e-DIU TUSAR
Bordeaux

Formation à l'échocardiographie en réanimation & impact thérapeutique

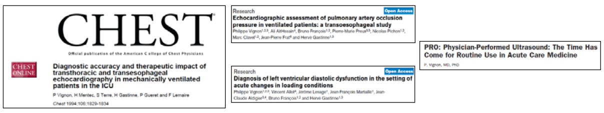
A. Ouattara/P. Vignon

e-DIU TUSAR
Bordeaux

Historique | Spécificités | Formation | Impact thérapeutique | Nouvelles techniques | Conclusion

D'où vient-on ?

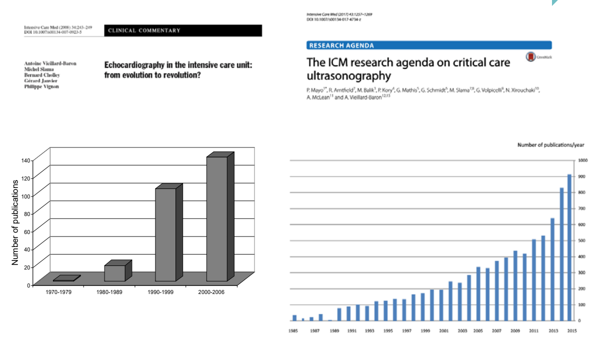
1990 → 2020



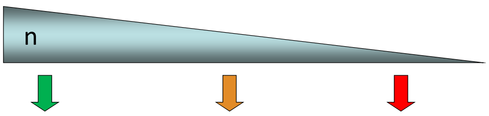
Monocentriques, insuffisance circulatoire (choc septique) et respiratoire aiguë

- Echocardiographie utilisée en dehors du laboratoire : contexte différent, type de patient et indications
- Longue période de validation (vs. hémodynamique invasive / imagerie)

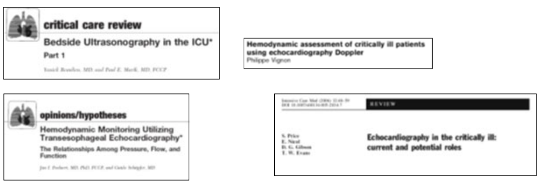
Historique | Spécificités | Formation | Impact thérapeutique | Nouvelles techniques | Conclusion



Critical Care Echocardiography (CCE): Echocardiographie en Réanimation

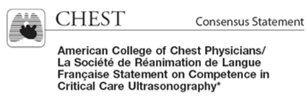


Insuffisance circulatoire | Insuffisance respiratoire | Autres indications



Historique | Spécificités | Formation | Impact thérapeutique | Nouvelles techniques | Conclusion

Une même technique utilisée différemment : changement de paradigme & reconnaissance par les cardiologues


CHEST Consensus Statement

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

CCE

CCE is performed and interpreted by the intensivist at the bedside to establish diagnoses and to guide therapy of patients with cardiopulmonary compromise. This part of the document defines the elements of echocardiography that are required to achieve competence in CCE.

Chest 2009;135:1050-60

Critical care echocardiography	Conventional echocardiography
Main indications: **cardiopulmonary compromise**	Main indications: cardiopathies
Performed **at the bedside** by the **ICU physician**	Performed in the Cardiology laboratory by the sonographer
On-line interpretation by the ICU physician	Off-line interpretation by the Cardiologist
Interpretation in light of the **Critical Care Medicine background** of the physician	Interpretation in light of the Cardiology background of the physician
Guide diagnostic work-up and **invasive** procedures	Expertise allows identification and interpretation of complex findings
Around-the-clock availability	Daytime schedule
Ventilated patients (heart-lung interactions)	Spontaneously breathing (out)patients
TEE frequently required and easy to perform	TTE is most commonly performed
Frequently **goal-oriented** examination	State-of-the-art exhaustive examination
Qualitative or quantitative evaluation using simple yet robust parameters	Quantitative assessment using all existing imaging tools
Immediate diagnostic / **therapeutic impact**	Delayed diagnostic / therapeutic impact
Monitoring tool / short term follow-up	Diagnostic tool / long term follow-up

Vignon P. In: Critical Care Ultrasound. P Lumb and D Karakitsos (Eds). Elsevier 2014

Intensive Care Med (2014) 40:1795–1815
DOI 10.1007/s00134-014-3525-z
CONFERENCE REPORTS AND EXPERT PANEL

Maurizio Cecconi
Daniel De Backer
Massimo Antonelli
Richard Beale
Jan Bakker
Christoph Hofer
Roman Jaeschke
Alexandre Mebazaa
Michael R. Pinsky
Jean Louis Teboul
Jean Louis Vincent
Andrew Rhodes

Consensus on circulatory shock and hemodynamic monitoring. Task force of the European Society of Intensive Care Medicine

