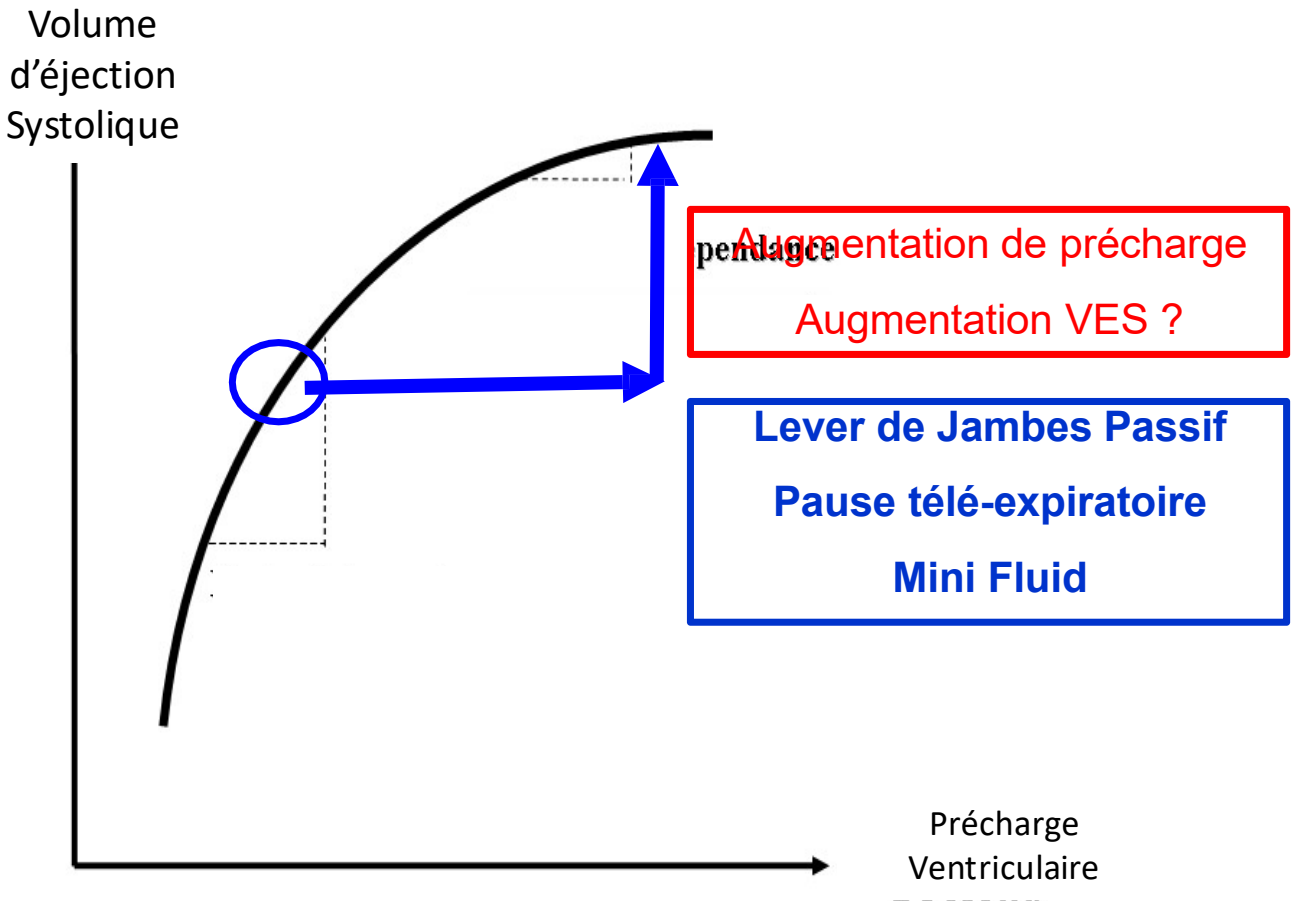
Contient 62% des patients !!

