Département universitaire de cardiologie

Hôpital Saint Philibert - GHICL

La formation des internes et des médecins non cardiologues en échocardiographie

Pr Sylvestre MARECHAUX

Groupement des Hôpitaux de l'Institut Catholique de Lille

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GROUPEMENT DES HÔPITAUX DE L'INSTITUT CATHOLIQUE DE LILLE

UNIVERSITÉ CATHOLIQUE DE LILLE

FACULTÉ DE MÉDECINE & MAÏEUTIQUE

La formation des internes et des médecins non cardiologues

- Deux problématiques:
  - Qui: internes (de cardiologie), non cardiologues (internes ou non)
  - Quoi: échocardiographie

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Qui fait quoi?

Table 2 **Different types of ultrasound examinations**[9–16]

Ultrasonic studies	
Standard or conventional echocardiography	A complete and comprehensive echocardiographic examination, including morphological and functional assessment performed by an operator fully trained in echocardiography, which acquires a well-defined data set
Emergency echocardiography	A standard/conventional echocardiogram performed in emergency environments in the assessment of patients with unstable cardiovascular diseases
Goal-oriented echocardiography	A targeted echocardiographic examination performed by an operator fully trained in echocardiography attempting to obtain an answer to a specific, often critical and frequently complex clinical dilemma
Point-of-care ultrasonography (POCUS)	A goal-oriented, limited ultrasound examination, extending physical examination performed in any body structure and environment with a predefined limited protocol(s)
Focused cardiac ultrasound (FoCUS)	A specific type of 'POCUS' applied to the heart, as an extension of the clinical examination, by an operator not necessarily trained in comprehensive echocardiography, but appropriately trained in FoCUS, usually responsible for decision making and/or treatment

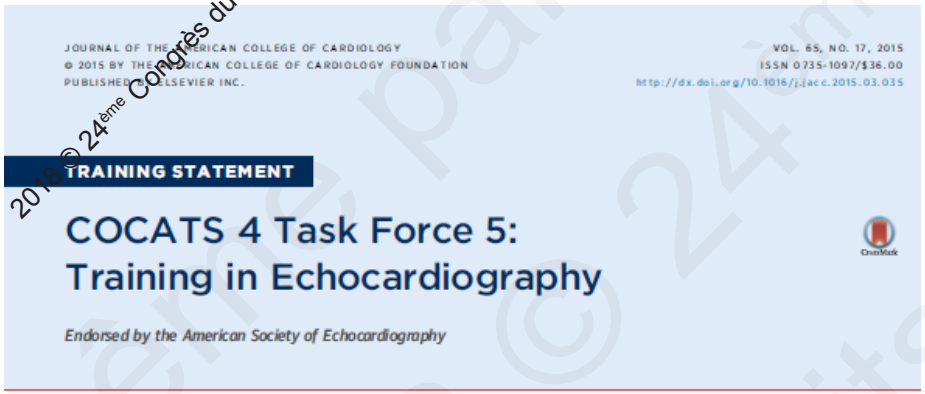
Cardim et al, Eur Heart J CVI, 2018

The EACVI 2018 position statement on the use of handheld ultrasound devices

Objectifs de formation : écho conventionnelle

Internes de cardiologie

Mais aussi autres spécialités (investissement)



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TRAINING STATEMENT

COCATS 4 Task Force 5: Training in Echocardiography

Endorsed by the American Society of Echocardiography

European Journal of Echocardiography (2009) 10, 893–905
doi:10.1093/ejechocard/jep151

EAE RECOMMENDATIONS

European Association of Echocardiography recommendations for training, competence, and quality improvement in echocardiography

Bogdan A. Popescu (Chair)[1]*, Maria J. Andrade (Co-Chair)[2], Luigi P. Badano[3], Kevin F. Fox[4], Frank A. Flachskampf[5], Patrizio Lancellotti[6], Albert Varga[7], Rosa Sicari[8], Arturo Evangelista[9], Petros Nihoyannopoulos[10], and Jose L. Zamorano[11] on behalf of the European Association of Echocardiography

Document Reviewers: Genevieve Derumeaux[a], Jaroslaw D. Kasprzak[b], and Jos R.T.C. Roelandt[c]

Objectifs de formation en échocardiographie conventionnelle

Table 1 Basic knowledge for competence in echocardiography
Ultrasound physics and biological effects
Principles of echocardiographic image formation and blood flow/ tissue velocity measurements
Machine settings and instrumentation handling for an optimal image quality
Normal cardiovascular anatomy, including possible normal variants
Pathological changes in cardiovascular anatomy in different disease states
Normal cardiovascular physiology and fluid dynamics of normal blood flow
Pathological changes in blood flow in different disease states
Indications, contraindications, and appropriateness criteria
Alternative diagnostic techniques for any given situation
Potential complications (e.g. for TEE, stress echo, and contrast procedures)

2 niveaux de compétence:

- Basique: faire de façon indépendante une ETT standardisée, stockée et avec un CR structuré; 6 mois temps plein recommandé; Objectif de passer l'accréditation personnelle de l'EACVI en ETT
- Avancée: ETT spécialisées (3D, ETO, stress, valvulopathies complexes, CRT, strain, cardiomyopathies, structurel)

Popescu et al, Eur Journal of Echocardiography, 2009

Objectifs de formation en échocardiographie conventionnelle

Table 2 Training requirements to achieve basic and advanced level of competence

Echocardiographic technique	Minimum number of examinations performed to become competent	Level of competence	Minimum number of examinations performed/year to maintain competence
TTE	350 (basic)	III	Reasonable exposure
	750 (advanced)	III	100[a]
TEE	75 (advanced)	III	50
Stress echocardiography	100 (advanced)	III	100

Level III, ability to independently perform the procedure (unsupervised).
[a]Details from reference 32.

