

DIU TUSAR

Bordeaux – Lundi 15 décembre 2025

Formation à l'échocardiographie en réanimation & impact thérapeutique

Philippe Vignon

Réanimation Polyvalente
Inserm CIC 1435
CHU Limoges

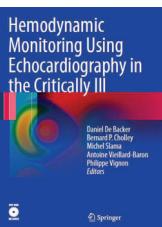


Conflit d'intérêt

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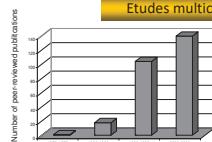
Historique

D'où vient-on ?

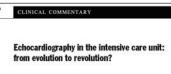
1990



Etudes monocentriques descriptives



2025



Identité de la Critical Care Echocardiography

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, Yvesick Bouillon, MD, Paul Dwyer, MD,
David Feller-Kopman, MD, Christopher Harrell, MD, Adolfo Kapit, MD,
John Konstam, MD, Michael Kellermann, MD, Steven Marder, MD,
David Lieberman, MD, Eric Marini, MD, Michel Simon, MD,
and Philippe Vignon, MD

Chest 2009;135:1050-60

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.

Echocardiographie en Réanimation

Echocardiographie en Cardiologie

Indication principale : insuffisance circulatoire et/ou respiratoire

Réalisation au lit du patient par le réanimateur

Interprétation en temps réel par le médecin réanimateur

Guide immédiatement la démarche diagnostique de pathologie aiguë ou chroniques décompensées

Disponibilité permanente 24/7

Patients fréquemment ventilés (interactions cardiopulmonaires)

Echocardiographie transoesophagienne fréquemment requise et facile à réaliser sous sédatation (ventilation mécanique)

Utilisation fréquente d'une évaluation ciblée

Évaluation qualitative, semi-quantitative ou quantitative utilisant des paramètres simples et reproductibles

Impact thérapeutique immédiat (y compris indication chirurgicale)

Evaluations répétées voire monitoring, suivi à court terme

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

ICM Antonelli 2007

ICM Cecconi 2014

Hemodynamic monitoring

-We do not recommend further hemodynamic assessment (such as assessing cardiac function) to determine the type of shock if the initial shock type does not lead to a clear diagnosis. *Ungraded best practice*

-We suggest that, when further hemodynamics assessment is indicated, it should be performed rapidly to initially evaluate the type of shock as opposed to more elaborate fluid resuscitation. Level 2 (weak)

(B)

-We do not recommend the routine use of the pulmonary artery catheter for patients in shock. Level 1: QoE: high (A)

-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 inotropic agents in patients who 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)

(D)

-We suggest the use of sequential evaluation of cardiac function in shock. *Statement of fact*

-We do not recommend the routine use of transpulmonary arterial thermodilution in patients with severe shock except in the case of associated acute respiratory distress syndrome. Level 2: QoE: low (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 except in the case of associated acute respiratory distress syndrome. Level 2: QoE: low (C)

-We recommend that less invasive devices are used instead of the pulmonary artery catheter whenever possible, have been validated in the context of patients with shock. *Ungraded best practice*

Conference Reports and Expert Panel

Marcello Curreri
David De Backer
Massimo Antonelli
Rinaldo Bellomo
Jan Balik
Christian Boer
Massimo Cereda
Alexandre Mebazaa
Michael J. Reinhart
Jean Louis Vincent
John W. Watson
Andrew Rhodes

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

2025

Intensive Care Med (2023) 31:1871–1912
https://doi.org/10.1007/s00386-023-02182-z

CONFERENCE REPORTS AND EXPERT PANEL

ESICM guidelines on circulatory shock and hemodynamic monitoring 2025

Author Manuscript ■ Antonio Mennini¹, Massimiliano Giroletti¹, Ian Barker^{1,2}, Nada Alsaif³, Mauro Ceccarelli⁴, Giacomo Cappelli⁵, Daniel De Backer⁶, Vania Kaneko Edou⁷, Laura Evans⁸, Hernán Hernández⁹, Oliver Hunsicker¹⁰, Can Ince¹¹, Thomas Kaufmann¹², Bruno Levy¹³, Mario L. N. G. Malbrain^{14,15}, Alexandre Melbataz¹⁶, Sheila Naiman Moulia¹⁷, Marlies Ostermann¹⁸, Michael R. Pinsky¹⁹, Bend Søgaard²⁰, Marta Sutti²¹, Mervyn Singer²², Jean-Louis Teboul²³, Antoine Velissaris Soukiazis²⁴, Jean-Louis Vincent²⁵, and Michael A. Cheifetz²⁶

