L Muller. MD, PhD.

CHU Nîmes

Echocardiographie et gestion du remplissage vasculaire :

Une démarche en 6 points

Conflits d'intérêts (Association, invitations congrès)

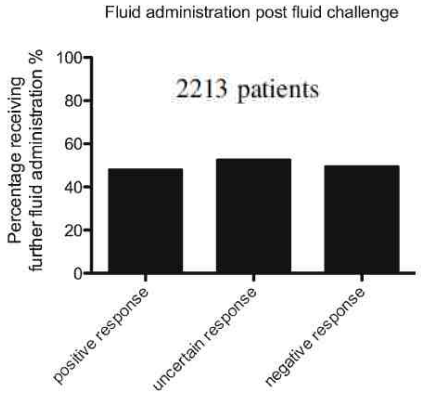
GE
Philips
Fresenius Kabi
Fresenius medical care
MSD
Astellas
Pulsion

Outils d'évaluation de la volémie :
La clinique en difficulté…

Fluid challenges in intensive care: the FENICE study

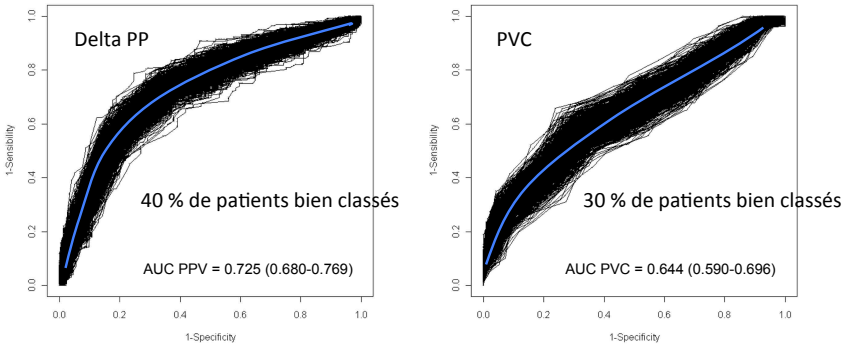
A global inception cohort study

Maurizio Cecconi
Christoph Hofer
Jean-Louis Teboul
Ville Pettila
Erika Wilkman
Zsolt Molnar
Giorgio Della Rocca
Cesar Aldecoa
Antonio Artigas
Sameer Jog
Michael Sander
Claudia Spies
Jean-Yves Lefrant
Daniel De Backer



Cecconi et al Intensive Care Med 2015

Indices de remplissage en réanimation
La « magic bullet » n'existe pas *n = 556*



Delta PP vs PVC p < 0.001

Biais, Lefrant, Muller Crit Care 2014

Review

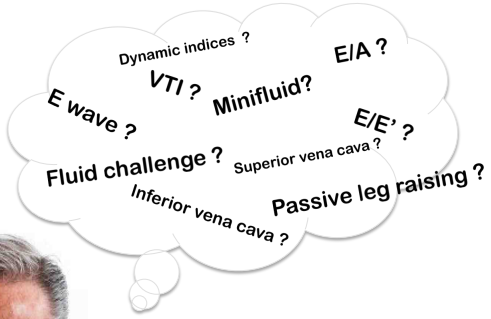
Septic Shock
Advances in Diagnosis and Treatment

Christopher W. Seymour, MD, MSc; Matthew R. Rosengart, MD, MPH

Table 1. Major Advances in the Diagnosis and Treatment of Traumatic and Septic Shock

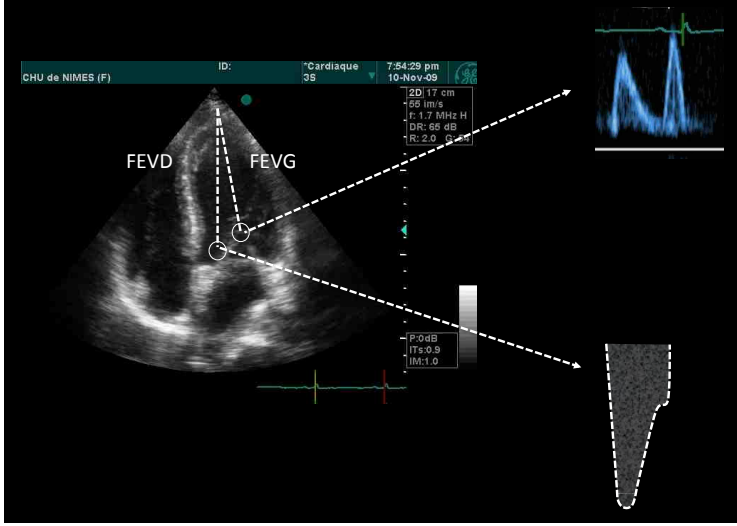
Action	Caveat
Diagnostic	
Clinical diagnosis is the criterion standard: Typically, systolic blood pressure ≤90 mm Hg or mean arterial blood pressure ≤65 mm Hg or >40-mm Hg decrease from baseline; Poor peripheral perfusion, low urinary output, altered mentation, elevated lactate	Normotensive shock with isolated hyperlactemia needs clarity; Lactate and systolic blood pressure thresholds are uncertain; Biologic phenotyping may be promising but not yet feasible in real time or tested in randomized clinical trials
Pulmonary artery catheterization and continuous monitoring of central venous oxygen saturation not recommended for routine diagnosis	May have a role in right ventricular dysfunction, complex cases with diagnostic uncertainty
Focused ultrasonography is suggested if there is concern for overlapping hemodynamic manifestations of shock	Practical, easy to use, and recommended by expert consensus[7]
Arterial pulse contour analysis	Awaiting randomized clinical trials for patient outcomes; Requires controlled mechanical ventilation and sinus rhythm

JAMA 2015



Nécessité d'une approche pas à pas …

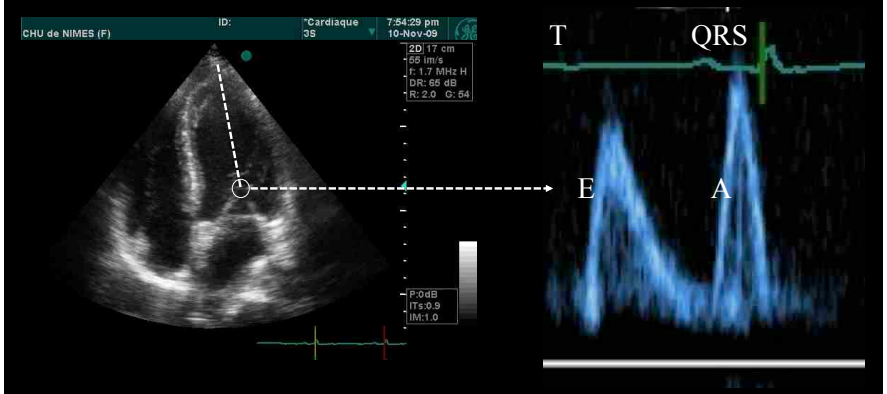
Echocardiographie
… Swan ganz non invasive



Première étape – approche statique
Evaluation de la PTDVG

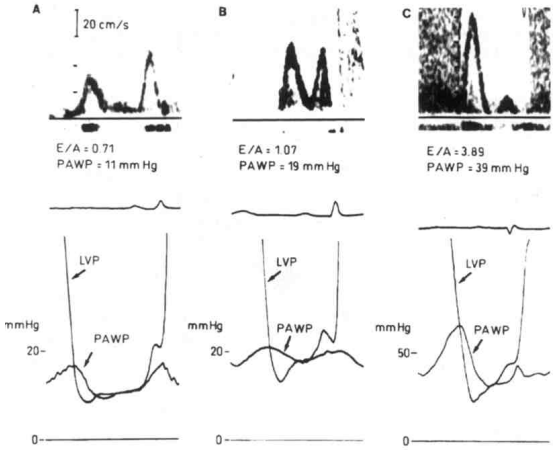
Profil mitral en échocardiographie

...évalue les pressions de remplissage



Evaluation statique de la PTDVG:

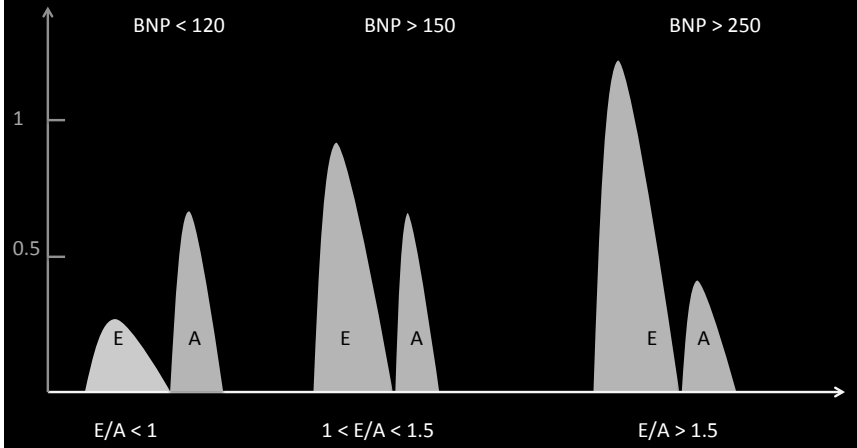
Le profil mitral est corrélé à la PTDVG



Vanoverschelde et al Am J Cardiol 1995

BNP, flux mitral et pressions de remplissage VG :