rospective

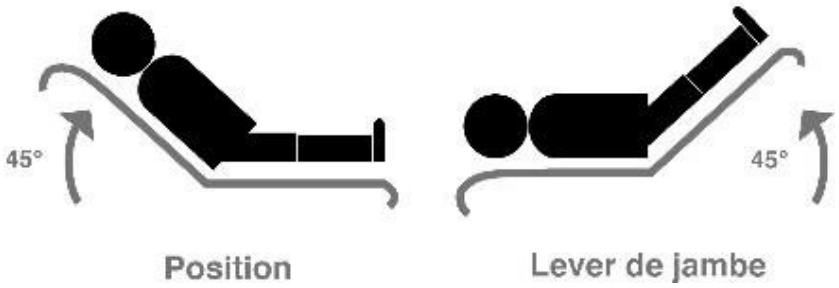
atients

Biais et al. Crit Care 2014

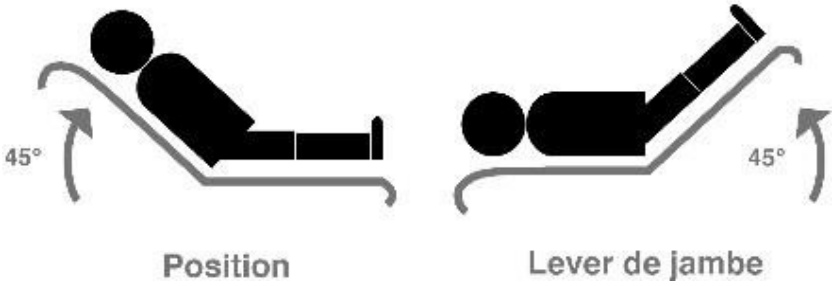
Indices Dynamiques

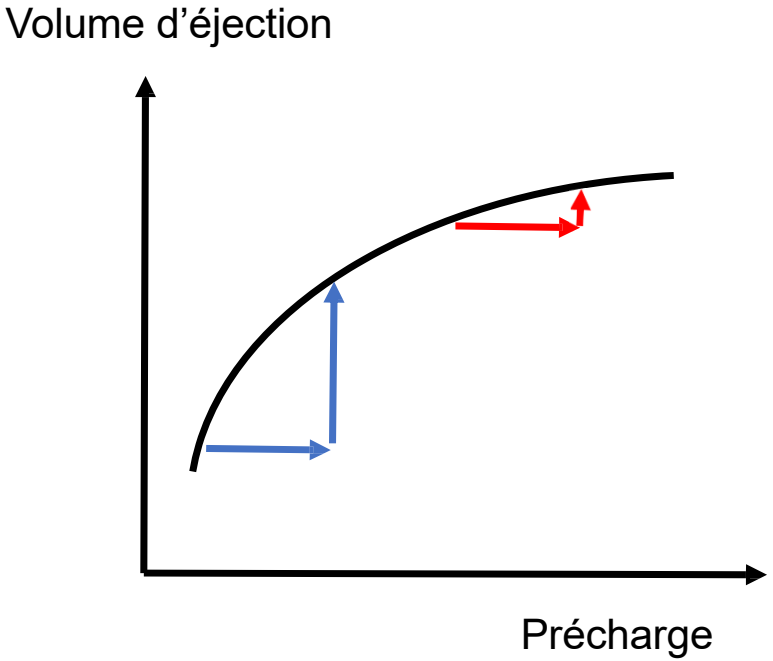


Lever de jambe passif



Lever de jambe passif





Mime un RV, réversible

Transfert de sang

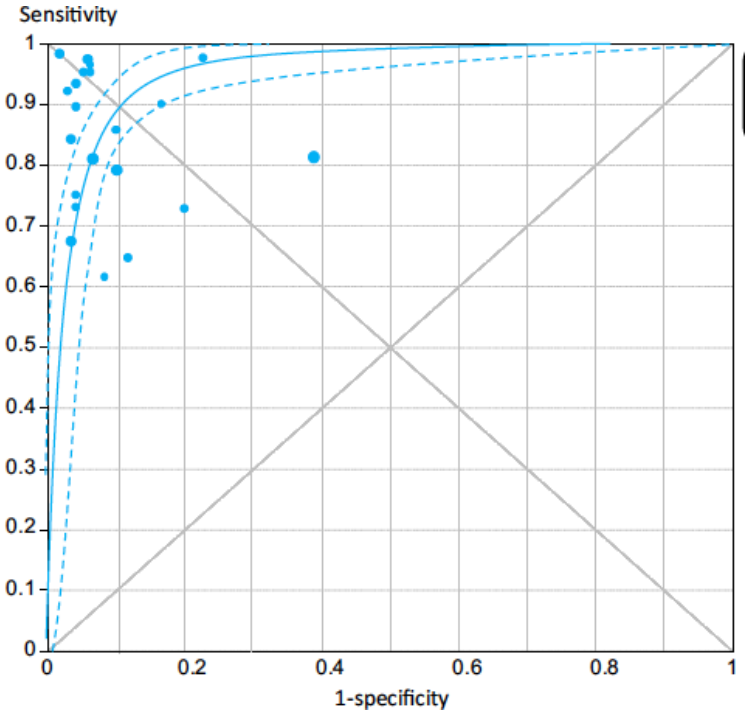
Augmentation de la précharge

↑ 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

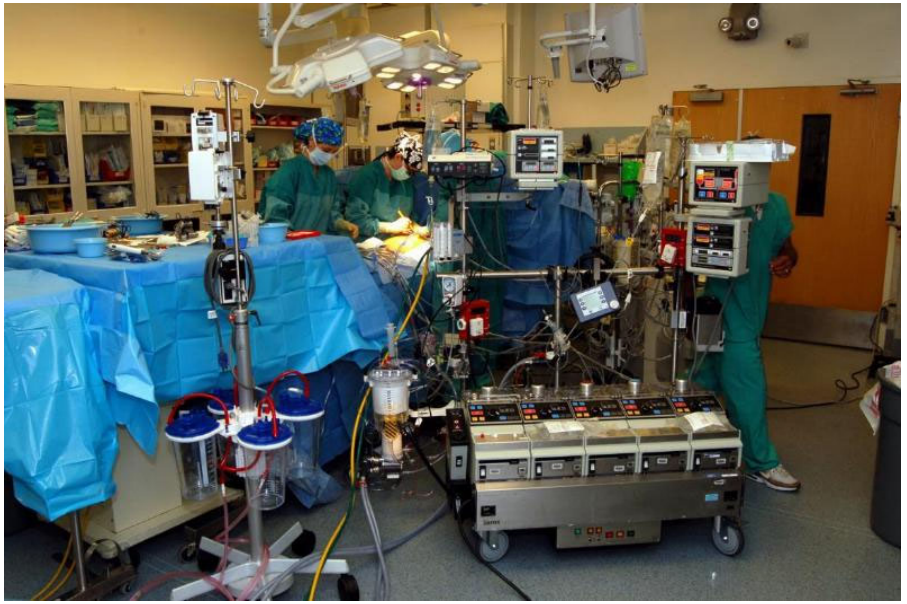
Faux NEGATIF

Vigilance si PIA ≥ 16 mmHg

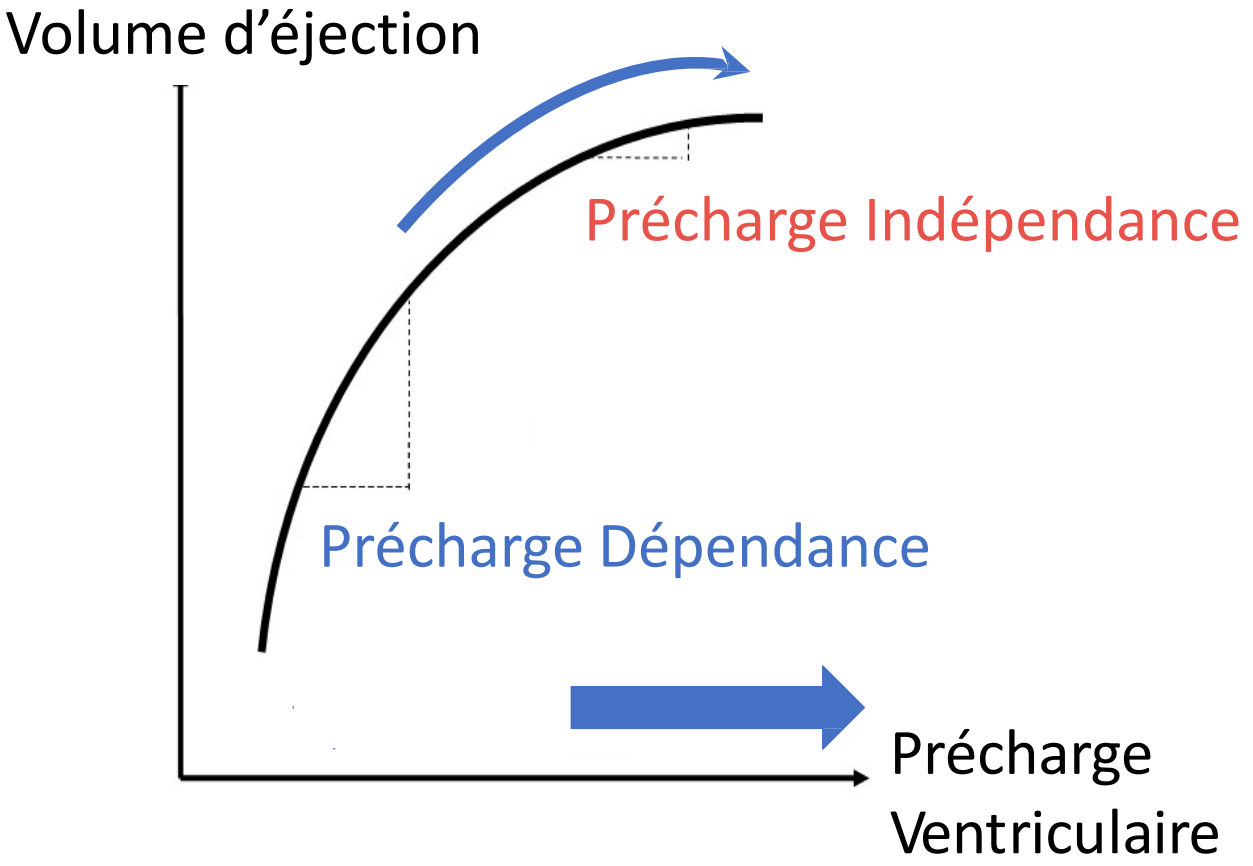
Mahjoub et al. CCM 2010

Lever de jambe passif

Pas toujours évident en pratique…



Alternatives aux indices dynamiques



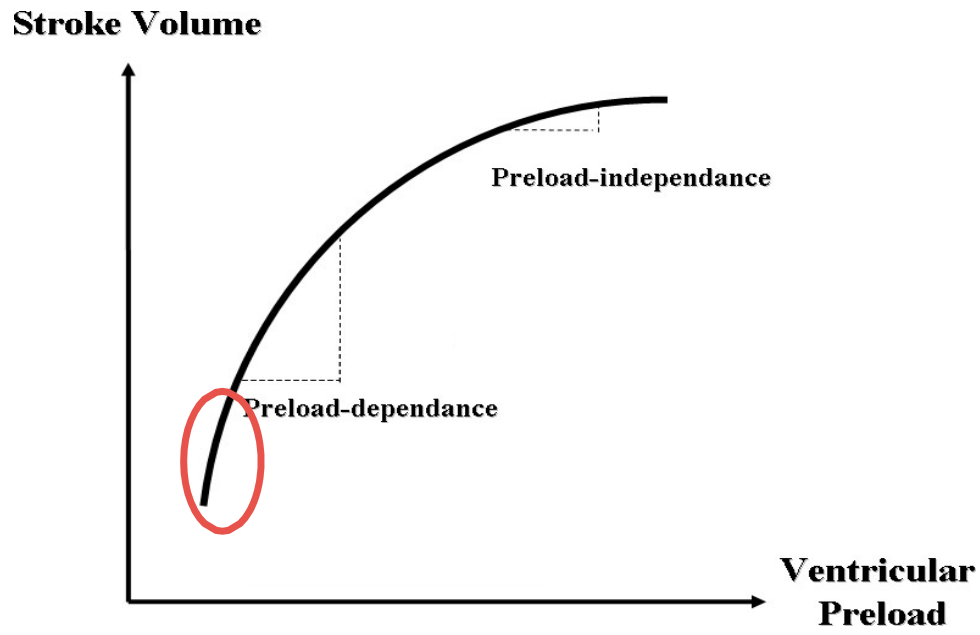
AUGMENTATION DE PRECHARGE

- 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
Colloid over 1 Minute Can Predict Fl