Topic	ICM Antonelli 2007	ICM Cecconi 2014
Hemodynamic monitoring	–We do not recommend routine measurement of CO for patients with shock. Level 1; QoE moderate (B) –We suggest considering echocardiography or measurement of CO for diagnosis in patients with clinical evidence of ventricular failure and persistent shock with adequate fluid resuscitation. Level 2 (weak); QoE moderate (B) –We do not recommend the routine use of the pulmonary artery catheter for patients in shock. Level 1; QoE high (A)	–We recommend further hemodynamic assessment (such as assessing cardiac function) to determine the type of shock if the clinical examination does not lead to a clear diagnosis. *Ungraded best practice* –We suggest that, when further hemodynamic assessment is needed, echocardiography is the preferred modality to initially evaluate the type of shock as opposed to more invasive technologies. Level 2; QoE moderate (B) –In complex patients we suggest to additionally use pulmonary artery catheterization or transpulmonary thermodilution to determine the type of shock. Level 2; QoE low (C) –We do not recommend routine measurement of cardiac output for patients with shock responding to the initial therapy. Level 1; QoE low (C) –We recommend measurements of cardiac output and stroke volume to evaluate the response to fluids or inotropes in patients that are not responding to initial therapy. Level 1; QoE low (C) –We suggest sequential evaluation of hemodynamic status during shock. Level 1; QoE low (C) –Echocardiography can be used for the sequential evaluation of cardiac function in shock. *Statement of fact* –We do not recommend the routine use of the pulmonary artery catheter for patients in shock. Level 1; QoE high (A) –We suggest pulmonary artery catheterization in patients with refractory shock and right ventricular dysfunction. Level 2; QoE low (C) –We suggest the use of transpulmonary thermodilution or pulmonary artery catheterization in patients with severe shock especially in the case of associated acute respiratory distress syndrome. Level 2; QoE low (C) –We recommend that less invasive devices are used, instead of more invasive devices, only when they have been validated in the context of patients with shock. *Ungraded best practice*

Historique | **Spécificités** | Formation | Impact thérapeutique | Nouvelles techniques | Conclusion

Utilisation différente: notion de *goal-oriented echocardiography*

Naissance de l'échocardiographie « Niveau basique »

For residents!!!

2007

Intensive Care Med (2007) 33:1795–1799
DOI 10.1007/s00134-007-0742-8
BRIEF REPORT

Philippe Vignon
Anthony Dugard
Julie Abraham
Dominique Belcour
Guillaume Gondran
Frédéric Pepino
Benoit Marin
Bruno François
Hervé Gastinne

Focused training for goal-oriented hand-held echocardiography performed by noncardiologist residents in the intensive care unit

2009

Basic critical care echocardiography: Validation of a curriculum dedicated to noncardiologist residents*

Philippe Vignon, MD, PhD; Frédérique Mücke, MD; Frédéric Bellec, MD; Benoît Marin, MD; Jérôme Croce, MD; Tania Brouqui, MD; Cédric Palobart, MD; Patrick Senges, MD; Christophe Truffy, MD; Alexandra Wachmann, MD; Anthony Dugard, MD; Jean-Bernard Amiel, MD

2014

Intensive Care Med (2014) 40:1475–1480
DOI 10.1007/s00134-014-3449-7
ORIGINAL

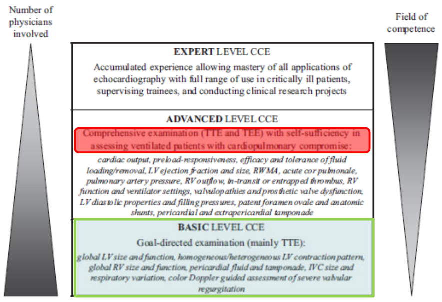
Emmanuelle Begot
Ana Grumann
Tiffany Duvoid
François Dalmay
Nicolas Pichon
Bruno François
Marc Clavel
Philippe Vignon

Ultrasonographic identification and semiquantitative assessment of unloculated pleural effusions in critically ill patients by residents after a focused training

EDITORIAL

PRO: Physician-Performed Ultrasound: The Time Has Come for Routine Use in Acute Care Medicine

P. Vignon, MD, PhD

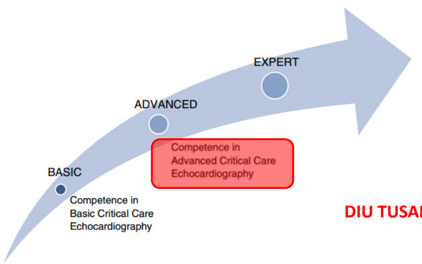


DIU TUSAR

Anesth Analgesia 2012

Historique | Spécificités | **Formation** | Impact thérapeutique | Nouvelles techniques | Conclusion