Evolution du flux mitral corrélée au BNP



Lubien et al Circulation 2002

Vitesse de l'onde E en ventilation spontanée :

*HYPOVOLEMIE **si < 0.75 m/s ??***

Table 1. Characteristics of the general population and comparison between Responders and Nonresponders at baseline (before fluid challenge)

	All patients (n = 40)	Responders (n = 20)	Nonresponders (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
HR (bpm)	101 (91-116)	101 (91-125)	103 (79-121)	0.78
MAP (mmHg)	71 (66-77)	70 (61-88)	72 (65-87)	0.56
LVEF (%)	55 (50-60)	55 (50-60)	55 (47-60)	0.41
VTI (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

Muller et al Critical Care 2012

Vélocité de l'onde E :

Evalue la PTDVG, même en cardiologie

New, Simple Echocardiographic Indexes for the Estimation of Filling Pressure in Patients with Cardiac Disease and Preserved Left Ventricular Ejection Fraction

...incremental accuracy to E/Ea alone in patients with E/Ea in the gray zone. 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.

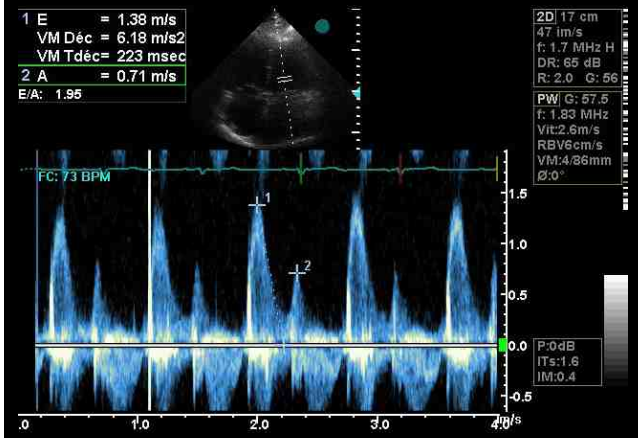
E < 60 cm/s => Low LVEDP

E > 90 cm/s => High LVEDP

Dokainish et al Echocardiography 2010

Rapport E/A:

Un bon marqueur de pressions hautes si > 2



E/A ratio > 2

=

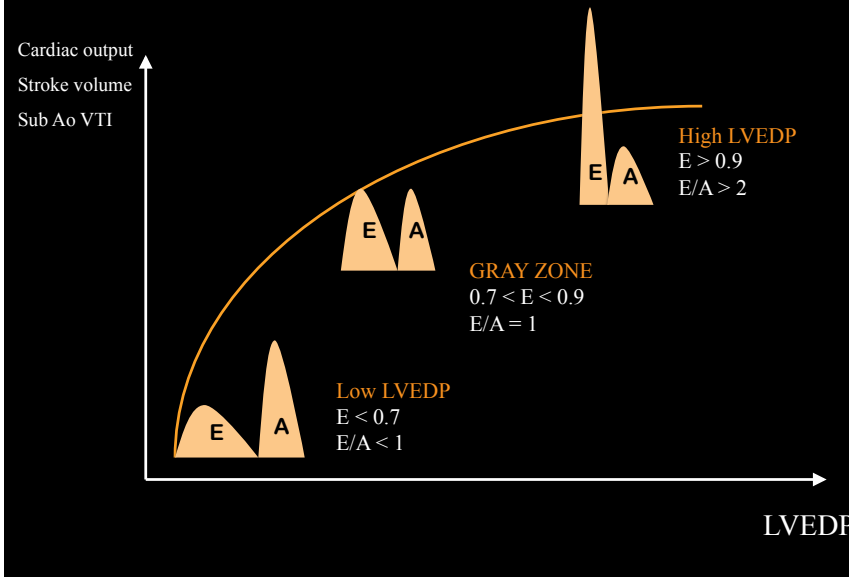
PAPO > 18 mmHg

PP value = 100 %

Boussuges et al Critical Care Med 2002

Valeur normale onde E = 0,7 – 0,9 m/s

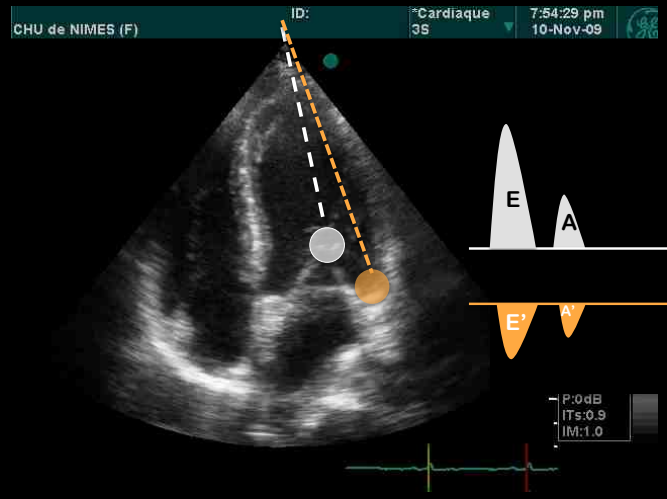
Static indices, fluid responsiveness and the Frank-Starling curve



Evaluation de la PTDVG par l'écho :
Le Doppler mitral souvent en défaut

- Si l'onde E est dans la zone grise 0,7 – 0,9 m/s
- On peut regarder le rapport E/E'

Rapport E / E'



Rapport E/E'
… principes

$$\frac{E}{E'} = \frac{\text{Charge x Compliance}}{\text{Compliance}}$$

L'onde E' est théoriquement précharge indépendante

Rapport E/E'
… principes

$$\frac{E}{E'} = \frac{\text{Charge x Compliance}}{\text{Compliance}}$$

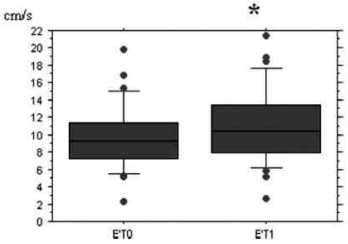
TDI en réanimation : *Onde E' précharge dépendante !*

Influence of Acute Preload Changes on Mitral Annulus Velocity Measured by Tissue Doppler Echocardiography in Critically Ill Patients

Hervé Quintard, MD,[1] Laurent Muller, MD,[2] Ivan Philip, MD,[3] Pierre Lena, MD,[4] Carole Ichai, MD, PhD[1]

TABLE 2
Echocardiographic Data Before and After Fluid Infusion (median ± interquartile range)

	Before Fluid Infusion (T0)	1 hour After Fluid Infusion (T1)	*p*
E mitral velocity (cm/s)	50.5 ± 25.9	62.6 ± 21.9	0.001
A mitral velocity (cm/s)	54.5 ± 21	53.3 ± 19	ns
E/A ratio	1.04 ± 0.5	1.2 ± 0.5	ns
E′ lateral mitral velocity (cm/s)	9.3 ± 3.8	10.5 ± 4.3	0.02
A′ lateral mitral velocity (cm/s)	8.5 ± 4.3	9.5 ± 4.7	ns
E/e′ lateral ratio	6.6 ± 3.8	7.2 ± 2.9	ns
E′ septal mitral velocity (cm/s)	7.5 ± 2.5	9.1 ± 3.8	<0.05
A′ septal mitral velocity (cm/s)	6.9 ± 2.8	9 ± 3.8	<0.05
E/e′ septal ratio	6.7 ± 7	6.8 ± 5	ns
LV area (cm^2)	17.2 ± 5.4	18.5 ± 5.5	<0.05