L'EACVI insiste sur l'importance du case mix +++

Popescu et al, Eur Journal of Echocardiography, 2009

Objectifs de formation en échocardiographie conventionnelle

Table 3 Case-mix for basic-level training in transthoracic echocardiography

Cardiac disease/clinical scenario	Knowledge and skills to be acquired
Valvular heart diseases	
Aortic stenosis	Display views for the diagnosis
Aortic regurgitation	Recognition of diagnostic features
Mitral stenosis	Evaluation/quantification of severity
Mitral regurgitation	Distinction between chronic and acute lesions (regurgitant lesions)
Tricuspid stenosis	Evaluation of the consequences on the size, geometry, and function of the cardiac chambers
Tricuspid regurgitation	Criteria and timing for intervention, amenability for surgical repair, and suitability for
Pulmonary stenosis	percutaneous intervention
Pulmonary regurgitation	Echocardiographic (2D and Doppler) findings of normal function and malfunction of biological and
Prosthetic valves	mechanical valves
	Judge the need for complementary diagnostic approaches
	Define the need for regular follow-up studies
Ischaemic heart disease	
Myocardial infarction	Recognition of the signs and consequences of myocardial ischaemia and infarction
Ischaemic cardiomyopathy	Localize segmental wall motion abnormalities in a standardized format
	Evaluation of infarct size and the amount of myocardium at risk
	Evaluation of global and regional LV systolic and diastolic function
	Diagnose mechanical complications of MI and their haemodynamic consequences
	Recognition of the prognostic implications of structural and functional parameters
Cardiomyopathies	
Dilated cardiomyopathy	Perform a complete M-mode, 2D, and Doppler examination which allows to establish the diagnosis,
Myocarditis	accurately quantify disease severity, and help to choose the proper therapeutical modality
Hypertrophic cardiomyopathy	Make the differential diagnosis of athlete's heart vs. hypertrophic cardiomyopathy
Restrictive and infiltrative	Identify patients who are appropriate candidates for cardiac resynchronization therapy
cardiomyopathies	
Heart failure	
	Outline echocardiographic features of cardiomyopathies, coronary heart disease, valvular heart disease, myocarditis, constrictive pericarditis, pulmonary hypertension, and other conditions associated with heart failure
	Identify causes of acute heart failure
	Recognize the prognostic implications of functional parameters
	Recognize typical complications in heart failure (spontaneous echo contrast and thrombus formation, pleural effusion, etc.)
Hypertension	
	Calculation of LV mass, relative wall thickness, evaluation of LV geometry
	Assessment of LV systolic function and diastolic function
	Estimation of LV filling pressures
Infective endocarditis	
Emergency echocardiography	
Simple CHDs	
Cardiac tumours and masses	
Sources of embolism	
Pulmonary embolism	
Pulmonary hypertension	
Diseases of the aorta	
Diseases of the pericardium	
Normal examinations	Not more than one-third of total studies

Level III competence in general adult TTE as recommended in the ESC Core Curriculum for general cardiologists.[8]

Popescu et al, Eur Journal of Echocardiography, 2009

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Objectifs de formation en échocardiographie conventionnelle

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TEE	75 (advanced)	III	50
Stress echocardiography	100 (advanced)	III	100

Level III, ability to independently perform the procedure (unsupervised).
[a]Details from reference 32.

Formation avancée doit être réalisée dans un laboratoire qui répond aux critères d'accréditation par l'EACVI, au mieux dans les laboratoires répondant aux critères d'accréditation avancée

Popescu et al, Eur Journal of Echocardiography, 2009

Accreditation of laboratories by the European Association of Cardiovascular Imaging (EACVI)

With their programme of accreditation for laboratories, EACVI is setting the standards in laboratory practice and patient care.

This programme is a voluntary process that must function within national and local regulations. It is designed to apply to all ESC member countries whatever their model of provision of echocardiography. This process does not provide a legal framework for practice.

Objectives:

- raise quality standards of practice and equipment
- be used as an educational tool to improve the overall quality of laboratories
- provide standards against which labs can benchmark themselves
- be used to reinforce a case for the purchase or upgrade of equipment and facilities to meet these standards

More information

Dossier assez lourd (nombre d'examens, type de machines, système d'**acquisition** et de stockage, protocoles médicaux, paramédicaux, nombre de m² des salles, publications issues du laboratoire d'échocardiographie)

Formation: réunions hebdomadaires (présentations, cas difficiles, indications, complications, **comparaisons avec les autres modalités;** formations suivies validantes au moins 1 fois par an (congrès etc…), implication dans les travaux de recherche du laboratoire

Compte rendus d'une journée tirée au sort aléatoirement

Différents niveaux selon les examens: ETT, ETO, stress echo: **standard** ou **advanced** echo lab

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More information

Rôle du formateur:

Superviser
Critiquer
Corriger
Faire participer les étudiants aux activités de recherche

Savoir laisser la main, perdre du temps

Accreditation of laboratories by the European Association of Cardiovascular Imaging (EACVI)

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More information

Standardization of adult transthoracic echocardiography reporting in agreement with recent chamber quantification, diastolic function, and heart valve disease recommendations: an expert consensus document of the European Association of Cardiovascular Imaging

Maurizio Galderisi[1]* (Chair), Bernard Cosyns[2] (Co-chair), Thor Edvardsen[3], Nuno Cardim[4], Victoria Delgado[5], Giovanni Di Salvo[6], Erwan Donal[7], Leyla Elif Sade[8], Laura Ernande[9], Madalina Garbi[10], Julia Grapsa[11], Andreas Hagendorff[12], Otto Kamp[13], Julien Magne[14], Ciro Santoro[6], Alexandros Stefanidis[15], Patrizio Lancellotti[16,17], Bogdan Popescu[18], and Gilbert Habib[19,20]

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Reporting standardisé EACVI?