The Mini fl

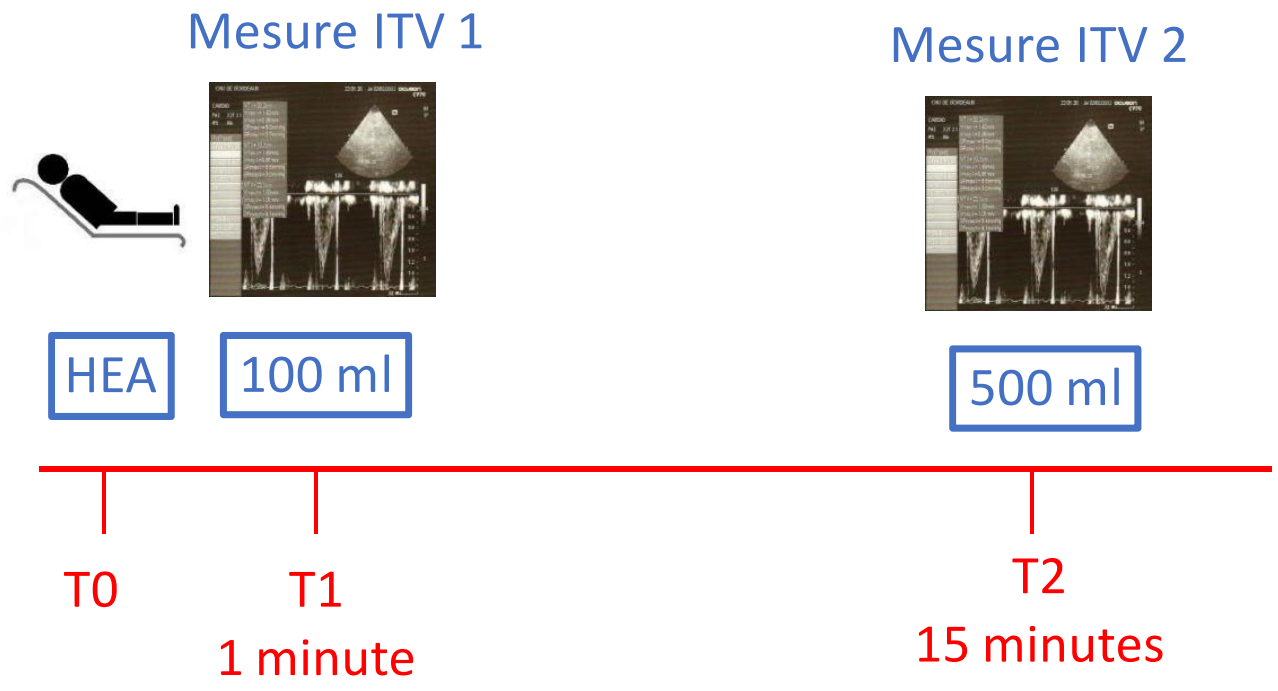
- Administration d'une faible quantité de fluide
- Monitorage de la réponse
-Prédiction de la réponse à l'administration d'une plus grande quantité de fluide

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

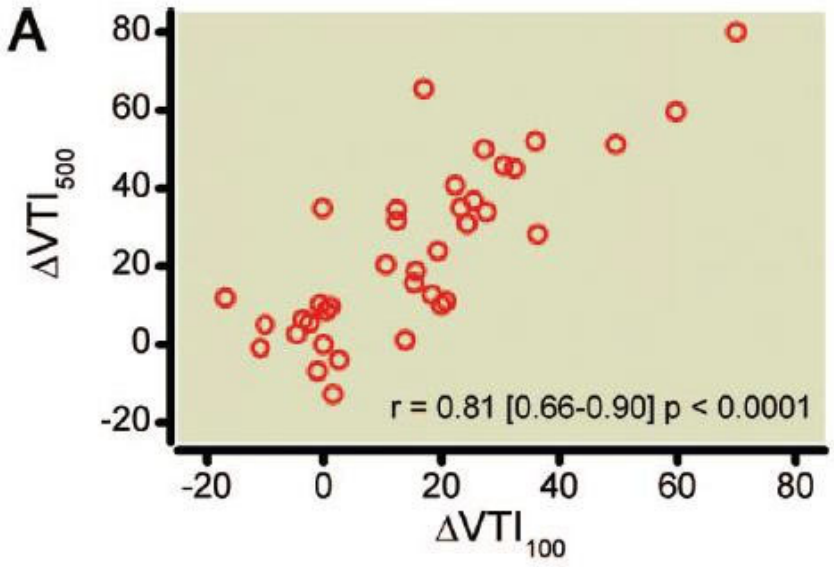
The Mini-fluid Challenge Study

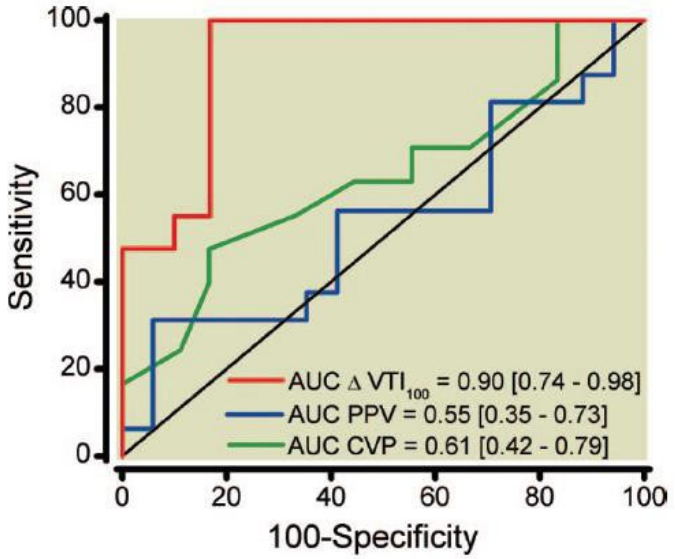


Muller et al. Anesthesiology 2011

Mini-fluid Challenge

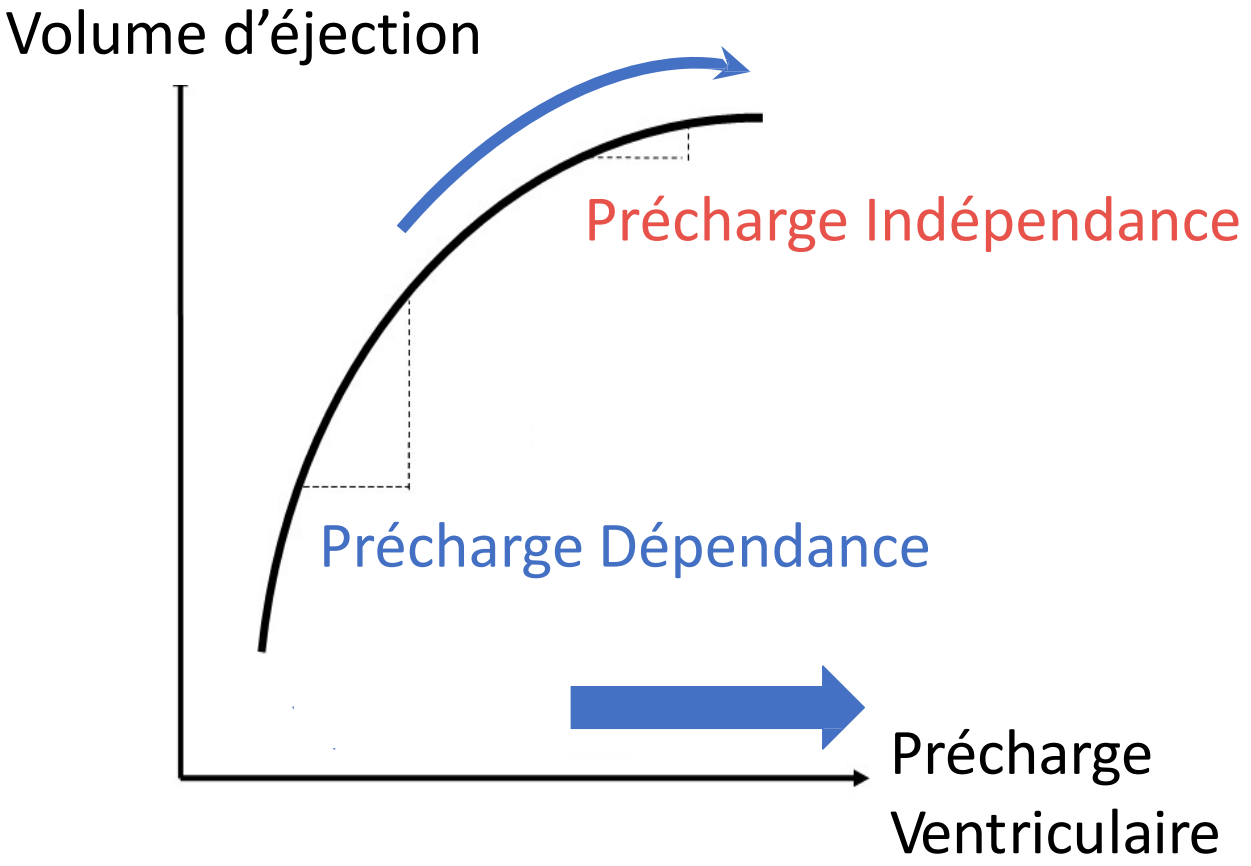
Une augmentation >10% de l'ITVAo après 100ml de colloide sur 1 minute prédit la réponse à un expansion volémique de 500 ml