HAEMODYNAMIC MONITORING ■ SUMMARY OF CLINICAL QUESTIONS AND RECOMMENDATIONS

ECHOCARDIOGRAPHY ■ SUMMARY OF CLINICAL QUESTIONS AND RECOMMENDATIONS

PRO: Physician-Performed Ultrasound: The Time Has Come for Routine Use in Acute Care Medicine
P. Vignon, MD, PhD
Anesth Analgesia 2012

DIU TUSAR
Field of competence
Number of physicians involved

EXPERT LEVEL CCE
Comprehensive examination (TTE and TEE) with self-sufficiency in assessing complex pathophysiology with cardiovascular complications, acute pericardial effusion, and evidence of fluid loading/unloading, i.e., oxygen saturation and air, EPMAC, acute cor pulmonale, pulmonary artery pressure, RV collapse in-trast or extrapulmonary, BT, pericardial effusion, and thromboembolic disease. TTE: trans-thoracic echocardiography; TEE: trans-esophageal echocardiography.

BASIC LEVEL CCE
Globalized examination (mainly TTE): global LV size and function, homogeneous/heterogeneous LV contraction pattern, global RV size and function, pericardial fluid and tamponade, PVC size and frequency, variation, color Doppler, qualitative assessment of severe valvular regurgitation.

Table 4 Clinical applications of advanced critical care echocardiography

Clinical settings

- 1. Circulatory failure (sustained hypotension, shock)
 - a. During resuscitation
 - b. After successful resuscitation
- 2. Acute respiratory failure
 - a. Severe hypoxemia with bilateral radiological infiltrates
 - b. ARDS
 - c. Decompensated chronic respiratory failure
 - d. Weaning failure from the ventilator
- 3. Specific clinical settings
 - a. Suspected systemic embolism
 - b. Suspected acute infective endocarditis
 - c. Acute aortic syndrome
 - d. Severe chest trauma
 - e. Circulatory assistance
- 4. Brain dead donor

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EXPERT → ADVANCED → BASIC
Competence in Basic Critical Care Echocardiography

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

Paul H. Meyer, MD, Yvesick Bouillon, MD, Peter Doolan, MD, David J. Finsen, MD, Michael J. Fischbach, MD, John Gattinoni, MD, Antonio Vieillard-Baron, MD, Olivier Adre, MD, David L. Angus, MD, Michael Mory, MD, Michel Stone, MD, and Philippe Vignon, MD

Intensive Care Med (2011) 37:1077–1083
DOI 10.1007/s00386-011-2246-9
EXPERT PANEL

2009

2011
Expert Round Table on Ultrasound in ICU

International expert statement on training standards for critical care ultrasonography
CONFERENCE REPORTS AND EXPERT PANEL

2014
Expert Round Table on Echocardiography in ICU

International consensus statement on training standards for advanced critical care echocardiography
CONFERENCE REPORTS AND EXPERT PANEL

Historique → **Formation**

International expert statement on training standards for critical care ultrasonography
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).

DIU TUSAR :
100 ETT
50 ETO vues
(25 ETO réalisées)

1. Theoretical program:
Course design should include specific learning goals as described in the ACCPSBRI competence statement [14]. The minimum number of hours for course design (estimated at 100 h) should be distributed evenly 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 mainly supervised by an experienced supervisor. This suggests that 150 fully supervised TTE studies and 50 fully supervised TEE studies are needed for training. Trainees require experience 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 competency in advanced CCE. 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 under supervision, images acquired, and interpreted, image interpretation, and the reports are co-signed by trainee and supervisor to attest that the findings have been verified by a physician who is qualified in advanced CCE.

ORIGINAL

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

Philippe Vignon^{1,2,3,4}, Sébastien Viala¹, Alexandre Tranter¹, Frédéric Bochet¹, Jean-Michel Boulé¹, Jean-Pierre Goubaud¹, and Antoine Vieillard-Baron¹

Intensive Care Med (2013) 39:1899–1904
DOI 10.1007/s00386-013-3162-z

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

$y = 1.07 \ln(x) + 1.745$

$> 31 \text{ ETO supervisées sur 6 mois}$

30±9 vs 36±7 ETT (p=0,01) sur 6 mois

European Diploma in advanced critical care EchoCardiography (EDEC)