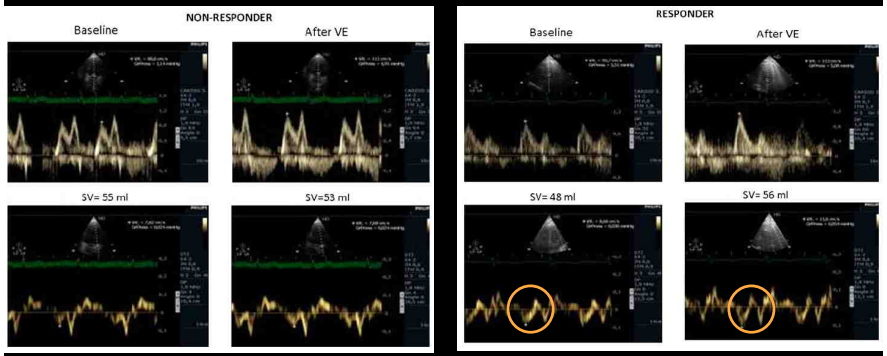


Quintard et al JCU 2011

TDI en réanimation : *Onde E' précharge dépendante !*

Non réponse au RV : E' inchangée de E' sous remplissage

Réponse au RV : augmentation de E' sous remplissage



Mahjoub et al Intensive Care Med 2013

TDI en réanimation :
Rapport E/E' mauvais pour prédire les pressions basses

Baseline haemodynamic parameters	Responders ($n = 59$)	Non responders ($n = 24$)	*p*
HR (bpm)	100 ± 18	96 ± 21	0.32
SAP (mmHg)	99 ± 20	100 ± 20	0.36
DAP (mmHg)	55 ± 12	55 ± 13	0.33
MAP (mmHg)	69 ± 13	70 ± 20	0.84
CVP (mmHg)	8.8 ± 6.6	11.5 ± 4.0	0.30
Stroke volume (ml)	52 ± 16	67 ± 22	0.006
Lactates (mmol/l)	3.0 ± 1.8	3.4 ± 2.3	0.40
Cardiac output (l/min)	5.2 ± 1.6	6.3 ± 2.3	0.04
LVEDA (cm^2)	28 ± 6	28 ± 10	0.64
E wave (m/s)	0.70 ± 0.20	0.76 ± 0.22	0.23
A wave (m/s)	0.80 ± 0.21	0.80 ± 0.21	0.95
E/A ratio	0.92 ± 0.41	0.98 ± 0.35	0.58
EDT (ms)	248 ± 107	226 ± 108	0.34
E′ wave (m/s)	0.12 ± 0.04	0.12 ± 0.05	0.60
A′ wave (m/s)	0.12 ± 0.04	0.11 ± 0.04	0.31
E/E′ ratio	6.5 ± 2.2	6.9 ± 2.7	0.41
Tei index	0.78 ± 0.38	0.54 ± 0.16	0.04
EF (%)	55 ± 15	53 ± 16	0.49
S′ wave (m/s)	0.16 ± 0.04	0.15 ± 0.06	0.4

Mahjoub et al Intensive Care Med 2013

TDI en réanimation : *Onde E' précharge dépendante !*

Variation de + 30% de la vélocité de E' sous remplissage chez les répondeurs au remplissage
Variation de 5 % chez les non répondeurs

Table 4 Comparison of VE–induced variation (Δ) of haemodynamic data between the two groups for patients with left ventricular diastolic dysfunction at baseline (E′ wave <0.12 m/s)

VE-induced variation in haemodynamic parameters	Responders ($n = 33$)	Non-responders ($n = 14$)	*p*
ΔHR % (bpm)	−5 ± 1 (−5 ± 1)	−4 ± 2 (−3 ± 2)	0.43
ΔSAP % (mmHg)	13 ± 3 (12 ± 3)	4 ± 3 (4 ± 2)	0.10
ΔDAP % (mmHg)	8 ± 4 (5 ± 3)	1 ± 2 (1 ± 2)	0.07
ΔMAP % (mmHg)	9 ± 3 (7 ± 3)	3 ± 4 (2 ± 3)	0.09
ΔCVP % (mmHg)	23 ± 15 (2.4 ± 0.9)	36 ± 16 (3.5 ± 1.1)	0.56
ΔSV % (ml)	31 ± 2 (16 ± 1)	−3 ± 3 (−2 ± 2)	<0.001
ΔCO % (l/min)	24 ± 3 (1.2 ± 0.1)	−4 ± 4 (−0.2 ± 0.2)	<0.001
ΔLVEDA % (cm^2)	13 ± 6 (3.0 ± 1.0)	−5 ± 8 (−2.5 ± 1.5)	0.04
ΔE wave % (m/s)	27 ± 7 (0.17 ± 0.03)	42 ± 11 (0.17 ± 0.05)	0.25
ΔA wave % (m/s)	11 ± 3 (0.08 ± 0.02)	−3 ± 5 (−0.02 ± 0.04)	0.03
ΔE/A ratio %	18 ± 1 (0.13 ± 0.05)	6 ± 17 (0.28 ± 0.08)	0.04
ΔEDT % (ms)	−4 ± 5 (−37 ± 13)	−14 ± 6 (−61 ± 18)	0.18
ΔE′ wave % (m/s)	29 ± 5 (0.022 ± 0.004)	5 ± 8 (0.005 ± 0.006)	0.01
ΔA′ wave % (m/s)	27 ± 17 (0.02 ± 0.02)	83 ± 28 (0.10 ± 0.04)	0.10
ΔE/E′ %	2 ± 6 (0.03 ± 0.39)	35 ± 9 (1.75 ± 0.61)	0.02
ΔTei index %	−25 ± 11(−0.20 ± 0.06)	4 ± 8 (−0.02 ± 0.10)	0.01
ΔEF %	0.1 ± 1.5 (−0.1 ± 0.9)	−6 ± 2 (−4.0 ± 1.0)	0.06
ΔS′ wave % (m/s)	6 ± 5 (0.06 ± 0.05)	1 ± 8 (0.01 ± 0.09)	0.63

Mahjoub et al Intensive Care Med 2013

TDI en réanimation *Onde E' précharge dépendante !*

Variation de + 35% de E/E' chez les non répondeurs sous remplissage
=> Bon indice pour les pressions hautes

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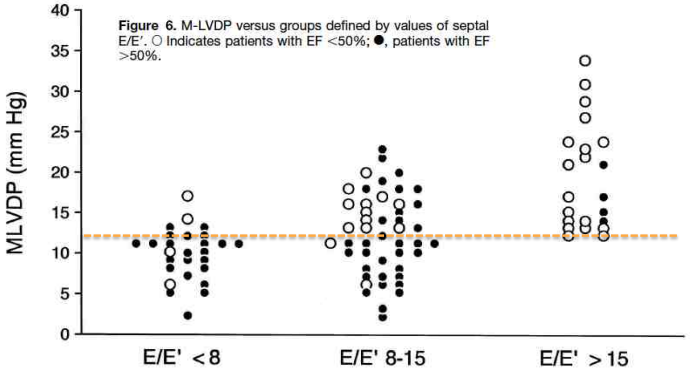
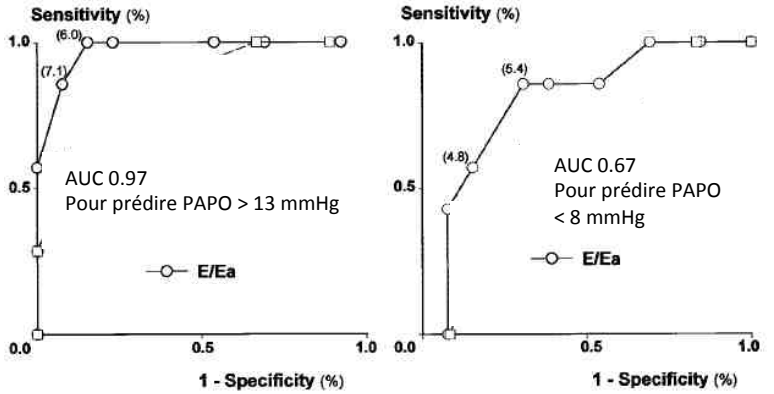
Mahjoub et al Intensive Care Med 2013

Rapport E/E': *surtout utile pour les pressions hautes ++++*



Ommen et al Circulation 2000

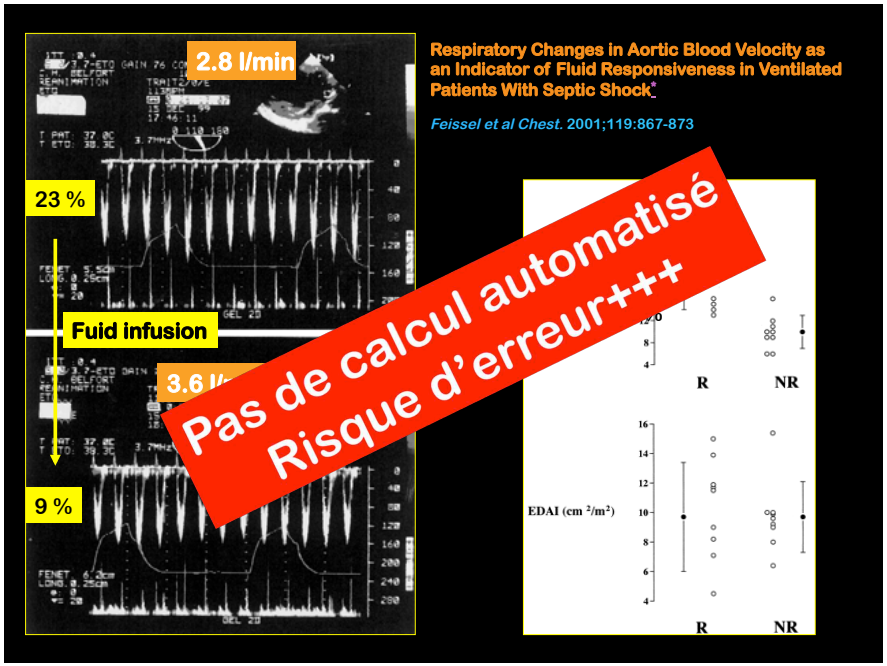
Rapport E/E': *surtout utile pour les pressions hautes*