Muller et al. Anesthesiology 2011

Alternatives aux indices dynamiques

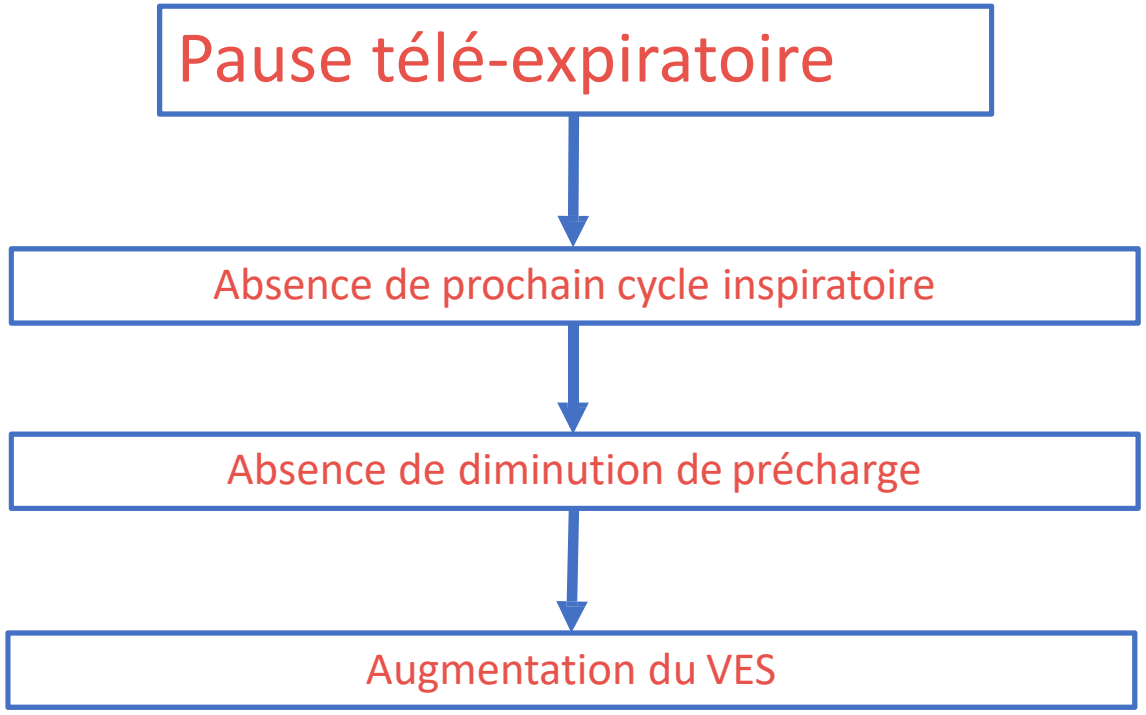


AUGMENTATION DE PRECHARGE

- Lever de jambe passif
- Minifluid Challenge
- Occlusion expiratoire

Occlusion télé-expiratoire

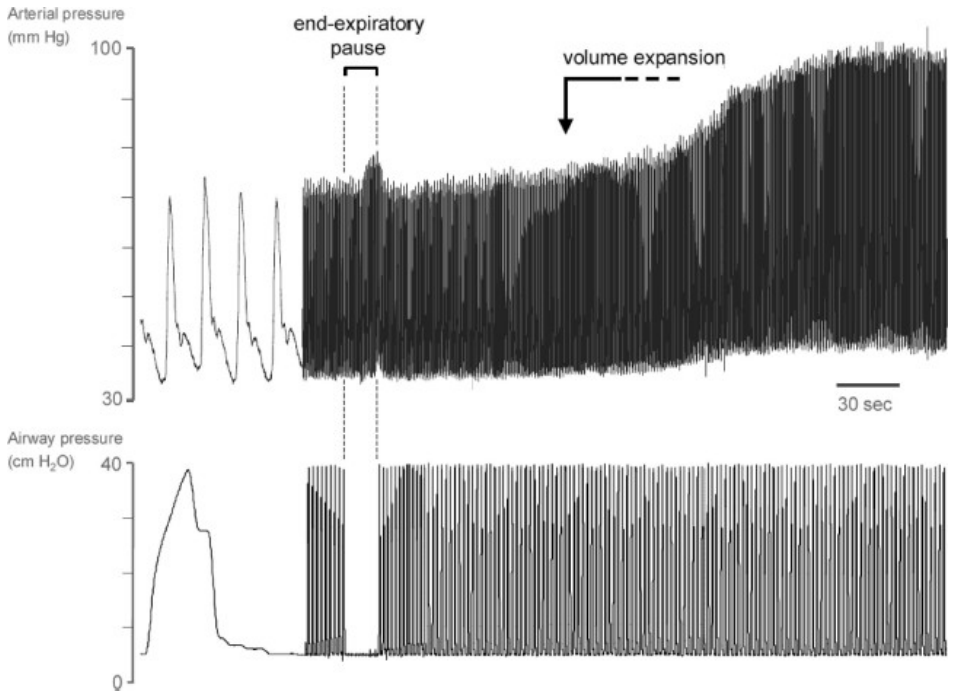
Predicting volume responsiveness by using the end-expiratory occlusion in mechanically ventilated intensive care unit patients