100 ETT et 35 ETO supervisées

Learning Components
Diploma Logbook Exam

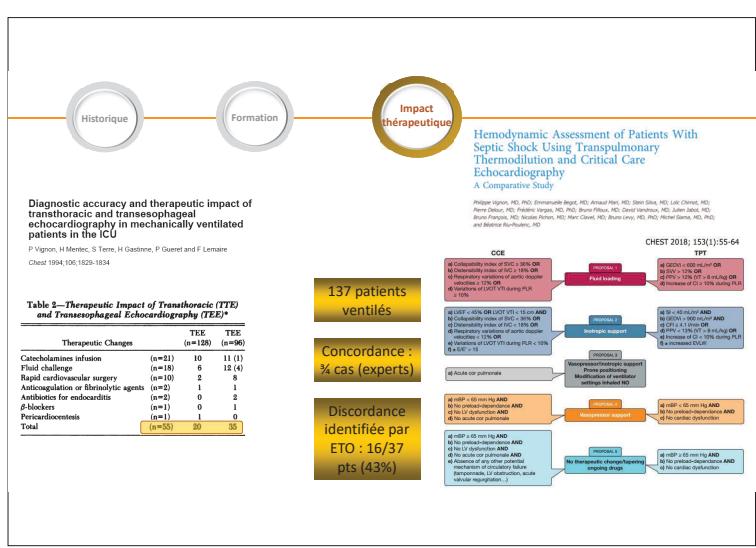
Examination
Written Practical reporting OSCE Diploma

24 months to complete

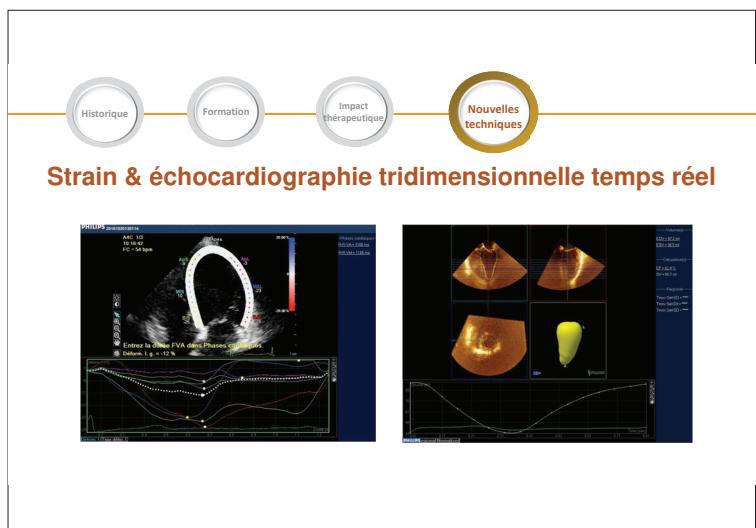
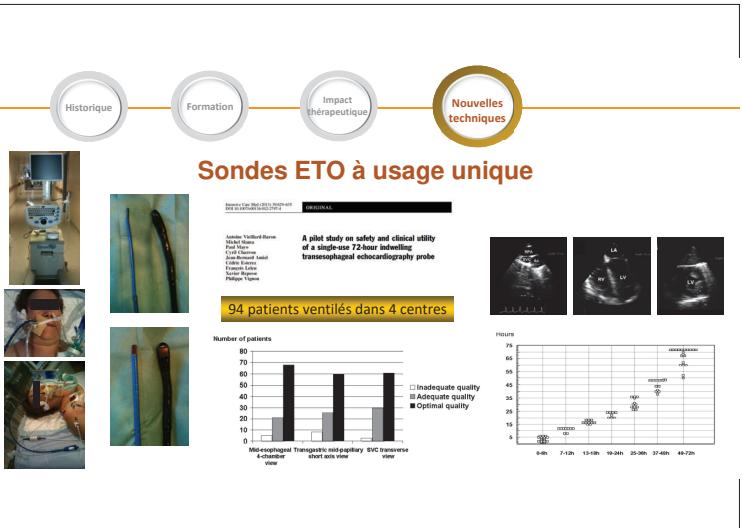
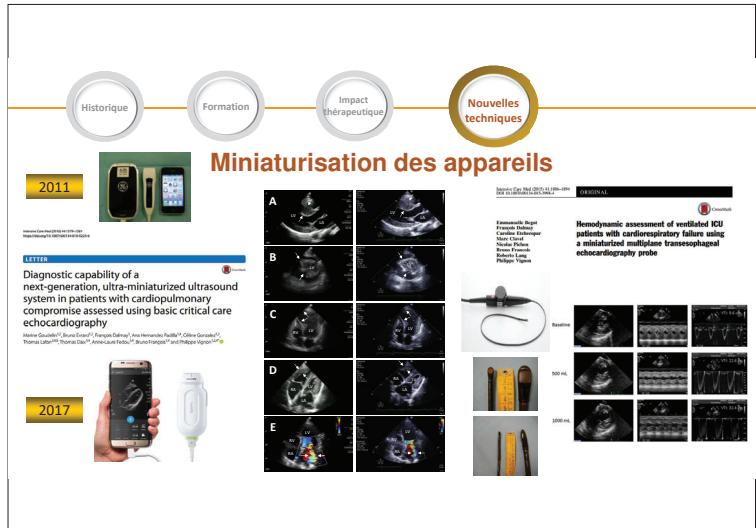
National Board of Certification (NBB)