A Indication for echo exam:

Name:

Date of birth:

Age (yrs):

Height (cm):

Weight (cm) : BSA(m^2):

Heart Rhythm: sinus □ other □

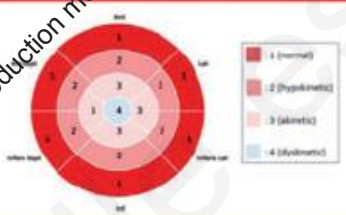
Heart Rate (bpm):

Blood Pressure (mmHg):

B Machine Type and model:

Exam quality:

C



D

Chamber	Parameter	Observed value	Normal Value
Left Ventricle	LV end-diastolic dimension (mm)		≤ 58.4 (M) ≤ 52.2 (F)
	LV end-systolic dimension (mm)		≤ 39.8 (M) ≤ 34.8 (F)
	Relative wall thickness (cm)		≤ 0.42
	LV mass/BSA (g/m^2)		≤ 102 (M) ≤88(F)
	LV EDD/BSA (mm/m2)		<75 (M) < 62(F)
	LV ESD/BSA (mm/m2)		<32 (M) <25(F)
	LV EF biplane (%)		>52 (M) > 54(F)
	LV SVi by Doppler (mL/m^2)		> 35
	LV GLS (%)		> 20
diastolic function	Transmitral E/a ratio		>0.8 or <2.0
	E velocity DT (msec)		>160 and <220
	Transmitral E velocity DT (cm/sec)		< 120
	e' velocity (septal and lateral) (cm/sec)		> 7 and > 10
	E/e' ratio		< 8
Left Atrium	Maximal LAVi (mL/m^2)		≤ 34
Estimated LV filling pressure (mmHg)			Normal, Abnormal, Indeterminate
Aortic root dimension (indexed value)	Annulus (cm/m^2)		≤ 1.4 (M &F)
	Sinus of Valsalva		≤ 1.9 (M) ≤ 2.0 (F)
	Sinotubular junction		≤ 1.7 (M & F)
	Proximal ascending aorta		≤ 1.7 (M) ≤ 1.9 (F)
Right Ventricle	Basal diameter (mm)		< 42
	Mid diameter (mm)		< 36
	RVOT proximal diameter (mm)		< 36
	RVOT distal diameter (mm)		< 28
	TAPSE (mm)		> 17
	Fractional area change (%)		< 35
	Free wall GLS (%)		> 23
Right atrium	RA volume (mL/m^2)		< 30 (M) <28 (F)
Inferior Vena Cava	IVC diameter (cm)		<2.1
	IVC collapsibility (%)		> 50
Tricuspid regurgitation (if any)	Regurgitant jet velocity (m/sec)		<2.8
	Estimated sPAP (mmHg)		<31

Pag. 1

E

Mitral valve			
Valve apparatus description (degenerative, dilation, calcification, prolapse)			
Regurgitation	EROA (mm^2)		Degree of MR
	Vena Contracta (mm)		
Stenosis	PHT (msec)		Degree of MS
	Peak and mean pressure gradient (mmHg)		
	Mitral valve area (anatomic/functional) (cm^2)		
Aortic Valve			
Valve apparatus description (degenerative, dilation, calcification, prolapse)			
Regurgitation	PHT (msec)		Degree of AR
	Vena Contracta (mm)		
Stenosis	Peak and mean pressure gradient (mmHg)		Degree of AS
	Peak velocity (m/sec)		
	Aortic valve area (anatomic/functional) (cm^2)		
Tricuspid valve			
Valve apparatus description (degenerative, dilation, calcification, prolapse)			
Regurgitation	EROA (mm^2)		Degree of TR
	Vena Contracta (mm)		
Stenosis	Mean pressure gradient (mmHg)		Degree of TS
Pulmonary valve			
Valve apparatus description (degenerative, dilation, calcification, prolapse)			
Regurgitation	PHT (msec)		Degree of PR
Stenosis	Peak pressure gradient (mmHg)		Degree of PS

F) Final Remarks

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Reporting standardisé EACVI?

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Laboratoires d'échocardiographie
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Hôpital Saint Philibert, 115 rue du Grand But, 59160 Lomme, Prise de RDV:0320225090

Echocardiographie transthoracique et échographie de stress

Age : 76 années
Date de naissance : 25/02/1942
Taille : 170.0 cm
Poids : 69.0 kg
Surf Corp : 1.80 m²
Pression sanguine (mmHg) : 168/[illegible]
Indication de l'examen : évaluation d'un rac
Date: 22/02/2018
Localisation patient: EXTERNE

Rythme cardiaque (sinusal - autre):
sinusal

Fréquence cardiaque
FC 84 BPM

Echogénicité :
bonne

Modèle d'échographe : Vivid E95 - GE

Fabricant GE Vingmed Ultrasound

WMSI=1.00

1 : Normal
2 : Hypokinétique
3 : Akinétique
4 : Dyskinétique

Ventricule gauche

Paramètre	Valeur mesurée		Valeurs de référence
Diamètre télédiastolique VG (mm)	VGd	44.9 mm	< 58.6 (H) <52.3 (F)
Diamètre télésystolique VG (mm)	VGs	23.5 mm	<38.0 (H) <34.7 (F)
Epaisseur pariétale relative (h/r)	h/r	0.72	<0.43
Ep. septum (mm)	SIVd	17 mm	
Masse VG indexée ASE (g/m²)	Masse ind VGd (ASE)	172 g/m²	<102 (H) <88 (F)
Volume télédiastolique VG indexé (ml/m²)	Volume TD du VG indexé (ml/m²)	69 ml/m²	<75(H) <62 (F)
Volume télésystolique VG indexé (ml/m²)	Volume TS du VG indexé (ml/m²)	21 ml/m²	<32 (H) <25(F)
Volume télédiastolique biplan (ml)	VG Vol tD (BP sim)	135 ml	
Volume télésystolique biplan (ml)	VG Vol tS (BP sim)	39 ml	
FE VG biplan (%)	FE (BP)	69 %	>52 (H) >54(F)
VES indexé doppler (ml/m²)	VG Véjec Ind (dop)	44 ml/m²	>35
Débit cardiaque (l/min)	VG Débit Card	7.4 l/min	
Strain longitudinal global (%)	G pic SL (Moy)	-14.9 %	<-20