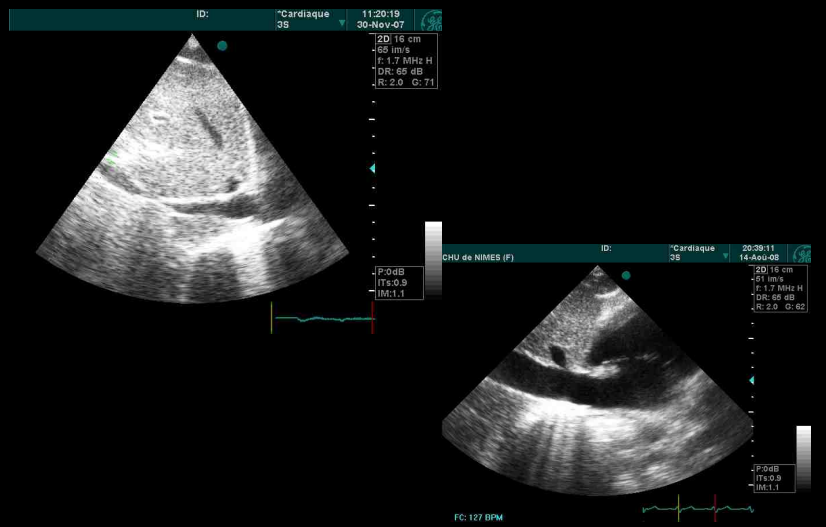
Bouhemad et al Anesthesiology 2003

Deuxième approche – Indices dynamiques

Evaluation de la précharge par les interactions cardio pulmonaires

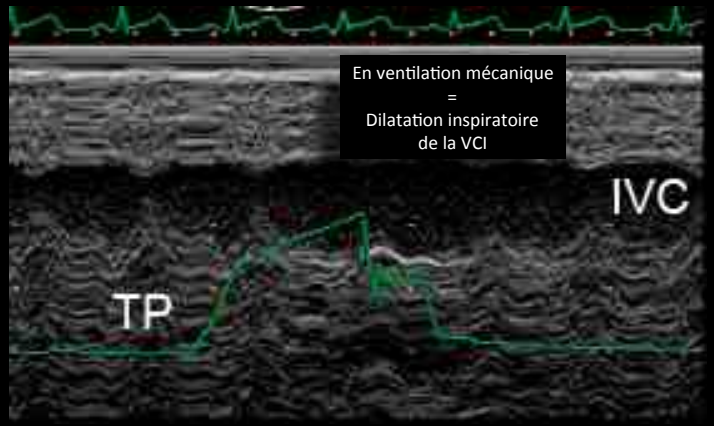


Variations respiratoires de la VCI: *un faux ami ?*



Variations respiratoires de la VCI en ventilation contrôlée:

Distensibilité de la VCI : max-min / (max + min /2)



Vieillard Baron et al ICM 2004

Variations respiratoires de la VCI : en ventilation mécanique contrôlée (max-min/max+min/2) Seuil = 12 %

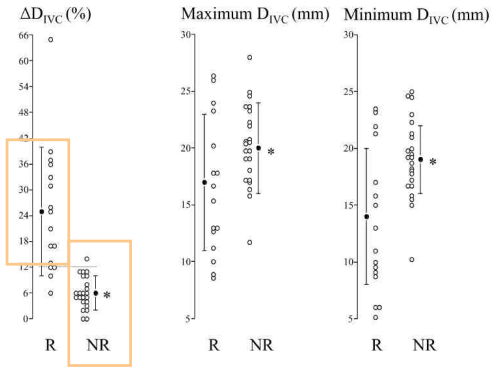
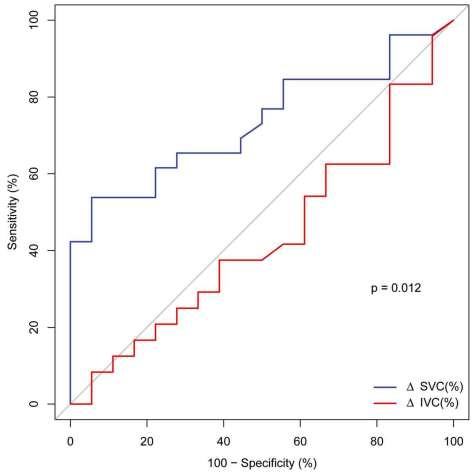


Fig. 3 Individual values (*open circles*) and mean ± SD (*closed circles*) of the minimum D_{IVC}, maximum D_{IVC} and ΔD_{IVC} before volume loading in responder (*R*) and non-responder (*NR*) patients. **P*<0.05 R vs NR

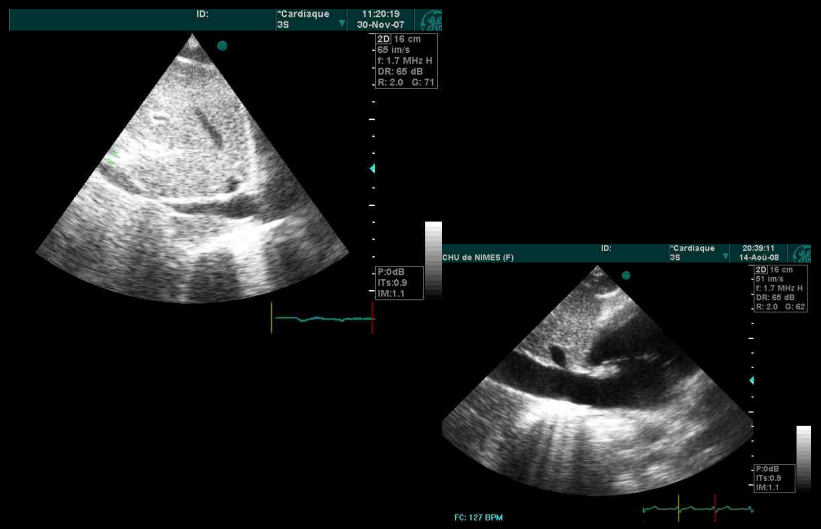
Feissel et al Intensive Care Medicine 2004

Variabilité respiratoire de la veine cave en ventilation mécanique…
… avec Vt = 8 mL/Kg : VCI ou VCS ?

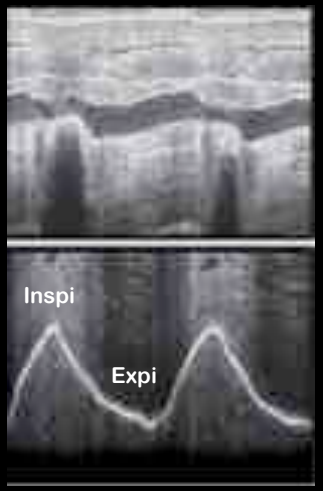


Charbonneau et al Crit Care 2014

Variations respiratoires de la VCI:
un faux ami en ventilation spontanée



Variations respiratoires de la VCI en ventilation spontanée :
Un collapsus inspiratoire



VCI

Diaphragme

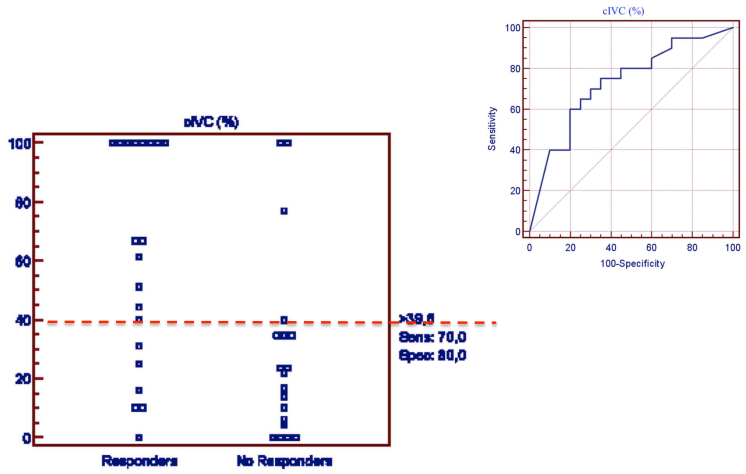
Gignon et al Anesthesiology In press

Veine cave inférieure et pression veineuse centrale

Diamètre de la VCI (mm)	Variations respiratoires de la VCI (%)	Valeur de POD (mmHg)
Bas : < 15	Collapsus inspiratoire de 100 %	0-5
Normal : 15-25	> 50	6-10
	< 50	11-15
Elevé : > 25	< 50	16-20
	Absentes	> 20