Tables rondes internationales



DIU TUSAR

Recommandations internationales

2009

CHEST Consensus Statement

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

Paul H. Mayo, MD; Yannick Beaulieu, MD; Peter Doelken, MD; David Feller-Kopman, MD; Christopher Harrod, MS; Adolfo Kaplan, MD; John Oropello, MD; Antoine Vieillard-Baron, MD; Olivier Axler, MD; Daniel Lichtenstein, MD; Eric Maury, MD; Michel Slama, MD; and Philippe Vignon, MD

2011

Intensive Care Med (2011) 37:1077–1083
DOI 10.1007/s00134-011-2246-9
EXPERT PANEL

Expert Round Table on Ultrasound in ICU

International expert statement on training standards for critical care ultrasonography

2014

Intensive Care Med (2014) 40:654–666
DOI 10.1007/s00134-014-3228-5
CONFERENCE REPORTS AND EXPERT PANEL

Expert Round Table on Echocardiography in ICU

International consensus statement on training standards for advanced critical care echocardiography

Intensive Care Med (2011) 37:1077–1083
DOI 10.1007/s00134-011-2246-9

EXPERT PANEL

Expert Round Table
on Ultrasound in ICU

International expert statement on training standards for critical care ultrasonography

Basic CCE = DESAR / DESMIR / DESC Réanimation (réanimateurs)

Advanced CCE = DIU TUSAR / DIU échocardiographie (cardiologues)

Statements

Preliminary general statements

All experts (100%) agreed upon the facts that:

- Basic-level critical care echocardiography and general critical care ultrasound should be a required part of the training of every ICU physician.
- Advanced-level critical care echocardiography is an optional component of the training of the ICU physician.

Intensivists who want to achieve competence in advanced CCE must be trained to basic-level CCE as a prerequisite (100% agreement).

Niveau « avancé » : DIU TUSAR

1. Theoretical program:

Course design should include specific learning goals as described in the ACCP/SRLF competence statement [14]. The minimum number of hours for course design required to teach advanced CCE is 40 h, to be divided between lectures and didactic cases with image-based training (100% agreement).

3. What is the required number of examinations to be performed by the trainee?

Trainees must acquire competencies in TTE and TEE (100% agreement). There was a consensus that TEE is mandatory for advanced CCE. Review of the literature suggests that 150 fully supervised TTE studies and 50 fully supervised TEE studies are a reasonable training target to achieve competence in image acquisition and interpretation [24, 25]. Trainees should learn advanced CCE with a locally qualified physician supervisor. Using validated scoring system to evaluate acquisition of competencies at bedside has been proposed [23]. A maximum period of 2 years is recommended to collect the appropriate number of echocardiographic studies.

5. What should be the format for documenting practical training in image acquisition and interpretation?

Each trainee must maintain a logbook of their scanning activity that includes reports of studies performed and/or interpreted. Trainees should write reports of their image interpretation, and the reports be cosigned by trainee and supervisor to attest that the findings have been verified by a physician who is qualified in advanced CCE.

6. Where should practical training take place, and who should supervise practical training in image acquisition and interpretation?

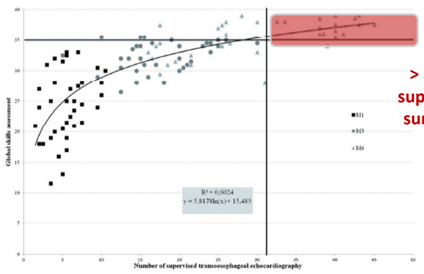
By definition, trainees have first to become competent in basic CCE. For that, practical training may initially use normal models under the supervision of hands-on training faculty. Subsequent training in advanced CCE requires bedside scanning by both transthoracic and transesophageal routes in the ICU under the direction of a supervisor who is competent in advanced CCE. The supervisor for practical training should be a locally qualified physician who regularly performs advanced CCE in the ICU environment (100% agreement). It is mandatory that a dedicated ultrasound machine with both transthoracic and transesophageal probes be available in every ICU where training occurs.

Intensive Care Med (2013) 39:1019–1024
DOI 10.1007/s00134-013-2838-7

ORIGINAL

Cyril Charron
Philippe Vignon
Gwenaël Prat
Alexandre Tonnelier
Philippe Aegerter
Jean-Michel Boles
Jean-Bernard Amiel
Antoine Vieillard-Baron

Number of supervised studies required to reach competence in advanced critical care transesophageal echocardiography



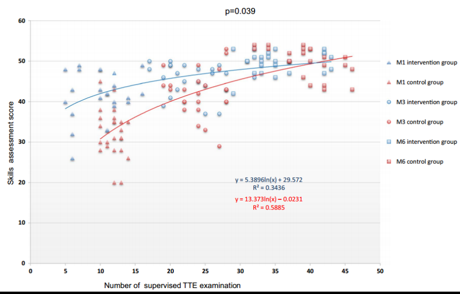
> 31 ETO supervisées sur 6 mois

Intensive Care Med (2018) 44:1097–1105
https://doi.org/10.1007/s00134-018-5248-z

ORIGINAL

Acceleration of the learning curve for mastering basic critical care echocardiography using computerized simulation