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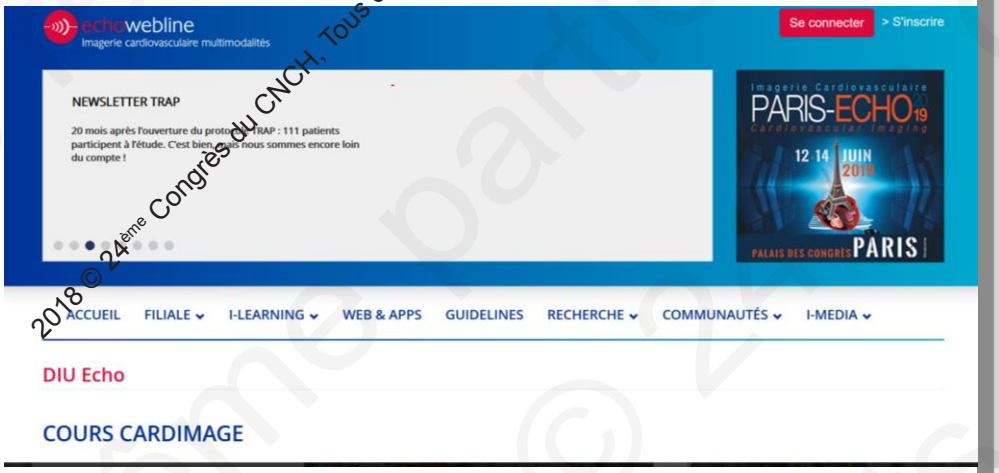
Objectifs de formation des internes

- « Self assessment »
  - Accréditation: publications, livres
  - Tutoriels: ESC, e-learning (Cardimage en France sur le site Echowebline)



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Objectifs de formation des internes

- ETO: idéalement, exposition à l'ETO périopératoire

Table 5 Knowledge and skills required for competence in transoesophageal echocardiography

Knowledge
Basic general knowledge related to echocardiography (*Table 1*)
Strengths and weaknesses of TEE for a given indication
Differential benefit compared with other imaging techniques, in particular TTE and other tomographic techniques
Indications, contraindications, risks, and complications of the TEE procedure
Infection control measures and electrical safety issues related to the use of TEE
Techniques and risks of local anaesthesia and sedation; pharmacology of involved drugs
Anatomy of the upper gastrointestinal tract with special emphasis on potential problems and hazards during oesophageal intubation
Knowledge of normal and abnormal cardiovascular anatomy on TEE, and of the typical cross-sections used
Ability to communicate examination results to the patient and to other healthcare professionals
Skills
Ability to perform a complete TTE examination
Ability to obtain a focused history of upper gastrointestinal disorders
Operation of the TEE probe and biteguard, including manipulation of the probe tip and change in imaging plane orientation
Ability to operate the echo machine, including all controls affecting image quality
Techniques of oesophageal intubation (both in ventilated and non-ventilated patients) including sedation techniques, appropriate monitoring, readiness of supportive equipment
Proficiency in cardiopulmonary resuscitation
Manipulating the probe to generate the necessary imaging cross-sections for answering specific clinical questions
Familiarity with obtaining typical sets of imaging and other data (cross-sections, Doppler data, and others) to be obtained during TEE for specific indications (e.g. search for cardiac source of embolism, prosthetic valve dysfunction, etc.), including intravenous right heart contrast injection for shunt detection
Ability to recognize anomalies of cardiac structure and function as imaged by TEE, and to recognize artefacts
Ability to perform qualitative and quantitative analyses of the echocardiographic data
Ability to produce a logical and comprehensive written report of the echocardiographic findings, including the possible clinical implications
Competence in disinfecting the probe and detecting technical defects, in particular in electrical insulation

Table 2. Advantages of simulation for competency-based medical education.

- **Advantages for training**
  - Enables repetitive practice in a safe learning environment
  - Allows experience with a wide range of clinical scenarios or pathology
  - Avoids concerns regarding patient safety and comfort
  - Compensates for inadequate patient volume
  - Reduces use of clinical resources for teaching
  - Preserves faculty time for advanced training
- **Advantages for assessment**
  - Provides feedback
  - Enables standardized testing (metrics are objective and cases are simulated)
  - Informs trainee and faculty of trainee progress
  - Saves faculty time spent recruiting and scheduling patients

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Sheehan F et al, Vascular Medecine, 2018

ETO

Table 4. Current echocardiography simulators with skill metrics.

Image source	Mode	Feedback to trainee	Metrics
Synthetic	TEE	Visual	• Economy and efficiency (time, path length, velocity, acceleration) • Probe handling fluidity and smoothness (jerk, peak, spectral arc length)
Patients	TEE and TTE	Quantitative and visual	• Angle between acquired view and anatomically correct view • Probe location: distance from correct location

TEE, transesophageal echocardiography; TTE, transthoracic echocardiography.