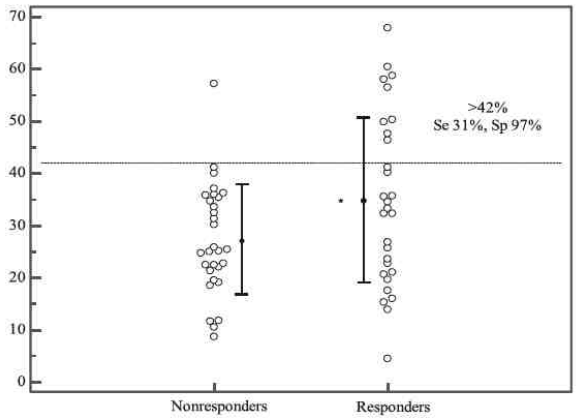
Luthra A, Echo made easy Anshan eds 2007
Wong SP, Practice of clinical echocardiography 2002
Brennan JASE 2007

Variations respiratoires de la VCI en ventilation spontanée :
utile que si > 40 % (max-min/max)



Muller et al Critical Care 2012

Variabilité respiratoire de la veine cave en ventilation spontanée…
… OK pour remplissage si > 40 %

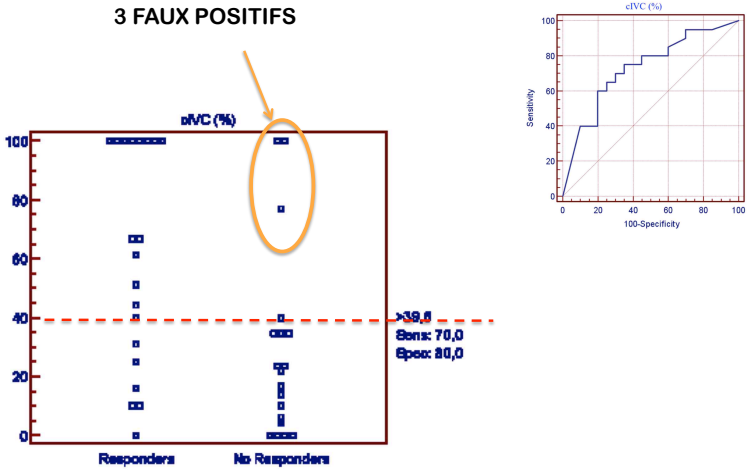


Airapetian et al Crit Care 2015

Variations respiratoires de la VCI :
Résumé

- En ventilation mécanique contrôlée > 10 mL/Kg Vt (??)
  - Dist. VCI > 12 % (formule max-min/(max+min/2) = hypovolémie
  - Dist. VCI < 12 % = pas d'hypovolémie
- En ventilation contrôlée < 8 ml/Kg : oublier
- En ventilation spontanée :
  - Coll. VCI > 40 % (formule max-min/max) = hypovolémie
  - Coll. VCI < 40 % = impossible de conclure

Variations respiratoires de la VCI en ventilation spontanée :
utile que si > 40 % (max-min/max)

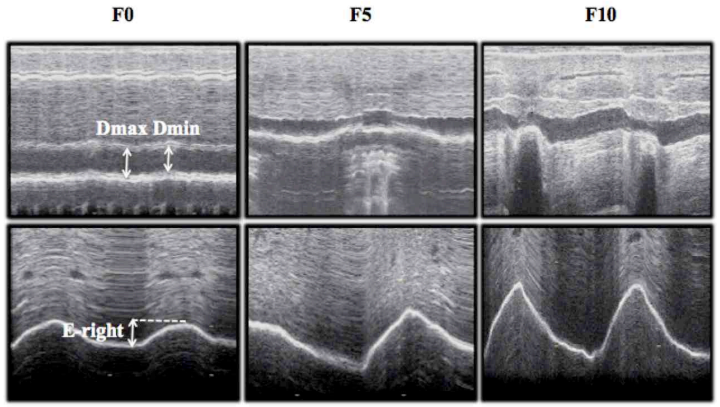


Muller et al Critical Care 2012

Interactions diaphragme – veine cave inférieure

Etude sur 50 volontaires sains – efforts inspiratoires standardisés

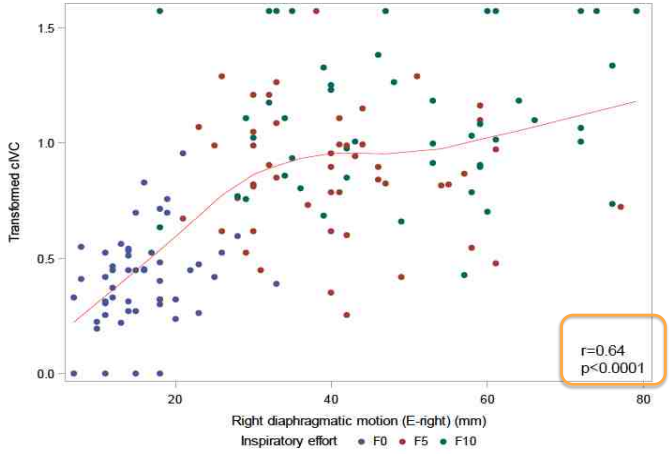
Ventilation calme | Effort inspi - 5 cmH2O | Effort inspi - 10 cm H2O



Gignon et al Anesthesiology 2016, in press

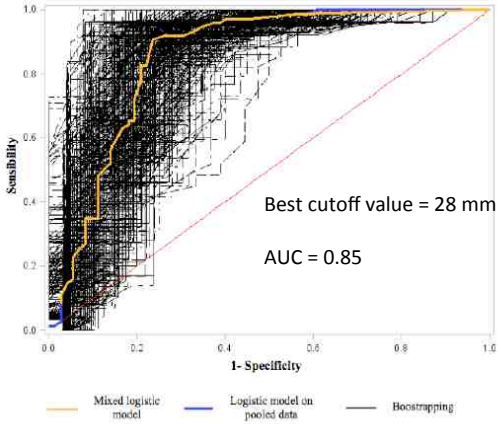
Corrélation course diaphragmatique
et variabilité respiratoire du diamètre de la VCI (cIVC)

Figure 3: Evolution of cIVC in relation to the diaphragm motions for the three levels of breathing intensity (n=50).



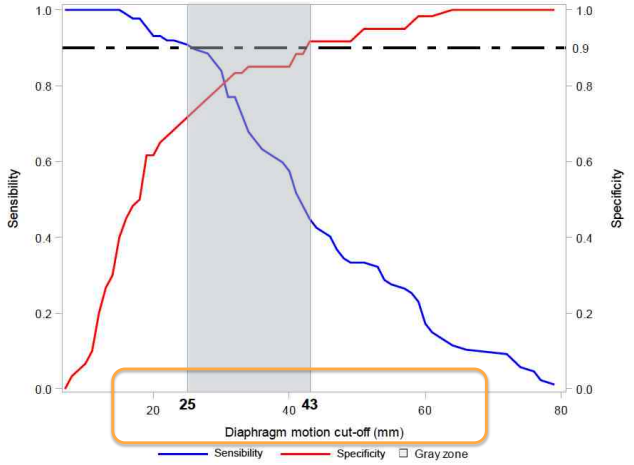
Gignon et al Anesthesiology 2016, in press

Course diaphragmatique
et prédictibilité d'un cIVC > 40 %



Gignon et al Anesthesiology 2016, in press

Course diaphragmatique
et variabilité respiratoire du diamètre de la VCI (cIVC)



Gignon et al Anesthesiology 2016, in press

Quatrième étape – Fluid challenge…

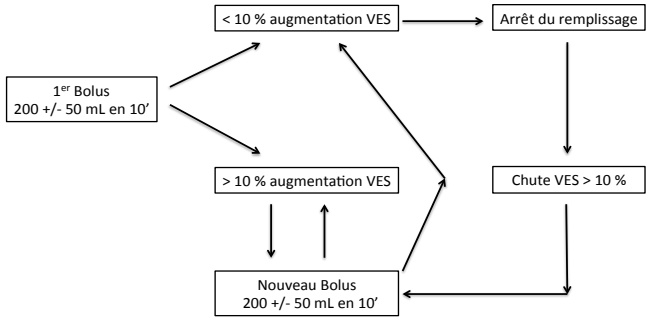
…et dérivés

RECOMMANDATIONS FORMALISÉES D'EXPERTS

SFAR
Société Française d'Anesthésie et de Réanimation

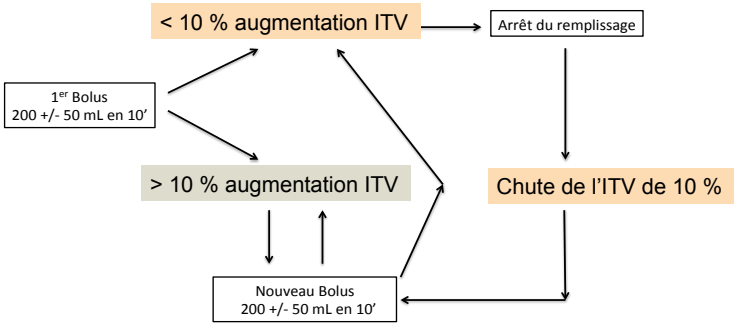
Stratégie du remplissage vasculaire périopératoire