Philippe Vignon[1,2,3,9*], Benjamin Pegot[1], François Dalmay[4], Vanessa Jean-Michel[5], Simon Bocher[5], Erwan L'her[5,6,7], Jérôme Cros[8], Gwenaël Prat[5] and EchoSimu Group



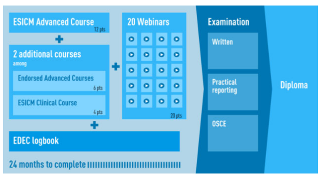
Indications de l'échocardiographie en Réanimation (niveau « avancé »)

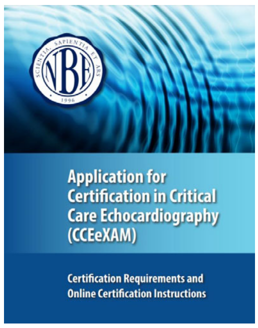
Table 4 Clinical applications of advanced critical care echocardiography

Clinical settings	Goal of advanced CCE
1. Circulatory failure (sustained hypotension, shock)	Identify main mechanism(s)
2. Cardiac arrest	
a. During resuscitation	Identify a reversible cause
b. After successful resuscitation	Identify a potential cause of cardiac arrest and the mechanism of subsequent circulatory failure
3. Acute respiratory failure	
a. Severe hypoxemia with bilateral radiological infiltrates	Distinguish between cardiogenic pulmonary edema and ARDS, identify the origin of pulmonary edema
b. ARDS	Identify acute cor pulmonale Identify consequences of ventilator settings
c. Decompensated chronic respiratory failure	Identify a cardiac cause of decompensation, chronic cor pulmonale, pulmonary hypertension
d. Weaning failure from the ventilator	Identify a cardiac cause
e. Unexplained sustained hypoxemia	Identify an anatomical shunt
4. Specific clinical settings	
a. Suspected systemic embolism	Identify a cardiovascular source
b. Suspected acute infective endocarditis	Identify Duke's criteria and assess anatomical/functional consequences
c. Acute aortic syndrome	Identify blood extravasation and associated aortic disease
d. Severe chest trauma	Identify blood extravasation and associated cardiovascular injury
e. Circulatory assistance	Confirm adequate anatomical localization of devices Identify potential associated local complications Guide weaning
f. Brain dead donor	Identify main mechanism(s) of hemodynamic instability Identify cardiovascular disease Evaluate suitability for organ donation

Historique | Spécificités | Formation | Impact thérapeutique | Nouvelles techniques | Conclusion

European Diploma in advanced critical care EchoCardiography (EDEC)





Ne pas tout confondre !!!

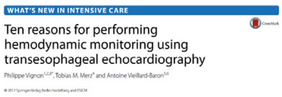
- Plusieurs types d'appareils pour des usages différents
- Améliorations technologiques incessantes (miniaturisation)
- A impulsé la distinction d'un niveau « basique »
- L'échocardiographie ne doit rester qu'un outil !!
- Choisir la déclinaison adaptée au patient :
  - Stéthoscope ultrasonique
  - ETT ou ETO
  - Modes « avancés » (Speckle tracking, 3D…) : recherche clinique.

Stéthoscopes ultrasoniques : *Point-Of-Care echocardiography* (niveau basique)

- Bidimensionnel et Doppler couleur
- Pas de Doppler spectral ni tissulaire
- Mesures 2D uniquement

2011

2017

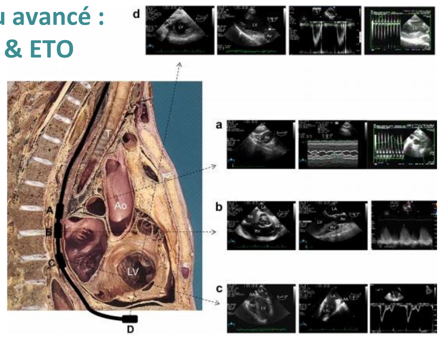

WHAT'S NEW IN INTENSIVE CARE

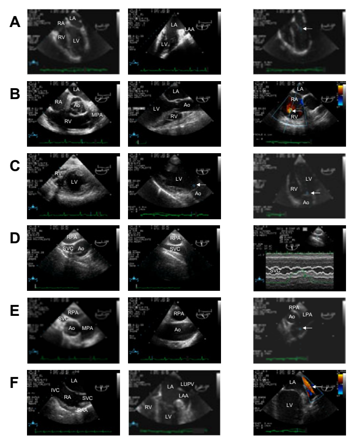
Ten reasons for performing hemodynamic monitoring using transesophageal echocardiography

Philippe Vignon[1,2,3*], Tobias M. Merz[4] and Antoine Vieillard-Baron[5,6]