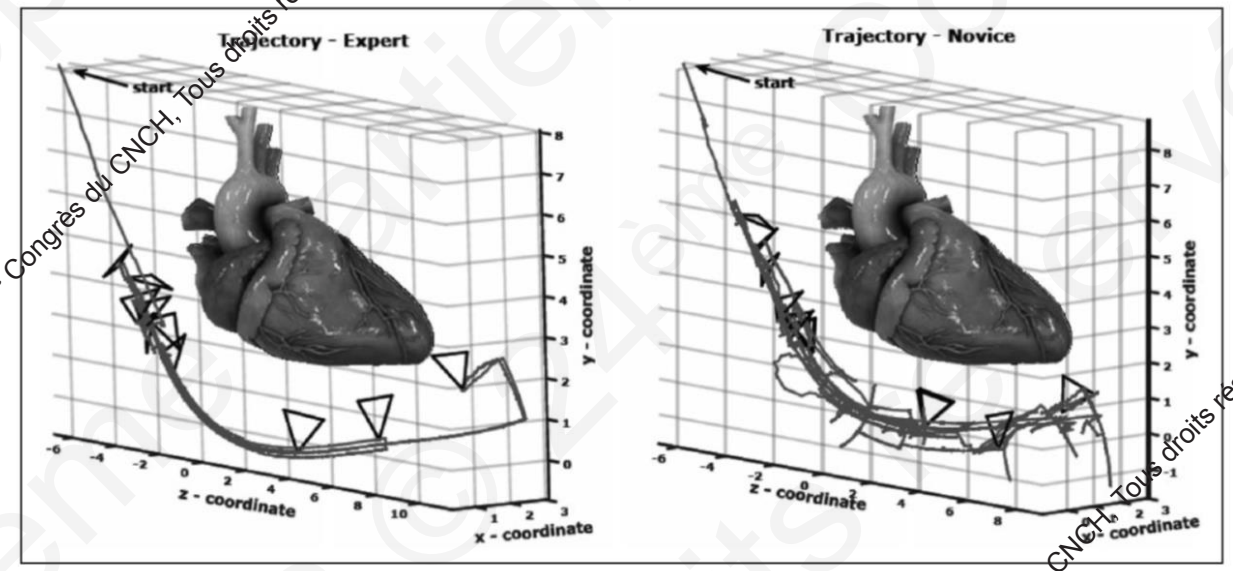

Figure 3. Kinematic metrics of skill in transesophageal echo (TEE) in the HeartWorks simulator.[61] Probe tip trajectory and depth of the transesophageal echo probe are smoother and more fluid for the expert than for the novice. Reproduced from ref. 61 (© Springer International Publishing Switzerland 2016) with permission of Springer.

Sheehan F et al, Vascular Medecine, 2018

Objectifs de formation des internes

- Stress echo:
  - Maitriser l'ETT, accreditation personnelle recommandée
  - Laboratoire à haut volume, corrélations angiographiques
  - Lecture conjointe expert / étudiant

Table 6 Staff requirements for stress echocardiography

Training requirements for performance and interpretation of stress echocardiography
Understanding the basic principles, indications, applications, and technical limitations of echocardiography
Level III training in TTE
Specialized training in stress echocardiography with performance and interpretation of 100 or more stress studies under appropriate supervision by an echocardiographer with level III of competence in stress echocardiography
Maintenance of competence in stress echocardiography
Performance and interpretation of 100 or more stress studies per year
Participation in continuing medical education in echocardiography
At least two persons are required to record and monitor stress echo studies. One should be qualified in advanced life support, the other in basic life support. A nurse should always be present to support the physician performing the test
If the study is performed by a sonographer/technician, a physician with expertise in both echocardiography and resuscitation should be always attending in case a life-threatening complication occurs

Popescu et al, Eur Journal of Echocardiography, 2009

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Objectifs de formation des internes

- Congénital
  - Anomalies communes: CIA, CIV, canal artériel, membrane sous aortique, transposition, Fallot, Ebstein, veine cave supérieure gauche
- Echo de contraste
  - Niveau d'expérience en stress echo nécessaire

Popescu et al, Eur Journal of Echocardiography, 2009

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Objectifs de formation des internes

- Preuve de la compétence:
  - Accréditation
    - » Evidence (formateur)
    - » Examen des connaissances
    - » Evaluation des pratiques (log book, case mix)

Popescu et al, Eur Journal of Echocardiography, 2009

Objectifs de formation des internes

In summary, the EAE requires candidates to undertake a supervised programme of training in a suitable echo laboratory and to demonstrate knowledge through a written examination and skill through submission of a log book of echo study reports.

Popescu et al, Eur Journal of Echocardiography, 2009

Objectifs de formation en échocardiographie conventionnelle

- Niveau 1:
  - 3 ans de formation; pas d'indépendance, ETT, exposition à ETO, stress
- Niveau 2 (minimal):
  - 3 ans de formation; examens qualifiants dans un domaine spécialisé; indépendance; ETT, ETO, stress, contraste; accréditation par l'ASE
- Niveau 3:
  - Au-delà de 3 ans, cas complexes, recherche, direction d'un laboratoire d'échocardiographie; développement de nouvelles techniques; encadrement par du niveau 3

Ryan T et al, J Am Coll Cardiol, 2015

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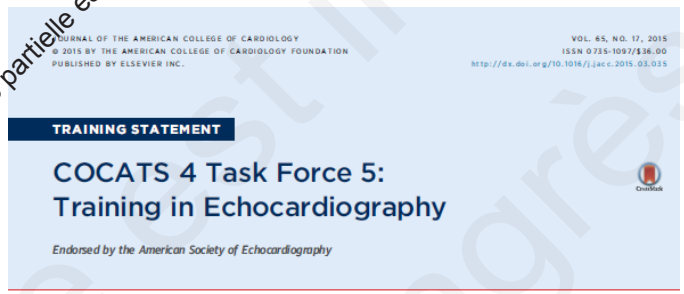
Objectifs de formation en échocardiographie conventionnelle

Objectifs, outils pour les évaluer

- **Connaissances médicales**: présentation de conférences, observation, pendant la formation
- **Prise en charge des patients, compétences techniques:** observation directe, logbook, simulation
- Fonctionnement du labo: observation directe, évaluation multisource
- Voies d'amélioration en pratique: présentation de conférences, observation directe
- Professionnalisme, canaux de communication

Ryan T et al, J Am Coll Cardiol, 2015

Objectifs de formation des internes



- Plusieurs formateurs
- Niveau d'activité: 2000 examens/an
- Accréditation du laboratoire fortement encouragée
- Implication dans l'amélioration de la qualité, compte rendu standardisé, l'amélioration des process et l'utilisation appropriée de l'examen
- Possibilité de formation en recherche (méthodologie, biostats, design des études, levée de fonds)
- Echo portables: adjonction, chez un étudiant préparé par la formation à l'échocardiographie classique
- ++++ Corrélation avec la clinique, les autres techniques, implications sur la prise en charge médicale ou chirurgicale du patient