Monnet et al. CCM 2009

Occlusion télé-expiratoire

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



Augmentation

≥ 5% IC

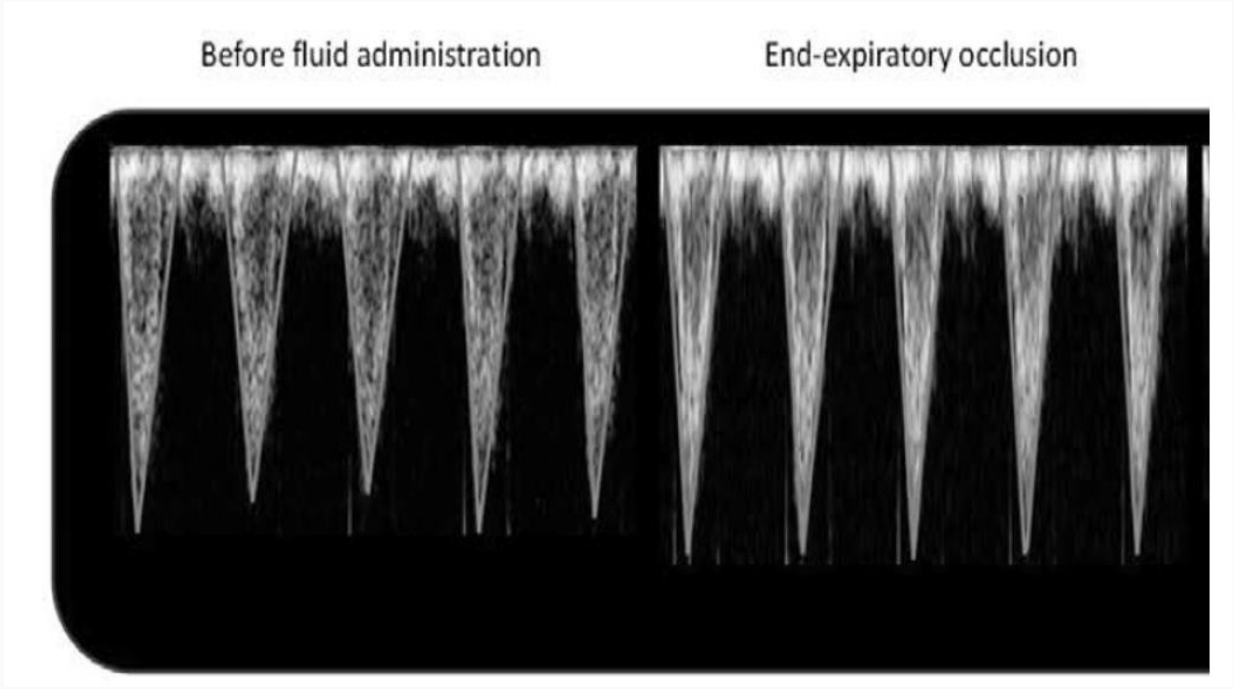
Prédit la réponse au RV

Monnet et al. CCM 2009

Occlusion télé-expiratoire

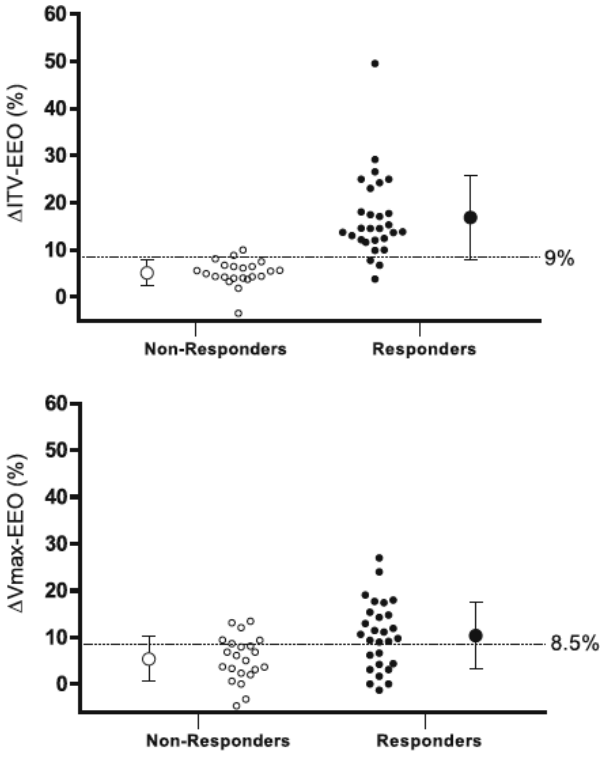
End-expiratory occlusion maneuver to predict fluid responsiveness in the intensive care unit: an echocardiographic study

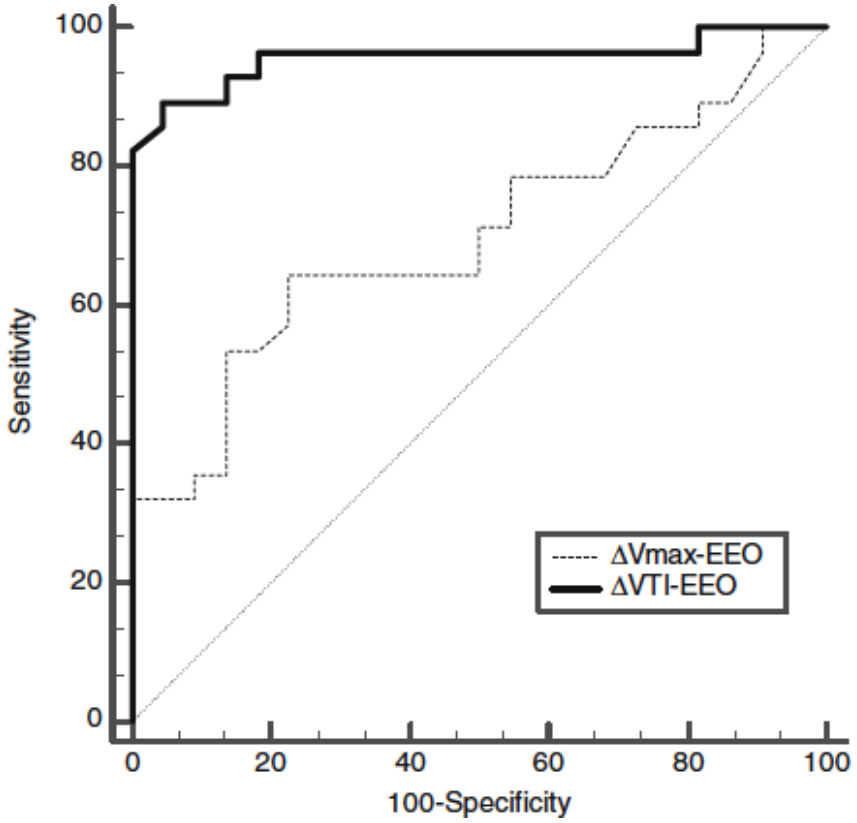
Critical Care (2018) 22:32



Georges et al. Crit Care 2018

Occlusion télé-expiratoire





Augmentation >9% ITV

AUC = 0,96 ± 0,03

Georges et al. Crit Care 2018

Quid de la vasoplégie

Vasopresseurs sans monitorage ?

« 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

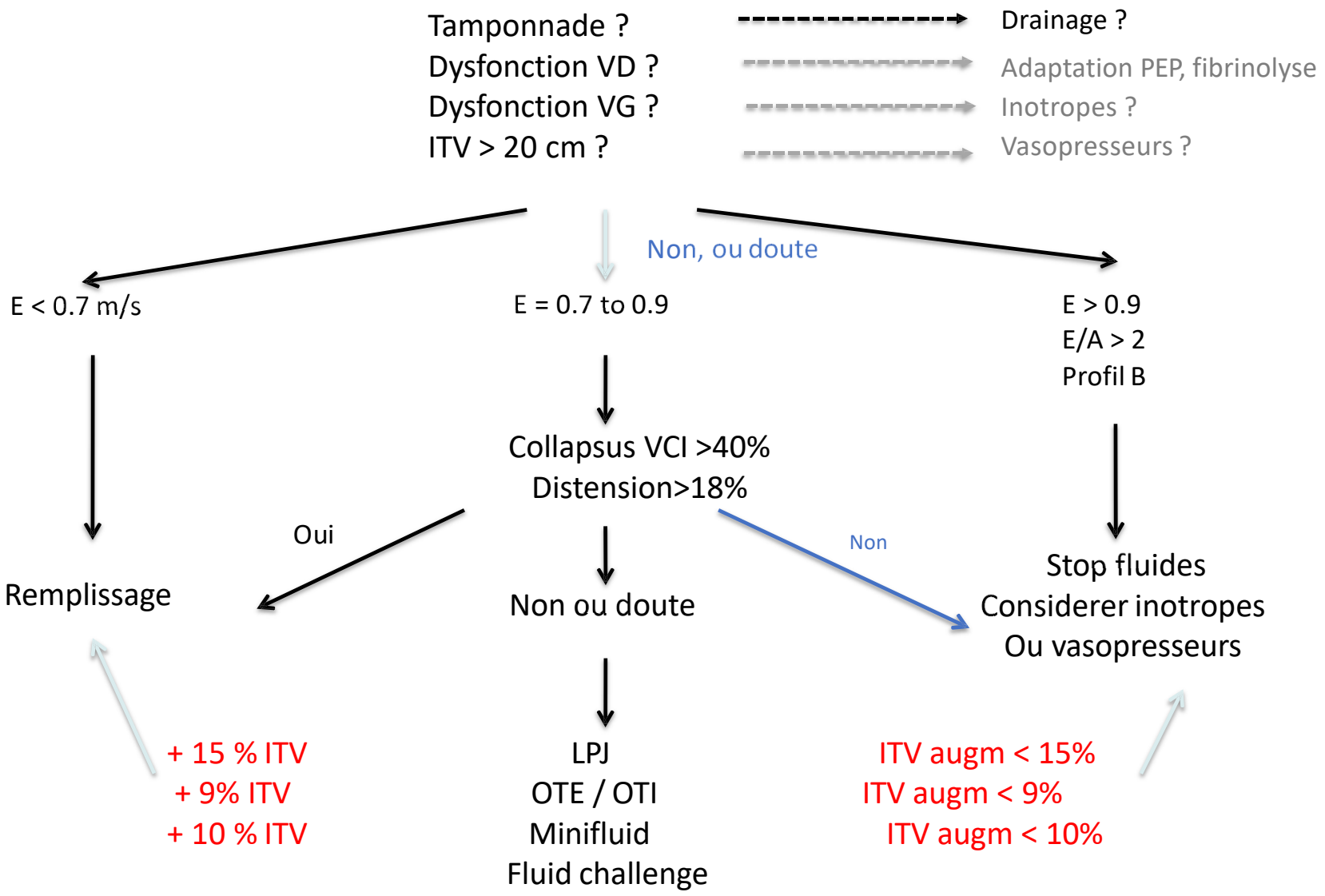
Pressions hautes + débit bas → INSUFFISANCE CARDIAQUE