Guidelines for perioperative haemodynamic optimization



Recommandations SFAR 2012

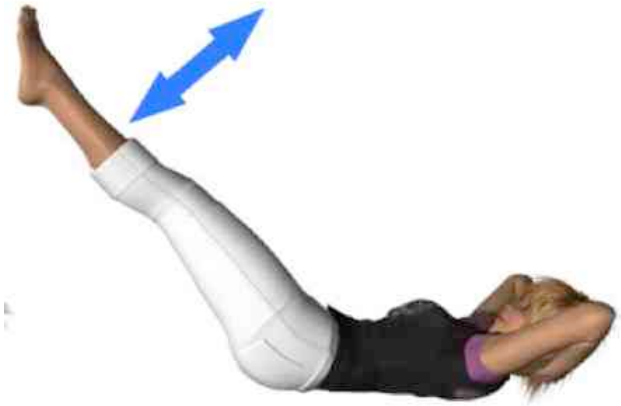
Comment utiliser le débit cardiaque ?
…pour remplir et pour arrêter de remplir

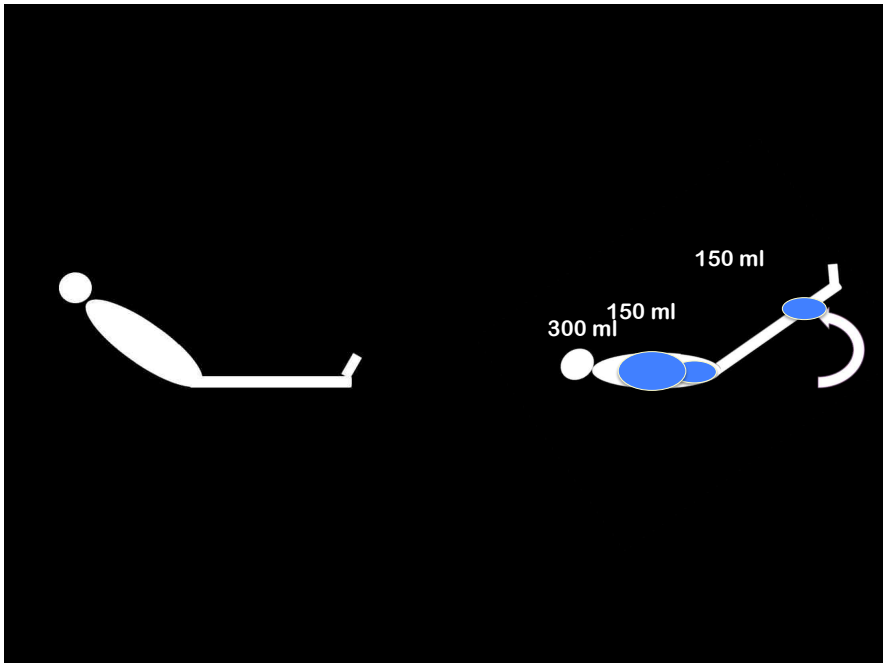


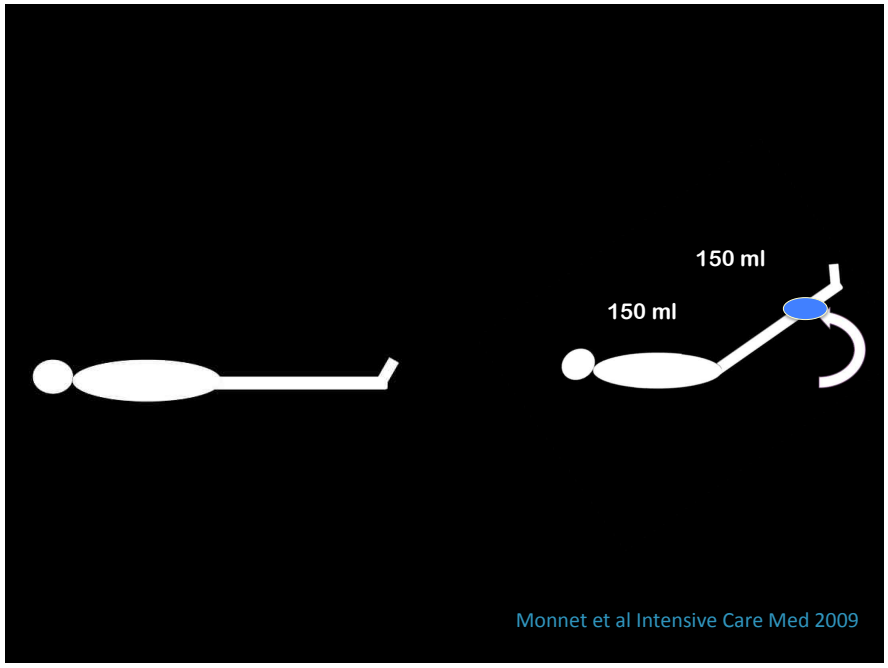
Recommandations SFAR 2012

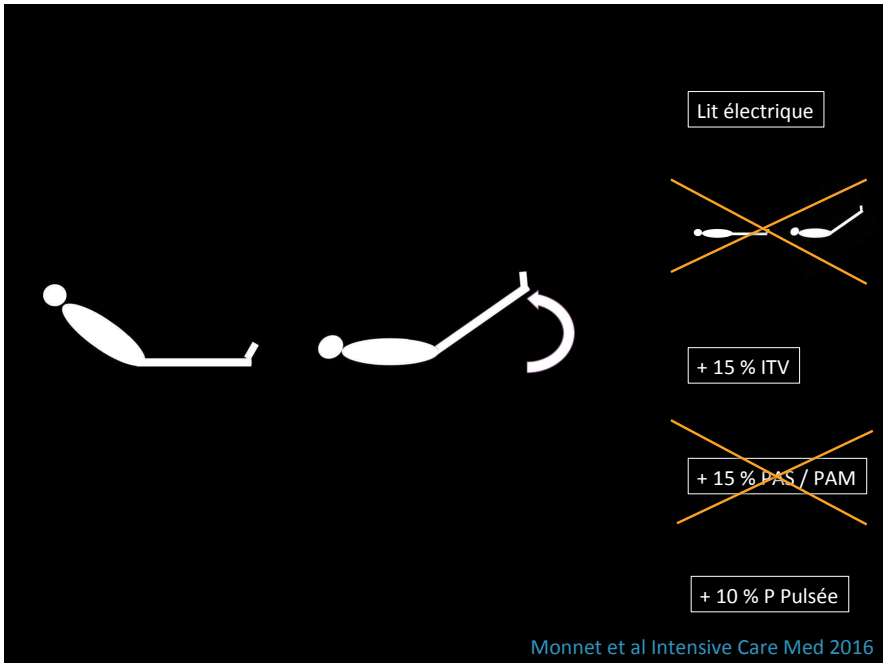
Utilisation du débit cardiaque : principe

Giving fluids without fluid infusion ?