Objectifs de formation des internes

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TRAINING STATEMENT

COCATS 4 Task Force 5: Training in Echocardiography

Endorsed by the American Society of Echocardiography

TABLE 2 Summary of Training Requirements for Echocardiography

Level	Duration of Training* (Months)	Cumulative Duration* of Training (Months)	Minimal No. of TTE Examinations Performed	Minimal No. of TTE Examinations Interpreted	TEE and Special Procedures
I	3	3	75	150	Yes†
II	3	6	150 (75 Add)	300 (150 Add)	Yes‡
III	3	9	300 (150 Add)	750 (450 Add)	Yes

*Typical duration assuming acceptable progress toward milestones and demonstrated competency. †Exposure to TEE and other special procedures. ‡Completion of Level II and additional special training are needed to achieve full competence in TEE and other special procedures.

Add = additional; TEE = transesophageal echocardiography; TTE = transthoracic echocardiography.

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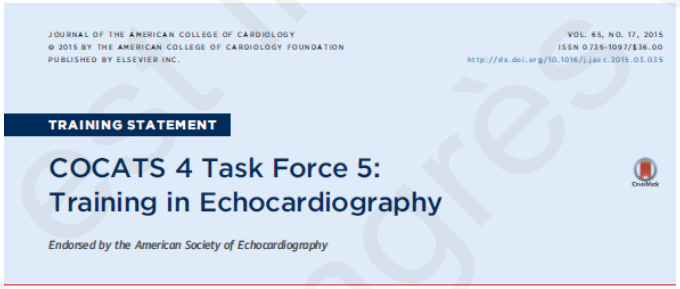
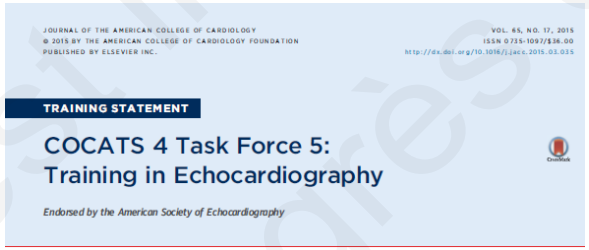
Objectifs de formation des internes



- ETO: au moins 500 examens/an dans le labo, 25 intubations, 50 examens (souvent 50 de plus nécessaires);
- Simulation +++
- ETO peropératoire: 100 ETO de plus
- ETO en salle de KT: pas de recommandation, formation dans centre à haut volume

Objectifs de formation des internes



- Stress echo:
  - Niveau 2, 100 examens
  - Interprétation, avantages, limites et risques de la technique
  - Niveau 3 pour valvulopathies, cardiomyopathies hypertrophiques, hypertension pulmonaire, viabilité myocardique
- Niveau 2 ou 3 pour le contraste (optimisation réglages etc….)
  - 3D (CIA, valvulopathies, volumes ventriculaires): niveau 2, niveau 3 pour indépendance
- Strain: niveau 3

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Objectifs de formation des médecins non cardiologues

- Peuvent être similaires à ceux d'un cardiologue
- **Niveau 1**, voire 2

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Objectifs de formation des médecins non cardiologues

European Heart Journal – Cardiovascular Imaging (2014) **15**, 956–960
doi:10.1093/ehjci/jeu081

POSITION PAPER

Focus cardiac ultrasound: the European Association of Cardiovascular Imaging viewpoint

Aleksandar N. Neskovic[1]*, Thor Edvardsen[2], Maurizio Galderisi[3], Madalina Garbi[4], Giuseppe Gullace[5], Ruxandra Jurcut[6], Havard Dalen[7,8], Andreas Hagendorff[9], and Patrizio Lancellotti[10], for the European Association of Cardiovascular Imaging Document Reviewers: Bogdan A. Popescu, Rosa Sicari and Alexander Stefanidis

Pratique encouragée par l'EACVI, mais chez des professionnels suffisamment entrainés
FoCUS différent d'échocardiographie d'urgence (où les compétences requises sont les mêmes pour les cardiologues et les non cardiologues)
Examen restreint, opérateur totalement ou non totalement autonome en echocardiographie, entrainé en FoCUS, responsable de la prise en charge

Echocardiographie FoCUS

Table 1 Clinically relevant limitations of the FoCUS when compared with comprehensive echocardiography

1. Technical inferiority of the imaging devices typically used for FoCUS examination compared with fully equipped high-end echocardiographic machines
2. Limited skills and experience of the operators
3. Typically unfavourable settings (emergencies, critically ill, time constrains)
4. Narrow list of detectable evidence-based targets
5. 'Absent/Present' or 'Yes/No' reporting style (related to 1–4)
6. Subtle/complex cardiac abnormalities (i.e. regional asynergy) difficult to assess (related to 1–4)

Table 2 Evidence-based targets of FoCUS examination and related emergency cardiovascular scenarios/conditions that might be addressed

Targets
Global LV systolic function and size
Global RV systolic function and size
Pericardial effusion
Intravascular volume assessment
Scenarios
Circulatory compromise/shock
Cardiac arrest
Chest pain
Chest/cardiac trauma
Respiratory compromise
Conditions
Ischaemic LV/RV Dysfunction
Cardiomyopathies (i.e. DCM, HCM, Takotsubo)
Myocarditis
Cardiac tamponade
Pulmonary embolism
Hypovolaemia

Neskovic et al, Eur Heart J CVI, 2014

Training en échocardiographie FoCUS

Table I **Classification of currently available echocardiographic machines according to their size and functions (modified with permission from Sicari *et al.*[5])**

Echo machines	Capabilities
Stationary high-end systems	Full range of standard echo modalities and measurements (MM, 2D, PW, CW, Colour, TDI, TEE) and advanced modalities
Mobile systems	Full range of standard echo modalities and measurements(MM, 2D, PW, CW, Colour, TDI, TEE)
Portable machines	Basic standard echo modalities and measurements (MM, 2D, PW, CW, colour)
Handheld ultrasound devices (HUD)	Limited functions (2D, Colour) and measurements package

2D, two-dimensional; Colour, colour Doppler; CW, continuous Doppler; MM, M-mode, PW, pulsed wave; TDI, tissue Doppler imaging; TEE, transesophageal echocardiography.