Pressions hautes/basses + débit haut → VASOPLEGIE

En résumé

Etat de choc

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



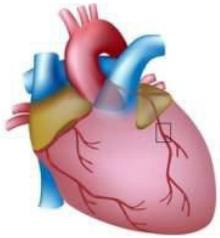
Mon patient est en insuffisance circulatoire aigüe

1. Quelle(s) thérapeutique(s) sont indiquées ?
2. Un remplissage vasculaire peut-il être bénéfique ?

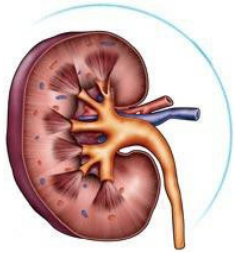
=> Va-t-il augmenter le débit cardiaque ?

3. Un remplissage vasculaire peut-il être néfaste ?

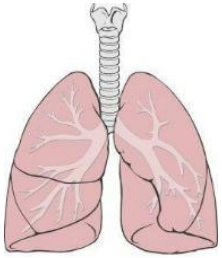
=> Risque-t-il d'aggraver une congestion veineuse ?



Ischémie ↑
Arythmie↑
Défaillance cardiaque



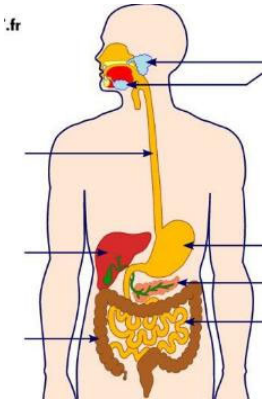
Insuffisance Rénale



Oedèmes
Hypoxie
Défaillances respiratoires

Prise de poids

Augmentation durée de séjour réa/SC/hôpital



Œdèmes
Délai reprise transit
Lâchage anastomose

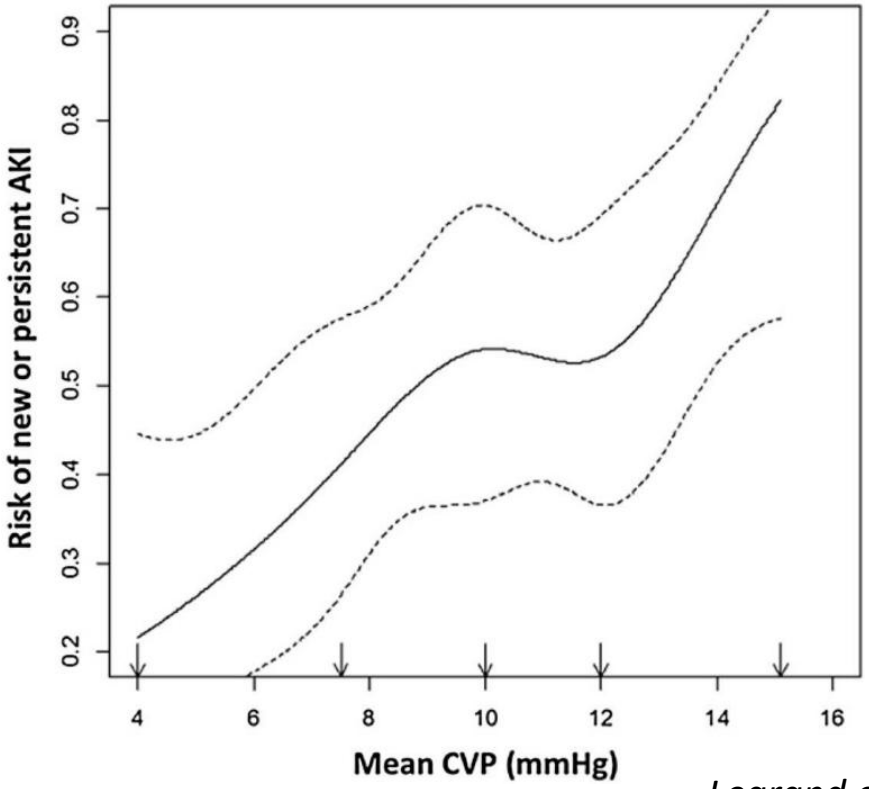
Prise de Poids

Association between systemic hemodynamics and septic acute kidney injury in critically ill patients: a retrospective observational study

137 patients septiques

Association PVC élevée et défaillance rénale

Rôle probable de la congestion veineuse !