© 2017 Springer-Verlag Berlin Heidelberg and ESICM

Niveau avancé : ETT & ETO





Transesophageal 4- and 2-chamber views:
Hemodynamics: LVEF, mitral Doppler pattern, TDI of mitral annulus, paradoxical septal motion, RV size, LVOT dynamic obstruction
Other information: RWMA, LV remodeling, mitral/tricuspid valvulopathy, pericardial disease, PFO

Transesophageal ~40° and ~120° views:
Hemodynamics: LVOT diameter/surface, maximal Doppler velocity of tricuspid regurgitation
Other information: aortic valvulopathy, RV function, RV infundibulum, pulmonary regurgitation, coronary arteries, aortic dissection

Transgastric short- and long-axis (& deep) views:
Hemodynamics: LVFAC, velocity time integral of LVOT Doppler velocities, paradoxical septal motion, LVOT dynamic obstruction
Other information: RWMA, LV remodeling, aortic/mitral valvulopathy, pericardial disease

Transesophageal views of great vessels 1- short- and long-axis views of SVC:
Hemodynamics: respiratory variations of SVC
Other information: proximal pulmonary embolus (RPA), abnormal ascending aorta

Transesophageal views of great vessels 2- short- and long-axis views of PA:
Hemodynamics: Doppler pattern of PA blood flow
Other information: proximal pulmonary embolus (right or left PA), abnormal ascending aorta

Transesophageal atrial views (bicaval and LSPV):
Hemodynamics: pulmonary vein Doppler pattern
Other information: atrial dilatation, PFO, bulging of interatrial septum, thrombus in LAA or in PFO, mitral regurgitation in pulmonary veins

ETT ou ETO ?

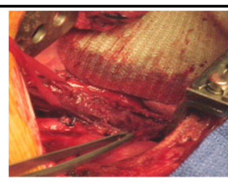
Si ETO : toujours commencer par une ETT pour guider l'examen (sauf BO)

Favors transthoracic echocardiography	Favors transesophageal echocardiography
Versatility, **strictly non invasive**, availability, no contra-indication (even in spontaneously breathing patients)	Consistent **high imaging quality**, **reproducibility** and stability of imaging planes (especially in ventilated patients)
Assessment of **superficial** anatomical structures (apical thrombus, pericardial space, inferior vena cava)	Assessment of **deep** anatomical structures (great vessels, base of heart, mediastinum, prosthetic valves, atria and appendages)
Optimal alignment of Doppler beam with transvalvular blood flows (mitral, aortic and tricuspid valves), **and abnormal jets** (valvulopathy, left ventricular outflow tract obstruction)	Precise identification of the **mechanism of certain native or prosthetic valve dysfunctions** (eccentric mitral regurgitation, prosthetic valve dysfunction) Identification of **intracardiac shunts**
Evaluation of **pulmonary artery pressure** (tricuspid and pulmonary regurgitant jets)	Identification of **great vessels diseases** (proximal pulmonary embolism, spontaneous or traumatic acute aortic conditions)

Vignon P. In: Critical Care Ultrasound. P Lumb and D Karakitsos (Eds). Elsevier 2014

Tolérance de l'ETO ?

Complication majeure : perforation oesophagienne



Good	Questionable	Contra-indications
Ventilated patients	Spontaneously breathing unstable patients	Oesophagogastric surgery
Adequate sedation	Shock potentially related to tamponade or massive pulmonary embolism in the absence of mechanical ventilation	Any relevant esophageal disease
		Excessive risk of bleeding
		Unstable neck fracture Mediastinal radiation therapy

Vignon P et al. In: Hemodynamic monitoring using echocardiography Doppler in the critically ill. Springer 2011

Tolérance de l'ETO

- Respect des contre-indications +++
- Introduction de la sonde d'ETO sous contrôle de la vue (ventilés)
- Hütteman et al. : 2 504 ETO en réanimation ; 2,6% complications
- Daniel et al. : 10 419 ETO en cardiologie (multicentrique) ; 0,88% complications (1991)
- Min et al. : 10 000 ETO en cardiologie (monocentrique) ; 0,88% complications et 0,03% de perforation digestive haute (2005)
- Risque respiratoire chez les patients instables en VS +++

Historique | Spécificités | Formation | Impact thérapeutique | Nouvelles techniques | Conclusion

Diagnostic accuracy and therapeutic impact of transthoracic and transesophageal echocardiography in mechanically ventilated patients in the ICU

P Vignon, H Mentec, S Terre, H Gastinne, P Gueret and F Lemaire

Chest 1994;106;1829-1834

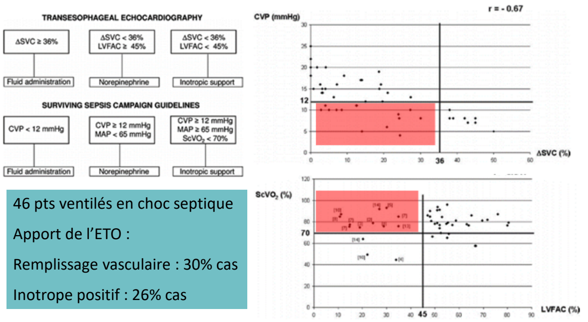
Table 2—*Therapeutic Impact of Transthoracic (TTE) and Transesophageal Echocardiography (TEE)***