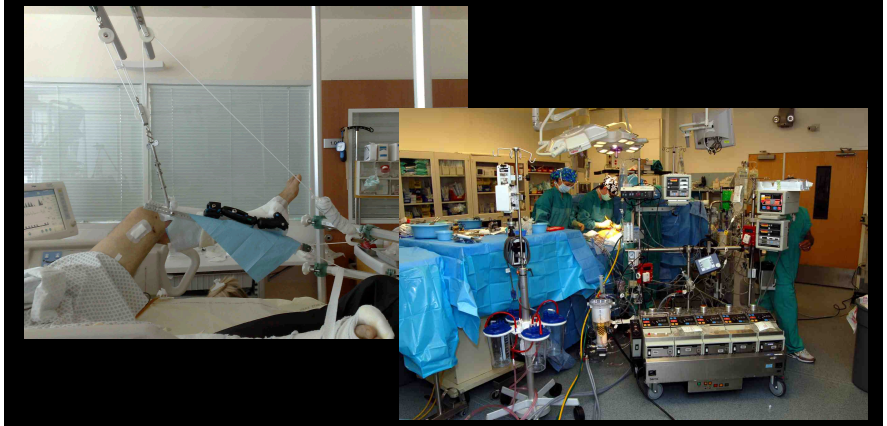




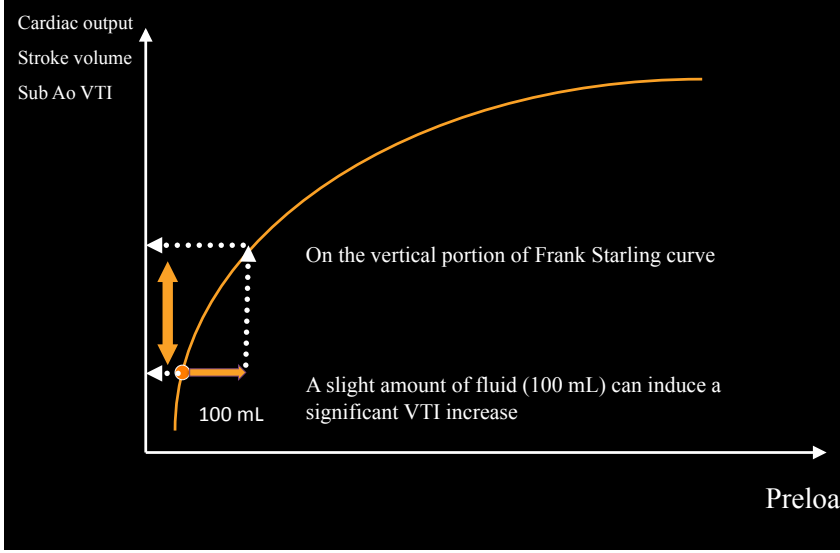




Passive leg raising test :
...not always possible !

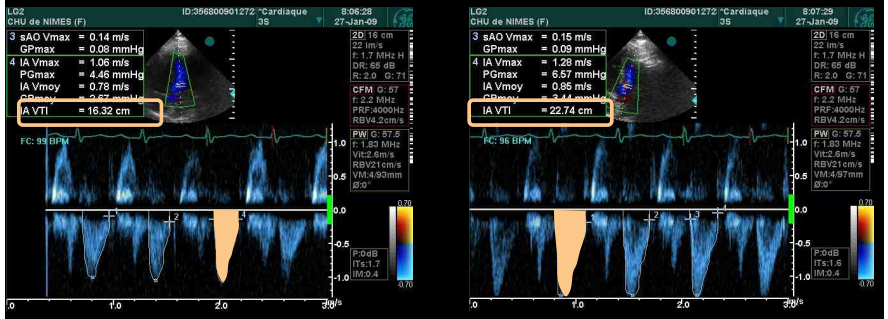


Mini fluid challenge : *the basics*



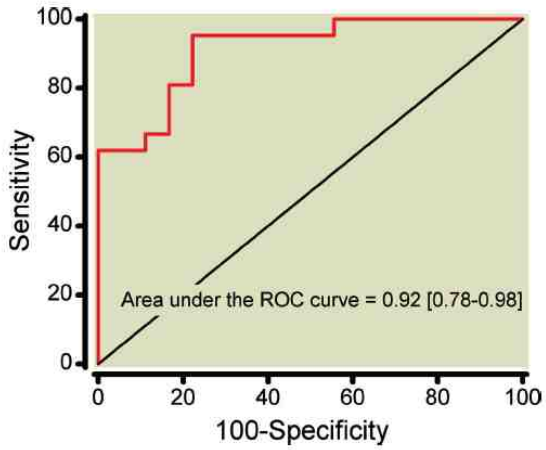
Exemple d'épreuve d'épreuve « mini fluid » positive

1 minute



100 ml

Mini fluid challenge



Muller et al Anesthesiology 2011

VTI T_0

⬇

100 mL fluid infusion over 1 minute

⬇

VTI T + 1 minute

⬇

VTI increase > 10%

⬇ Yes (Responder) ⬇ Fluid 400 ml over 15 minutes

⬇ No (No responder) ⬇ Stop fluid

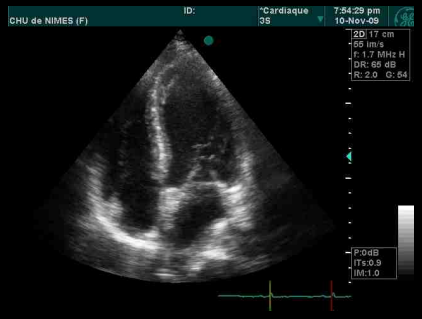
Cinquième étape…

…Le patient ne répond pas au remplissage

Eliminer une défaillance cardiaque ou une vasoplégie

Remplissage ou vasopresseurs

…raisonnement pratique?



+

ITV sous aortique > 20

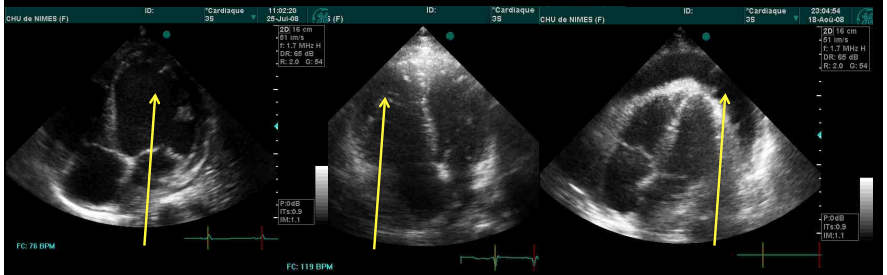
=

Vasoplégie

Avis personnel

Echocardiographie et fonction cardiaque :

L'ETT permet <u>en visuel</u> dans 95 % des cas d'éliminer 3 diagnostics appelant un traitement spécifique



Défaillance VG Défaillance VD Tamponnade

Joseph et al Chest 2004

Orme et al Br J Anaesth 2009

Sixième étape…

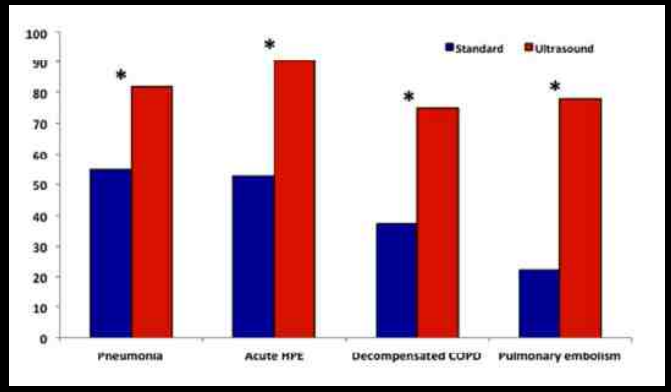
…Associer echo cardio et pleuro pulmonaire

Association echocardio et pleuro pulmonaire:
Une approche logique

	Lung	Heart
Pulmonary embolism	A-profile with deep venous thrombosis	RV failure (acute)
Acute haemodynamic pulmonary oedema	B-profile	High end-diastolic LV pressure
Decompensated COPD	A-profile	RV failure (chronic)
Pneumothorax	A'-profile	Non-specific
Pneumonia	C-profile A-profile plus PLAPS A/B-profile	Non-specific

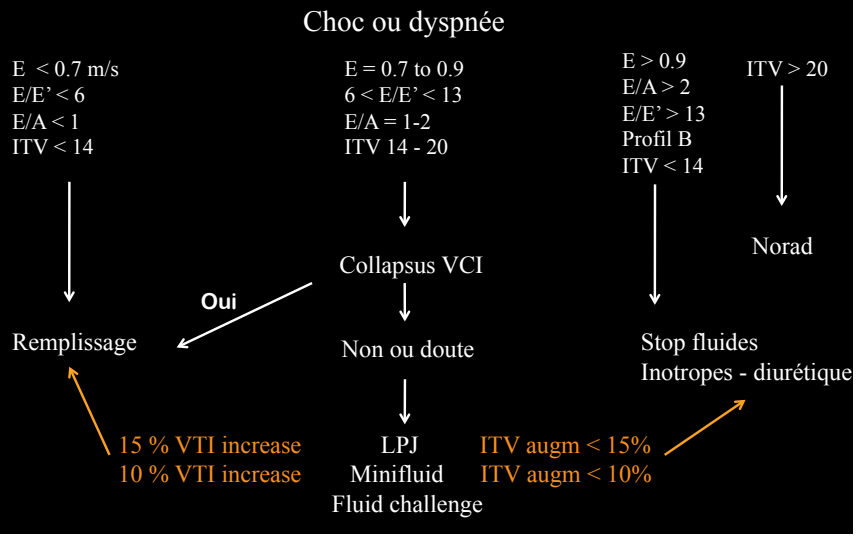
Silva et al Chest 2013

Association echocardio et pleuro pulmonaire:
Une approche logique



Silva et al Chest 2013

Evaluation de la volémie par échographie :
Proposition d'algorithme



Intensive Care Med (2005) 32:9–10
DOI 10.1007/s00134-005-2833-8

EDITORIAL

Bernard P. Cholley
Antoine Vieillard-Baron
Alexandre Mebazaa

Echocardiography in the ICU: time for widespread use!