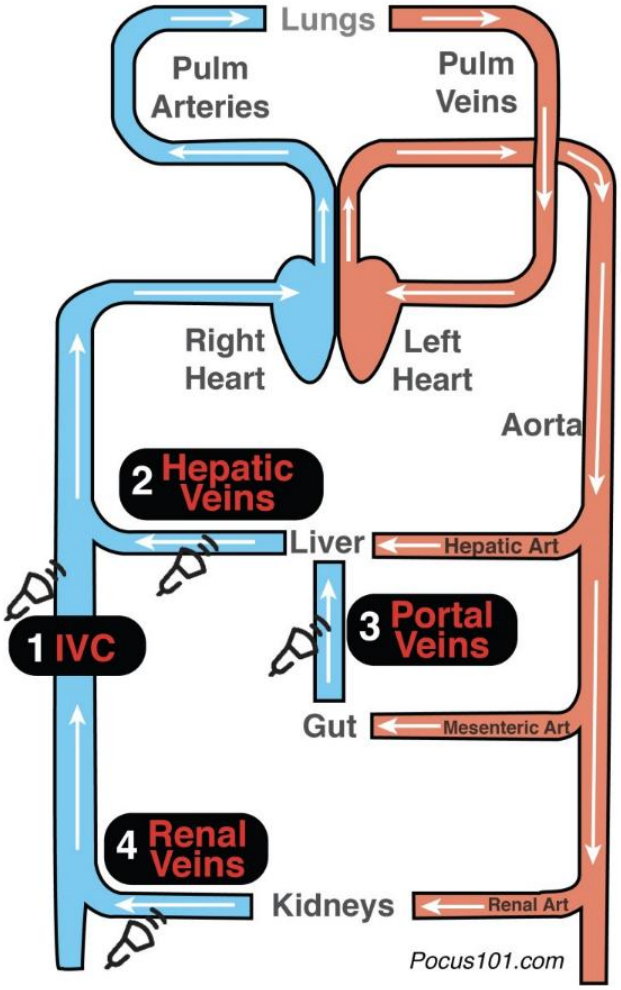
Legrand et al. Crit Care 2013

Evaluation de la Congestion Veineuse

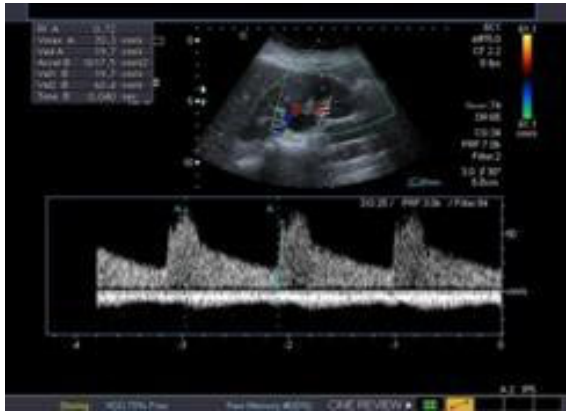
Evaluation de la Congestion Veineuse

Présentation du VexUs score

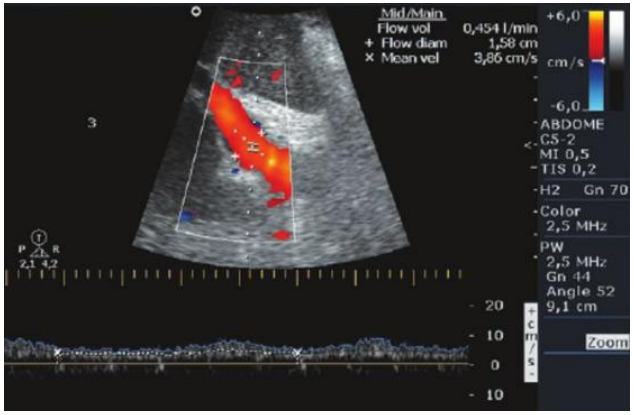
Venous Excess Ultrasound
VExUS



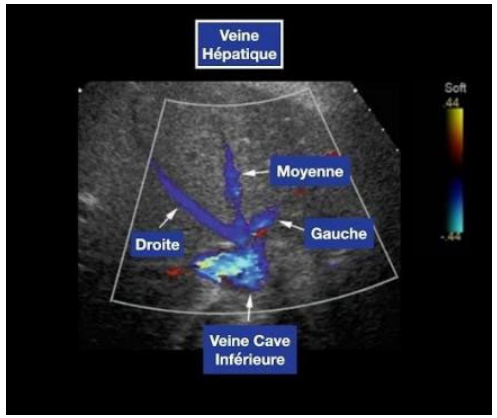
Doppler veineux rénal



Doppler portal



Doppler des veines sus hépatiques



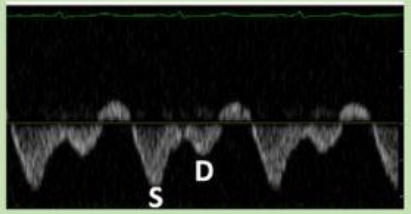
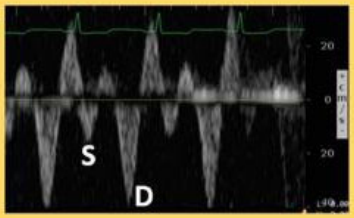
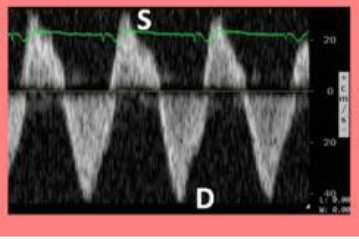
Vexus score