Therapeutic Changes		TEE (n=128)	TEE (n=96)
Catecholamines infusion	(n=21)	10	11 (1)
Fluid challenge	(n=18)	6	12 (4)
Rapid cardiovascular surgery	(n=10)	2	8
Anticoagulation or fibrinolytic agents	(n=2)	1	1
Antibiotics for endocarditis	(n=2)	0	2
β-blockers	(n=1)	0	1
Pericardiocentesis	(n=1)	1	0
Total	(n=55)	20	35

Initial resuscitation guided by the Surviving Sepsis Campaign recommendations and early echocardiographic assessment of hemodynamics in intensive care unit septic patients: A pilot study*

Crit Care Med 2012 ; 40 : 2821-7

Koceila Bouferrache, MD; Jean-Bernard Amiel, MD; Loïc Chimot, MD; Vincent Caille, MD; Cyril Charron, MD; Philippe Vignon, MD, PhD: Antoine Vieillard-Baron, MD, PhD



46 pts ventilés en choc septique

Apport de l'ETO :

Remplissage vasculaire : 30% cas

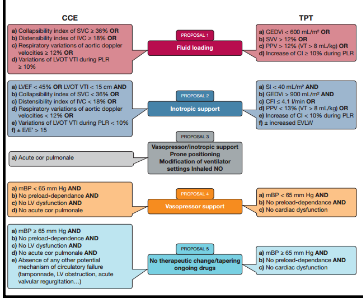
Inotrope positif : 26% cas

Hemodynamic Assessment of Patients With Septic Shock Using Transpulmonary Thermodilution and Critical Care Echocardiography

A Comparative Study

CHEST 2018; 153(1):55-64

Philippe Vignon, MD, PhD; Emmanuelle Begot, MD; Arnaud Mari, MD; Stein Silva, MD; Loïc Chimot, MD; Pierre Delour, MD; Frédéric Vargas, MD, PhD; Bruno Filloux, MD; David Vandroux, MD; Julien Jabot, MD; Bruno François, MD; Nicolas Pichon, MD; Marc Clavel, MD; Bruno Levy, MD, PhD; Michel Slama, MD, PhD; and Béatrice Riu-Poulenc, MD



- 137 patients ventilés en choc septique
- Concordance dans 2/3 des cas (lit du patient) et dans 3/4 des cas (rexperts)
- Source de discordance et cœur pulmonaire aigu (non identifiable par TDTP) identifiée par échocardiographie chez 16/37 patients (43%).

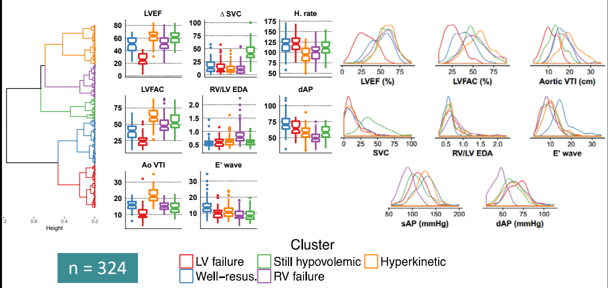
Intensive Care Med (2019) 45:657–667

https://doi.org/10.1007/s00134-019-05596-z

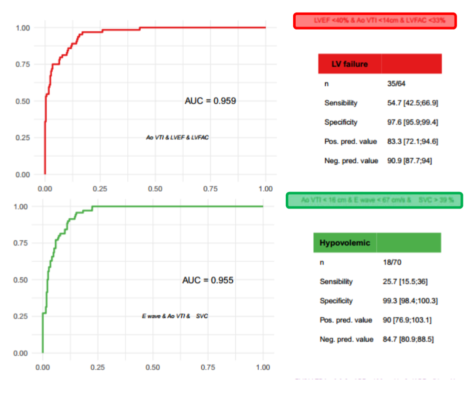
ORIGINAL

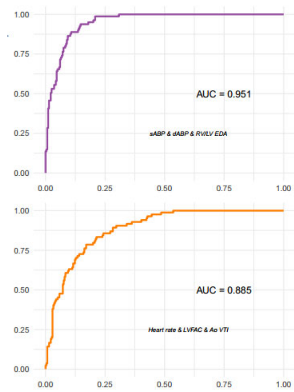
Cardiovascular clusters in septic shock combining clinical and echocardiographic parameters: a post hoc analysis