Cardim et al, Eur Heart J CVI, 2018

Training en échocardiographie FoCUS

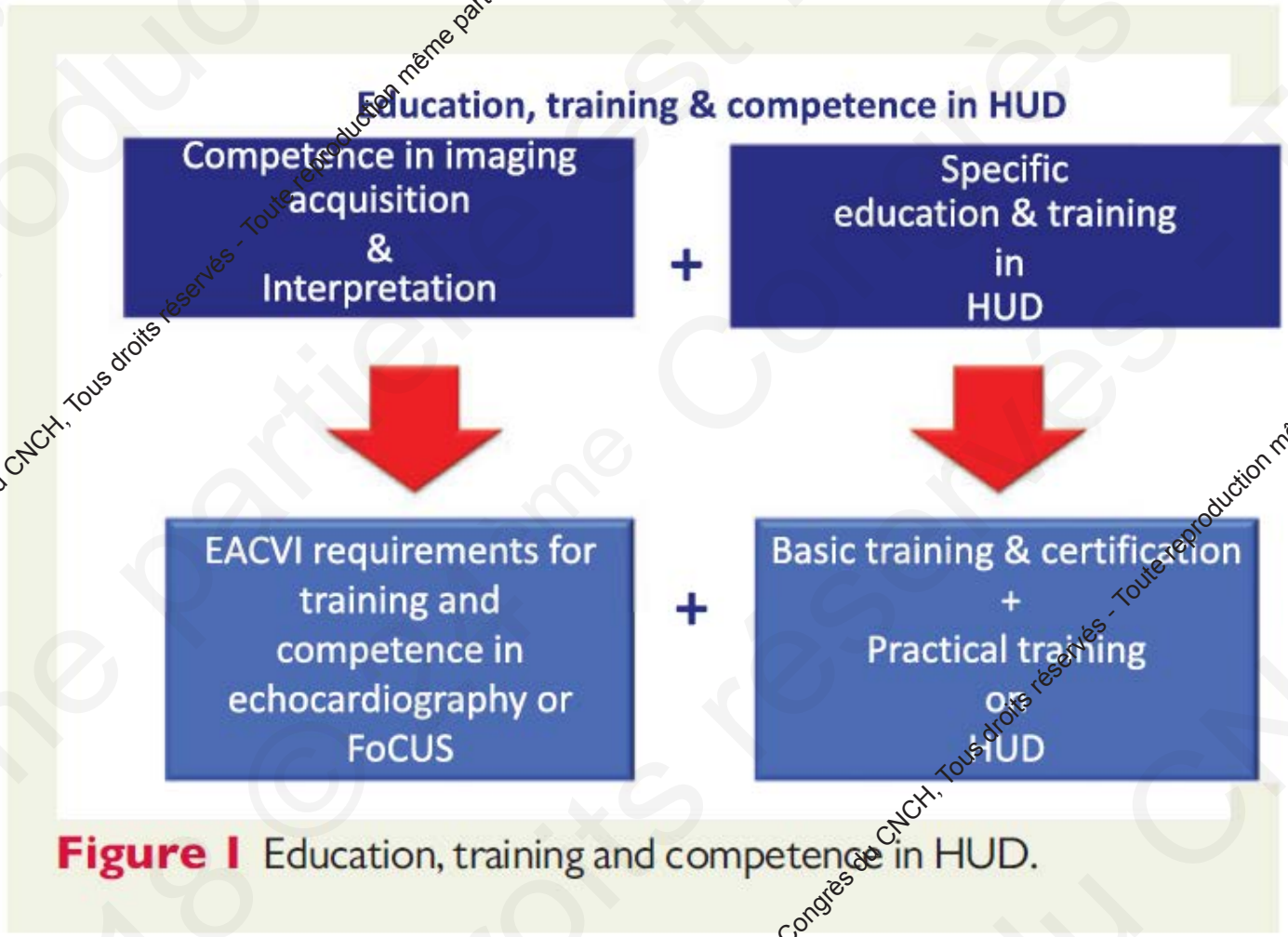

Figure 1 Education, training and competence in HUD.

Cardim et al, Eur Heart J CVI, 2018

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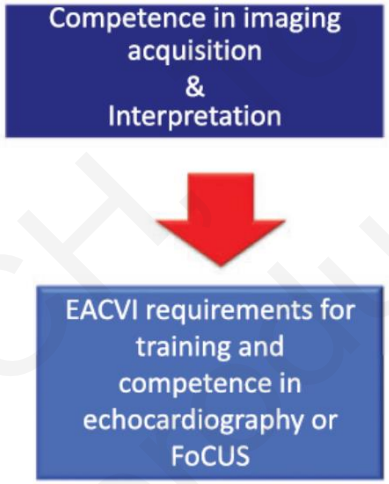


Echocardiographie FoCUS

- Différents protocoles de training existent par les différentes sociétés savantes et sont sous leur responsabilité / collaboration avec les sociétés savantes d'échocardiographie

- EACVI insiste sur la nécessité de recourir à l'échocardiographie si données complexes (valvulopathies, masses cardiaques, cinétique segmentaire)

- EACVI recommande: nombre significatif, scénarios cliniques, case mix

- Disponibilité constante des échocardiographistes

- Labo d'écho doit être le hub pour le contrôle qualité et la supervision des examens FOCUS qui ne sont que le prolongement de l'examen clinique