Hepatic vein Doppler

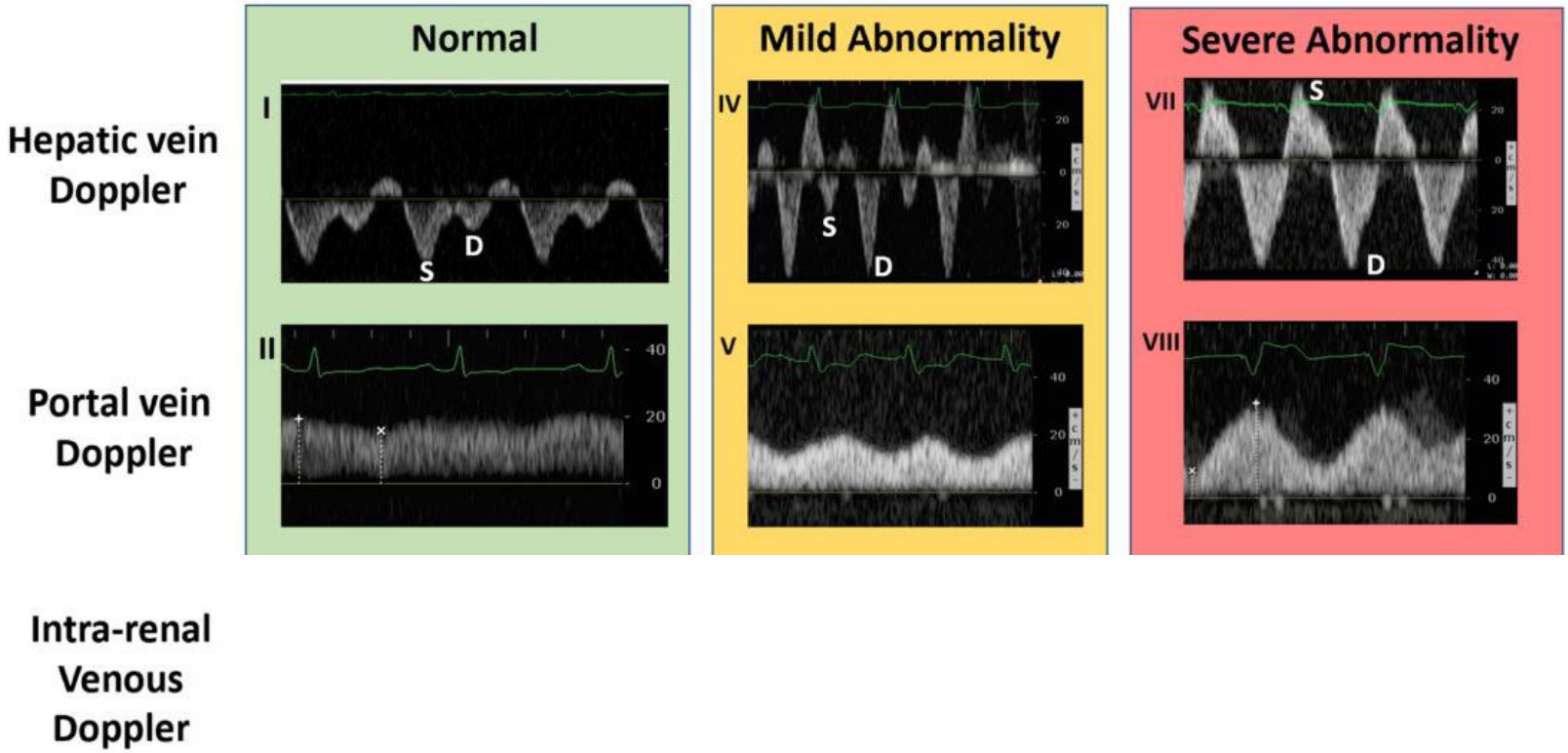
Portal vein Doppler

Intra-renal Venous Doppler

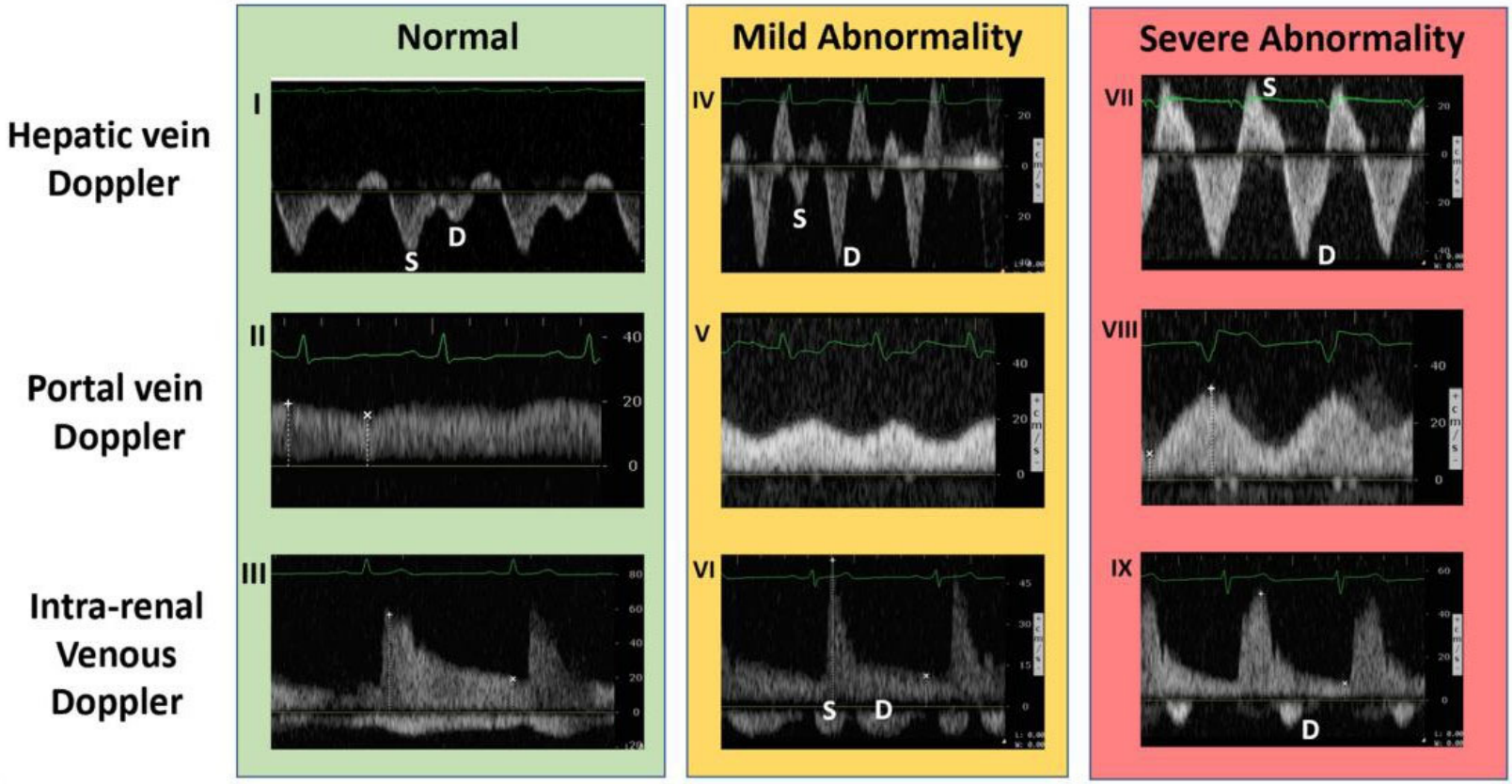
Vexus score

	Normal	Mild Abnormality	Severe Abnormality
Hepatic vein Doppler			
Portal vein Doppler			
Intra-renal Venous Doppler			

Vexus score


Normal
Mild Abnormality
Severe Abnormality
Hepatic vein Doppler
Portal vein Doppler
Intra-renal Venous Doppler
I
II
IV
V
VII
VIII
S
D
40
20
0

Vexus score

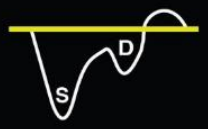

Normal
Mild Abnormality
Severe Abnormality
Hepatic vein Doppler
Portal vein Doppler
Intra-renal Venous Doppler
I
II
III
IV
V
VI
VII
VIII
IX
S
D

Step 1: IVC Diameter: If ≥2cm, proceed to step 2

Step 2: Hepatic Vein Doppler

NORMAL

S>D



Mildly Abnormal

S<D

Severely Abnormal

S wave Reversal

Step 3: Portal Vein Doppler

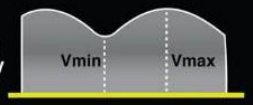
NORMAL

< 30% Pulsatility Index

*Pulsatility Index= (Vmax-Vmin)/Vmax

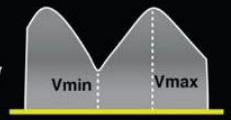
Mildly Abnormal

30-49% Pulsatility Index



Severely Abnormal

≥50% Pulsatility Index



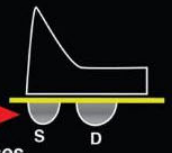
Step 4: Renal Vein Doppler

NORMAL

Continuous Monophasic Flow

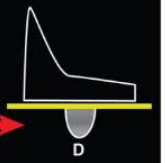
Mildly Abnormal

Discontinuous Biphasic flow with Systolic/Diastolic Phases



Severely Abnormal

Discontinuous Monophasic flow with Only Diastolic Phase



POCUS 101

Interpretation

Grade 0
(no congestion)
IVC < 2cm

Grade 1
(Mild congestion)
IVC ≥2cm and any combo of Normal or Mildly Abnl Patterns

Grade 2
(Moderate congestion)
IVC ≥2cm and ONE Severely Abnl Pattern

Grade 3
(Severe congestion)
IVC ≥2cm and ≥ 2 Severely Abnl Patterns

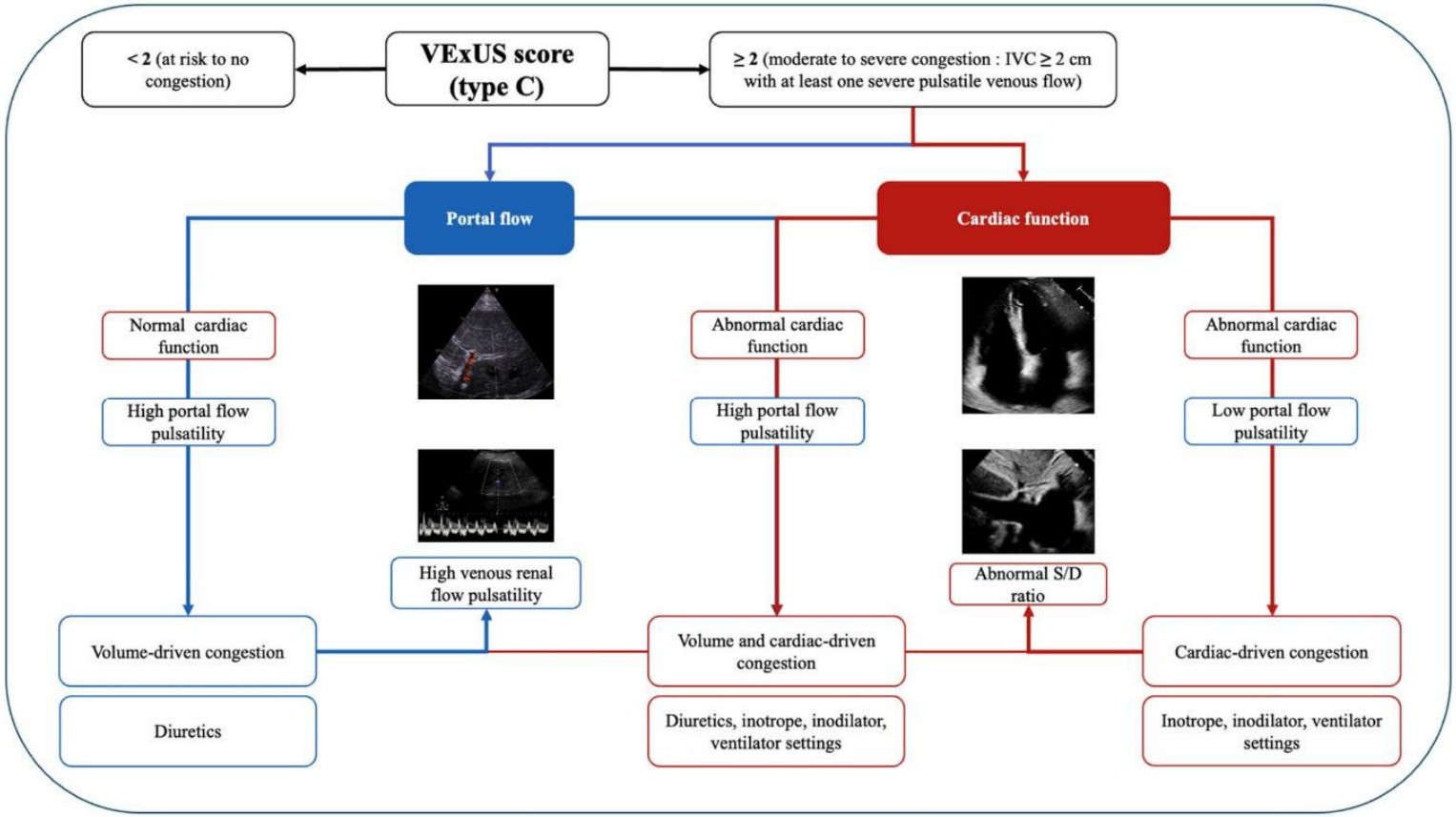
Vexus score

VEXUS 0	VCI < 2 cm
VEXUS 1	VCI > 2 cm **sans** flux sévèrement anormal
VEXUS 2	VCI > 2 cm **et** un flux sévèrement anormal
VEXUS 3	VCI > 2 cm **et** au moins 2 flux sévèrement anormaux

VExUS score: optimizing its use in perioperative and critical care management

Guinot Pierre-Grégoire[1,2,3,4*]

Critical Care (2025) 29:472



Merci de votre attention