Guillaume Geri, Philippe Vignon, Alix Aubry, Anne-Laure Fedou, Cyril Charron, Stein Silva, Xavier Repessé and Antoine Vieillard-Baron



n = 324





RV/LV EDA >0.8 & sABP <100mmHg & dABP <51mmHg

RV failure	
n	24/81
Sensibility	29.6 [19.7;39.6]
Specificity	98.9 [97.7;100.1]
Pos. pred. value	88.9 [77;100.7]
Neg. pred. value	82.9 [78.8;86.9]

Ao VTI >20cm & Heart rate <106bpm & LVFAC >58%

Hyperkinesia	
n	15/84
Sensibility	17.9 [9.7;26]
Specificity	98.2 [96.6;99.8]
Pos. pred. value	75 [56;94]
Neg. pred. value	79.7 [75.4;84]

Historique | Spécificités | Formation | Impact thérapeutique | **Nouvelles techniques** | Conclusion

- Actuellement : recherche clinique
- Diffusion progressive : utilisation en pratique à moyen terme?
- Probablement plus sensibles que les modes conventionnels : bidimensionnel, temps-mouvement, couleur Doppler, Doppler spectral et tissulaire
- *Strain* (déformation myocardique), imagerie tridimensionnelle en temps réel, miniaturisation des sondes transthoraciques et transoesophagienne.

ETT ultra-miniaturisée

Intensive Care Med (2018) 44:1579–1581
https://doi.org/10.1007/s00134-018-5225-6

LETTER

Diagnostic capability of a next-generation, ultra-miniaturized ultrasound system in patients with cardiopulmonary compromise assessed using basic critical care echocardiography

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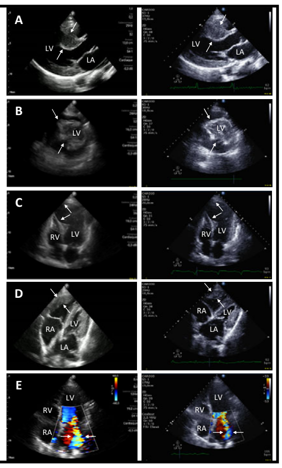

Intensive Care Med (2015) 41:1886–1894
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ORIGINAL

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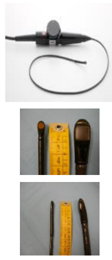
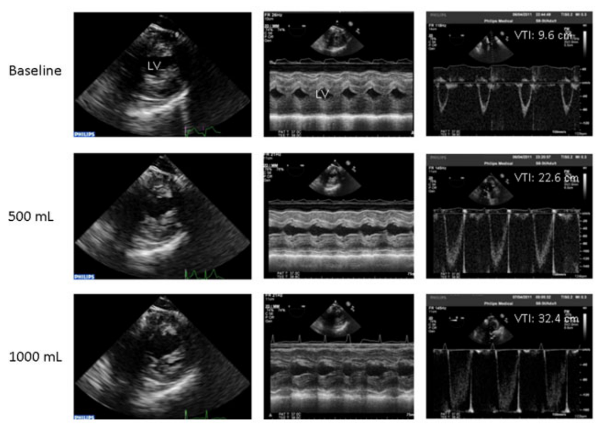
Hemodynamic assessment of ventilated ICU patients with cardiorespiratory failure using a miniaturized multiplane transesophageal echocardiography probe



- 57 patients ventilés avec défaillance cardiorespiratoire nécessitant une ETO
- ETO classique et avec la microsonde par 2 opérateurs différents, ordre aléatoire
- Comparaison des mesures et propositions thérapeutiques

Table 2 Proposed therapeutic changes directly resulting from hemodynamic assessment using the standard and miniaturized TEE probes

Therapeutic changes	Standard TEE probe (*n*)	Miniaturized TEE probe (*n*)	Kappa (95 % CI)
Fluid loading	14 (40 %)	12 (35 %)	0.80 (0.62–0.99)
Vasopressor support (initiation or increasing dose)	5 (14 %)	4 (12 %)	0.90 (0.65–1.0)
Inotropes (initiation or increasing dose)	8 (23 %)	9 (26 %)	0.90 (0.40–1.0)
Diuretics/negativation of fluid balance	2 (6 %)	3 (9 %)	0.80 (0.40–1.0)
Protective mechanical ventilation	3 (9 %)	3 (9 %)	1 (1.0–1.0)
Inhaled NO	2 (6 %)	2 (6 %)	1 (1.0–1.0)
Pericardiocentesis	0	0	1 (1.0–1.0)
Emergency cardiac valve surgery	4 (11 %)	3 (9 %)	0.80 (0.56–1.0)



Intensive Care Med (2013) 39:629–635
DOI 10.1007/s00134-012-2797-4

ORIGINAL

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A pilot study on safety and clinical utility of a single-use 72-hour indwelling transesophageal echocardiography probe