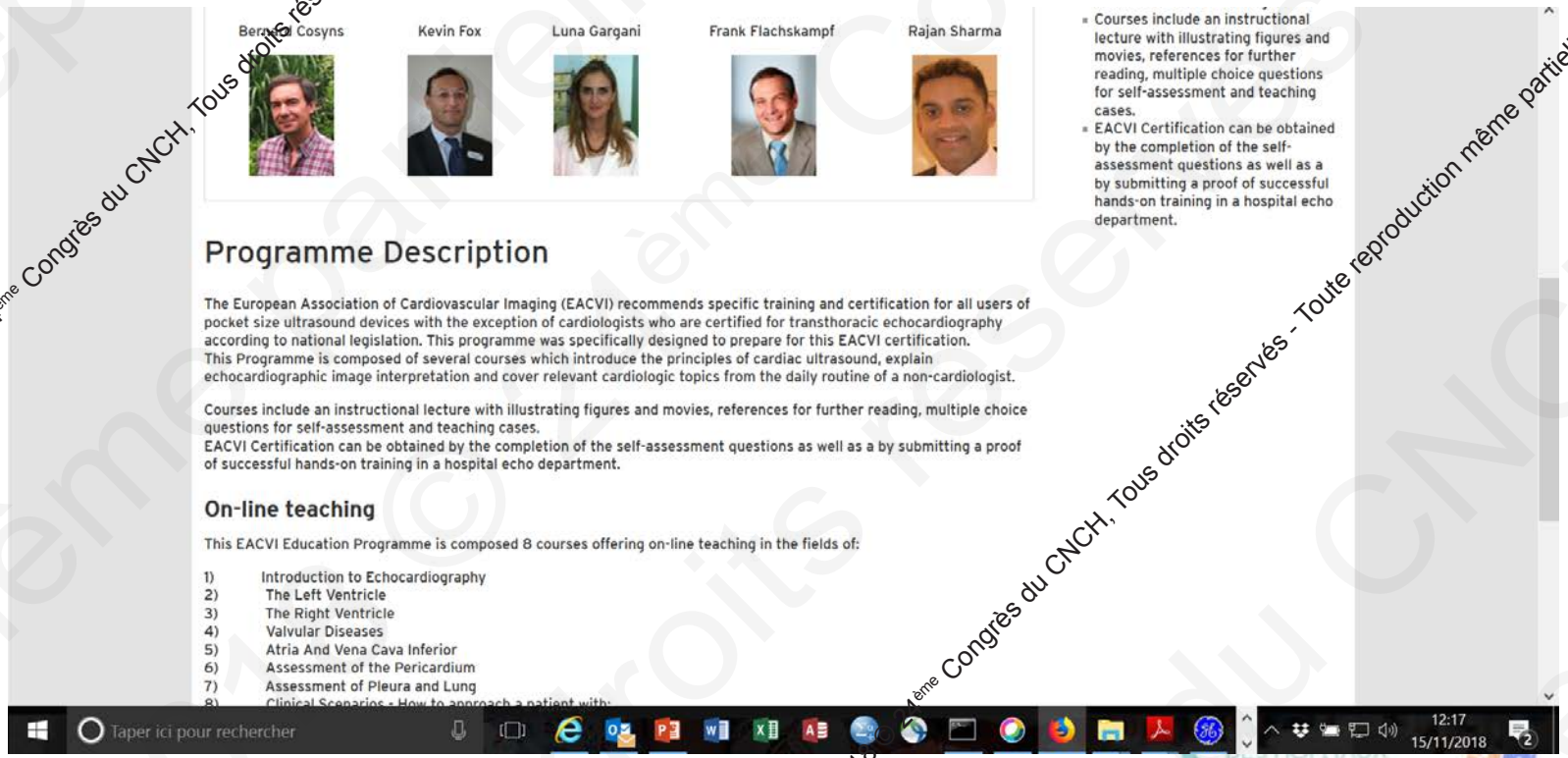
Neskovic et al, Eur Heart J CVI, 2014

Specific education & training in HUD

Basic training & certification + Practical training on HUD

Echocardiographie avec les Hand Held Ultrasound devices

- E learning: http://learn.escardio.org/eacvi-pocket-size-programme
- Workflow sur simulateur ArtWork



Neskovic et al, Eur Heart J CVI, 2014

Conclusions

- La formation en échocardiographie est exigeante, nécessité un accompagnement constant, des formateurs aguerris, des laboratoires d'échocardiographie répondant à des standards de qualité (Accréditation)
- Importance de l'évaluation des compétences des étudiants mais aussi des échocardiographistes confirmés (certification valable pour 5 ans)

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Conclusions

- Le développement des machines ultrasonores de poche est en pleine expansion
- Elles sont utilisables par tous
- Grande rigueur dans la formation des médecins non cardiologues ne bénéficiant pas de la formation complète en échocardiographie
- Développement d'outils spécifiques dans ce cadre (e-learning, simulation, etc….)

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Merci pour votre attention

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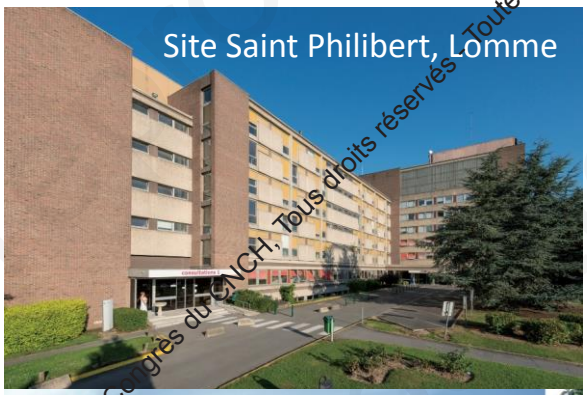

Le laboratoire d'échocardiographie du GHICL est certifié « laboratoire avancé » par l'association européenne d'imagerie cardiovasculaire (EACVI) jusqu'en 2023
https://www.escardio.org/Education/Career-Development/Accreditation/EACVI-Laboratory-accreditation/Accredited-Laboratories

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