Application for Certification in Critical Care Echocardiography (CCeXAM)

Certification Requirements and Online Certification Instructions



Year	Title	Project of ECR-EPIC patient management and the ECR-WHO registration from Helsinki										Impact of PDI	
		Year	Study	Design	Sample (n)	Recruitment	Baseline	Intervention	Control	Follow-up	Completion	Registration	Impact
1996 ²	Albert ²	8	1096	46	121	CELE	N/A	N/A	22	98 ^a	N/A	80	25
1997 ³	Albert ³	8	1095	45	121	CELE	N/A	N/A	65	N/A ^a	0	45	15
1998 ⁴	Chaitzstein ⁴	8	1994	59	113	CELE/GRD	N/A	N/A	65	N/A ^a	45	26	18
1999 ⁵	Albert ⁵	8	2002	46	598	CELE/GRD	N/A	N/A	42	99 ^a	2	55	20
2000 ⁶	Albert ⁶	8	1992	25	121	CELE/GRD	N/A	N/A	40	N/A	0	37	12
2001 ⁷	Albert ⁷	8	2002	46	598	CELE/GRD	N/A	N/A	65	N/A ^a	0	77	22
2002 ⁸	Albert ⁸	8	1992	25	121	CELE/GRD	N/A	N/A	40	N/A	0	46	12
2003 ⁹	Albert ⁹	8	1999	14	206	CELE	N/A	N/A	23	N/A	N/A	47	22
2004 ¹⁰	Albert ¹⁰	8	2003	25	262	CELE	N/A	N/A	50	97 ^a	0	52	12
2005 ¹¹	Albert ¹¹	8	1995	41	76	CELE/GRD	N/A	N/A	44	60 ^a	6	88	35
2006 ¹²	Albert ¹²	8	1994	41	77	CELE/GRD	N/A	N/A	27	100 ^a	0	N/A	35
2007 ¹³	Albert ¹³	8	1996	24	51	CELE/GRD	N/A	N/A	67	N/A ^a	5	64	18
2008 ¹⁴	Albert ¹⁴	8	1998	24	51	CELE	N/A	N/A	53	N/A	10	6	2
2009 ¹⁵	Albert ¹⁵	8	1999	12	51	SCD/CELE/GRD	N/A	N/A	59	N/A ^a	58	N/A	24
2010 ¹⁶	Albert ¹⁶	8	1990	10	62	CELE/GRD	N/A	N/A	56	N/A ^a	5	44	N/A
2011 ¹⁷	Albert ¹⁷	8	1995	7	103	CELE/GRD	N/A	N/A	51	N/A	1	78	44
2012 ¹⁸	Albert ¹⁸	8	1995	10	123	CELE/GRD	N/A	N/A	100	N/A	0	30	14
2013 ¹⁹	Albert ¹⁹	8	1994	8	101	CELE/GRD	N/A	N/A	22	84 ^a	4	73	20
2014 ²⁰	Albert ²⁰	8	1994	8	101	CELE/GRD	N/A	N/A	81	100 ^a	2	60	12
2015 ²¹	Albert ²¹	8	1994	12	102	CELE/GRD	N/A	N/A	86	100 ^a	0	97	44
2016 ²²	Albert ²²	8	1994	12	102	CELE/GRD	N/A	N/A	22	N/A ^a	0	95	8
2017 ²³	Albert ²³	8	1994	12	102	CELE/GRD	N/A	N/A	96	N/A ^a	0	95	45
2018 ²⁴	Albert ²⁴	8	1994	12	102	CELE/GRD	N/A	N/A	24	N/A ^a	0	95	45
2019 ²⁵	Albert ²⁵	8	1994	12	102	CELE/GRD	N/A	N/A	96	N/A ^a	0	95	45
2020 ²⁶	Albert ²⁶	8	1994	12	102	CELE/GRD	N/A	N/A	24	N/A ^a	0	95	45



Formation & impact thérapeutique

- ❖ L'échocardiographie en réanimation est **reconnue** avec ses **spécificités**
 - ❖ Elle doit être **réalisée et interprétée** par le réanimateur pour l'intégrer dans la prise en charge
 - ❖ Elle est recommandée en **1^{ère} intention** pour **l'évaluation hémodynamique** du patient choqué
 - ❖ Elle est utilisée de manière **répétée** (monitoring) **plus que ponctuelle** (diagnostic)
 - ❖ Elle évalue **l'efficacité** et la **tolérance** de l'intervention thérapeutique (ex, remplissage vasculaire)
 - ❖ Elle identifie les limites de techniques de monitoring aveugles (thermodilution transpulmonaire)
 - ❖ L'ETO est fondamentale en post-opératoire de chirurgie cardiaque et en cas d'ECMO.