Commentary

Myocardial Doppler velocities as a marker of prognosis in the ICU

Jan Poelaert[1] and Carl Roosens[2]

Intensive Care Med
DOI 10.1007/s00134-007-0923-5

CLINICAL COMMENTARY

Antoine Vieillard-Baron
Michel Slama
Bernard Cholley
Gérard Janvier
Philippe Vignon

Echocardiography in the intensive care unit: from evolution to revolution?

CHEST

Consensus Statement

American College of Chest Physicians/ La Société de Réanimation de Langue Française Statement on Competence in Critical Care Ultrasonography*

Goal-directed ultrasonography in the intensive care unit: No more excuses!*

CHEST

Edito

CHEST | Volume 135 | Number 6 |

POINTS OF VIEW

All intensivists need echocardiography skills in the 21st century

Ian M Seppelt

Intensive Care Med (2014) 40:1763–1765
DOI 10.1007/s00134-014-3465-7

EDITORIAL

ICU Ultrasound
The Coming Boom

Anthony McLean
Massimo Lamperti
Jan Poelaert

Echography is mandatory for the initial management of critically ill patients: Yes

British Journal of Anaesthesia 109 (4): 490–2 (2012)
doi:10.1093/bja/aes323

EDITORIAL III

Critical care echocardiography: cleared for take up

S. N. Fletcher* and R. M. Grounds

Intensive Care Med (2014) 40:1760–1762
DOI 10.1007/s00134-014-3460-z

EDITORIAL

Paul H. Mayo
Eric Maury

Echography is mandatory for the initial management of critically ill patients: We are not sure

Echographie en réanimation :
… Utile, peu cher et pertinent : EchoDay Study

Laurent Zieleskiewicz
Laurent Muller
Karim Lakhal
Zoe Meresse
Charlotte Arbelot
Pierre-Marie Bertrand
Belaid Bouhemad
Bernard Cholley
Didier Demory
Serge Duperret
Jacques Duranteau
Christophe Guervilly
Emmanuelle Hammad
Carole Ichai
Samir Jaber
Olivier Langeron
Jean-Yves Lefrant
Yazine Mahjoub
Eric Maury
Eric Meaudre
Fabrice Michel
Michel Muller
Cyril Nafati
Sébastien Perbet
Hervé Quintard
Béatrice Riu
Coralie Vigne
Kathia Chaumoitre
François Antonini
Bernard Allaouchiche
Claude Martin
Jean-Michel Constantin
Daniel De Backer
Marc Leone

Point-of-care ultrasound in intensive care units: assessment of 1073 procedures in a multicentric, prospective, observational study

Table 3 Factors associated with diagnostic and therapeutic impacts

Variable	Univariate analysis			Multivariate analysis	
	Yes *n* (%)	No *n* (%)	*p*	OR (95 % CI)	*p*
Diagnostic impact					
US certified	464 (86)	178 (78)	0.005	2.0 (1.2–3.1)	0.002
Disinfection protocol	311 (90)	312 (80)	<0.001	2.4 (1.5–3.7)	0.004
Shock	293 (88)	337 (80)	0.05	1.5 (1.0–2.4)	0.01
Management algorithm	136 (75)	487 (87)	<0.001	0.4 (0.3–0.7)	<0.001
Pediatric patient	66 (71)	560 (86)	<0.001		
Adult patient	560 (86)	66 (71)	<0.001		
Emergency US	312 (87)	318 (80)	0.02		
PaO_2/FiO_2 <300 mmHg	268 (86)	354 (82)	0.1		
Therapeutic impact					
Operator: intensivist	579 (71)	55 (55)	0.04	1.7 (1.0–2.9)	0.002
Daily practice of US	509 (71)	124 (61)	0.001	1.8 (1.2–2.7)	0.01
TTE	349 (75)	284 (63)	0.001	1.7 (1.2–2.3)	<0.001
Emergency US	319 (75)	312 (63)	<0.001	2.6 (1.8–3.8)	<0.001
University hospital	430 (65)	180 (79)	0.01	0.6 (0.4–0.9)	<0.001
Pediatric patient	70 (52)	550 (72)	<0.001	0.4 (0.3–0.7)	<0.001
US certified	528 (71)	110 (62)	<0.001		
Ward US	166 (75)	457 (67)	0.03		
Shock	287 (73)	342 (66)	0.03		

Intensive Care Med 2015

Outils d'évaluation de la volémie :
Place de l'échocardiographie en pratique

Volume expansion in the first 4 days of shock: a prospective multicentre study in 19 French intensive care units

Haemodynamic tools used during the period of shock (during at least one fluid bolus)	
Cardiac output monitoring	69 (8.9 %)
Central venous pressure measurement	131 (16.9 %)
Echography	56 (7.2 %)
Functional predictive indices of fluid responsiveness	134 (17.2 %)

Boulain et al Intensive Care Med 2015

Outils d'évaluation de la volémie :
Place de l'échocardiographie en pratique

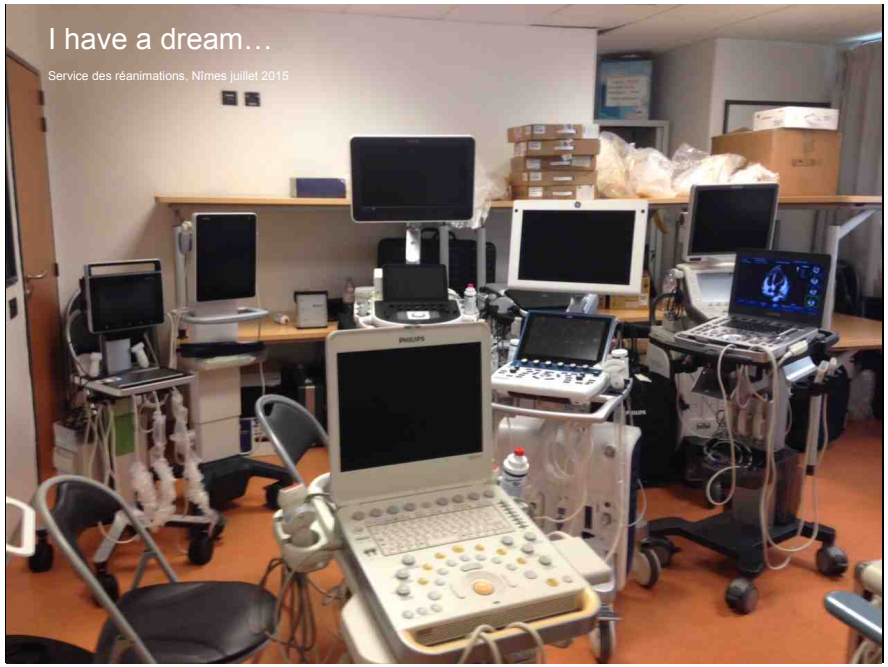
Fluid challenges in intensive care: the FENICE study

A global inception cohort study 2213 patients

Maurizio Cecconi
Christoph Hofer
Jean-Louis Teboul
Ville Pettila
Erika Wilkman
Zsolt Molnar
Giorgio Della Rocca
Cesar Aldecoa
Antonio Artigas
Sameer Jog
Michael Sander
Claudia Spies
Jean-Yves Lefrant
Daniel De Backer

Hemodynamic variable used to predict fluid responsiveness	*n*	% Of category	% All
No variable used	945		42.7 [40.6–44.8]
Any variable used	1268		57.3 [55.2–59.4]
Static	785		35.5 [33.5–37.5]
CVP	572	89.9 [87.8–92.0]	25.8 [24.0–27.6]
PAOP	31	4.9 [3.4–6.4]	1.4 [0.9–1.9]
GEDVI	33	5.2 [3.6–6.8]	1.5 [1.0–2.0]
Other	149	23.4 [20.4–26.4]	6.7 [5.7–7.8]
Dynamic	483		21.9 [20.2–23.6]
PPV	88	18.2 [14.8–21.6]	4.0 [3.2–4.8]
SVV	88	18.2 [14.8–21.6]	4.0 [3.2–4.8]
PPV + SVV	24	5.0 [3.1–6.9]	1.1 [0.7–1.5]
PLR	238	49.3 [44.8–53.8]	10.7 [9.4–12.0]
Echo variables	45	9.3 [6.7–11.9]	2.0 [1.4–2.6]

Cecconi et al Intensive Care Med 2015


I have a dream…
Service des réanimations, Nîmes juillet 2015
PHILIPS