Intensive Care Med (2013) 39:629–635
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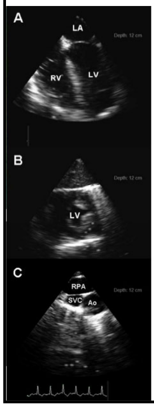
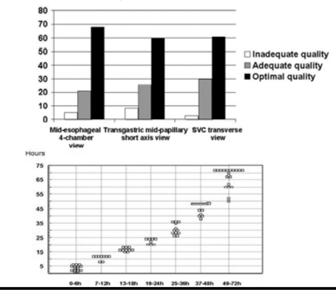
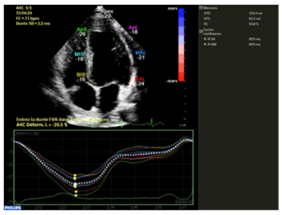


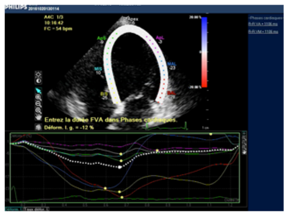
94 patients ventilés dans 4 centres



Historique | Spécificités | Formation | Impact thérapeutique | **Nouvelles techniques** | Conclusion

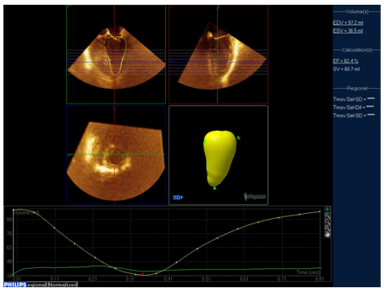
Strain ou déformation myocardique





Historique | Spécificités | Formation | Impact thérapeutique | **Nouvelles techniques** | Conclusion

Echocardiographie tridimensionnelle en temps réel



Historique | Spécificités | Formation | Impact thérapeutique | Nouvelles techniques | **Conclusion**

Editorial

Critical care echocardiography: diagnostic or prognostic?

Philippe Vignon[1,2,3]^

Table 1 Illustrative reasons potentially limiting the development of randomized controlled trials to establish the impact of CCE on patient-centered outcome

Parameters	Limitations	Alternatives
Primary criterion	Mortality is multifactorial	Consider intermediate criteria, such as organ dysfunction scores[1]
Study population	ICU patients constitute a highly heterogeneous population	Determine distinct cardiovascular phenotypes to select a homogeneous population of interest
Paradigm	CCE guides therapy, hence influences outcome	CCE identifies eligible patients for a specific, potentially beneficial therapeutic intervention
Modality of CCE	Level of competence is variable TTE and TEE are not interchangeable CCE can be used punctually or repeatedly	Use the same CCE level uniformly Adapt CCE modality to clinical setting[2] Stratify on participating centers[3]
Hemodynamic indices	Large numbers of quantitative parameters Inter- and intra-observer variability No consensual definition of relevant variations	Use simple indices (external validity) Use reproducible indices (<10%) Select meaningful, validated threshold values
Therapeutic impact	CCE-related therapeutic changes are variable CCE-confirmed therapeutic adequacy is frequent Adequate CCE interpretation may still lead to various (potentially inadequate) therapeutic changes	Focus on predefined organs support[4] Record exhaustively (severe) adverse effects[5] Combine a standardized therapeutic algorithm with CCE diagnostic work-up

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Historique | Spécificités | Formation | Impact thérapeutique | Nouvelles techniques | **Conclusion**

Vignon *Critical Care* (2018) 22:40
https://doi.org/10.1186/s13054-018-1970-8

Critical Care

EDITORIAL Open Access

What is new in critical care echocardiography?

Philippe Vignon[1,2,3]

Table 1 Main recent proceedings in the use of CCE

New developments in echocardiography in the critically ill

1. CCE is currently recommended as the first-line modality to assess patients with shock
2. CEE relies on basic and advanced levels of competence corresponding to distinct standardized educational requirements
3. CCE guides the front-line intensivist in assessing fluid requirement
4. CCE is currently recommended for the diagnosis of acute respiratory distress syndrome
5. CCE uses a simple yet robust and sound diagnostic approach
6. CCE becomes a monitoring rather than a diagnostic tool
7. CCE benefits from continuous technological refinements (e.g., speckle tracking)
8. CCE is ideally suited for guiding tailored management of unstable patients

CCE critical care echocardiography

Intensive Care Med (2019) 45:770–788
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REVIEW

A decade of progress in critical care echocardiography: a narrative review

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Key-points for CCE

1. Every new ICU physician should be able to perform basic CCE
2. Hemodynamically unstable patients should receive CCE at least for initial evaluation
3. Structured training is essential for advanced CCE training
4. Every ICU should have some physicians trained in advanced CCE
5. Every ICU should have its own TEE probe
6. Physicians trained in CCE should recognize advantages, pitfalls and limitations of TTE/TEE
7. Simulation is crucial for education and should be a standard for CCE training
8. CCE is a pivotal in the management of cardiac surgery and ECMO patients