

ETT & ETO : quelles incidences pour quels paramètres en soins critiques ?

Philippe Vignon

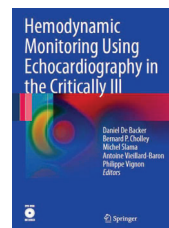
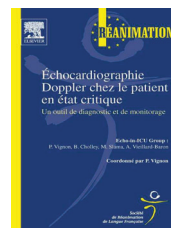
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Conflit d'intérêt

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ETT vs ETO

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

P Vignon, H Menéec, S Terre, H Gastinne, P Gueret and F Lemaire
Chest 1994;106:1829-1834

L'ETO a globalement une capacité diagnostique supérieure à l'ETT

Table 3—Transathoracic (TTE) vs Transesophageal (TEE) Echocardiographic Findings According to the Clinical Problems (n=88) in Patients Who Were Scheduled for Both Examinations (n=96)

Clinical Problem	No Superiority Over TTE	Diagnosis Ruled Out by TTE	Diagnosis Confirmed by TTE		Diagnosis Confirmed by TTE	
			Without Therapeutic Impact	With Therapeutic Impact	Without Therapeutic Impact	With Therapeutic Impact
Shock/hypotension	0	(n=10)	4	12	4	12
Endocarditis	0	(n=18)	1	10	4	3 (2)
Transmitral regurgitation of the aortic valve, acute aortic dissection	0	(n=10)	1	10	1	4 (3)
Velocisphycty or valvular prolapse assessment	0	(n=6)	1	1	1	1 (1)
Left ventricular function	0	(n=6)	2	1	3	1
Assessment of mitral regurgitation	0	(n=4)	5	1	3	1
Pulmonary hypertension, thrombus in right chambers	0	(n=5)	0	4	0	1
Systemic aortic aneurysm	0	(n=4)	0	4	0	1
Ventricular assist device	0	(n=4)	2	2	0	0
Patient forearm occlusion	0	(n=3)	2	1	0	0
Atrial compression by postoperative haematoma	0	(n=1)	1	0	0	0
Tumor of the mediastinum	0	(n=1)	0	1	0	0
	0	(n=68)	2	44	2	30

*The number of patients who underwent cardiovascular surgery based on TEE findings are indicated in parentheses.

ETT vs ETO

Si ETO, toujours commencer par l'ETT
(guide l'examen, informations complémentaires)

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)

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

ETT vs ETO

ASE GUIDELINES AND STANDARDS

Guidelines for Performing a Comprehensive
Transesophageal Echocardiographic Examination:
Recommendations from the American Society of
Echocardiography and the Society of Cardiovascular
Anesthesiologists

Rebecca T. Hahn, MD, FASE, Chair, Theodore Abraham, MD, FASE, Mark S. Adams, RECS, FASE, Charles J. Bruce, MD, FASE, Kathryn T. Glaes, MD, MBA, FASE, Roberto M. Lang, MD, FASE, Scott T. Reeves, MD, MBA, FASE, Jack S. Shumway, MD, FASE, Samuel C. Sie, MD, FASE, William Stewart, MD, FASE, and Michael H. Picard, MD, FASE, New York; *New York: Baltimore, Maryland; Baton Rouge, Louisiana; Rochester, Minnesota; Atlanta, Georgia; Chicago, Illinois; Charleston, South Carolina; London, Ontario; Canada; Cleveland, Ohio.*

J. Am. Soc. Entomol. 2013 106:621–634

Table 4 General indications for TEE

Generalization	Specific exemplars
1. Evaluation of cardiac and aortic structure and function in situations where the findings will alter management and TTE is non-diagnostic or TTE is deferred because there is a high probability that it will be non-diagnostic.	a. Detailed evaluation of the abnormalities in structures that are typically in the far field such as the aorta and the left atrium. b. Evaluation of prosthetic valve function. c. Evaluation of transcatheter absccesses (both native and prosthetic valves). d. Patients on ventilators. e. Patients with chest wall injuries. f. Patients with body habitus preventing adequate TTE imaging. g. Patients unable to move into left lateral decubitus position. h. All open heart (i.e., valvular and thoracic aortic) surgical procedures.
2. Intraoperative TEE.	a. Use in some coronary artery bypass graft surgeries. b. Oncologic surgery when patients have known or suspected cardiovascular pathology which may alter outcome. c. Guiding management of catheter-based intracardiac or transcatheter procedures including medical devices to alter appendage obliteration, and transcatheter valve procedures.
3. Guidance of transcatheter procedures	
4. Critically ill patients	a. Patients in whom diagnostic information is not obtainable by TTE and this information is essential to alter management (oblation, and transcatheter valve procedures).

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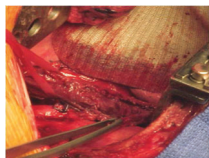
Rebecca T. Hahn, MD, FASE, Chair, Theodore Stratham, MD, FASE, Mark S. Adams, RDCS, FASE, Charles J. Brant, MD, FASE, Katherine E. Gao, MD, MBA, FASE, Roberto M. Lang, MD, FASE, Scott E. Koenigs, MD, MBA, FASE, Michael S. Swanowitz, MD, FASE, Samuel C. Sin, MD, FASE, William Stewart, MD, FASE, and Richard H. Picard, MD, FASE, New York, New York; Baltimore, Maryland; Rochester, Minnesota; Atlanta, Georgia; Chicago, Illinois; Charleston, South Carolina; Los Angeles, California; Cleveland, Ohio.

(1) See Eric Foner, *The Second Reconstruction*, 208–9.

Table 6 List of absolute and relative contraindications to transesophageal echocardiography

Relative contraindications	Relative contraindications
- Perforated viscus - Esophageal stricture - Esophageal tumor - Esophageal perforation, laceration - Esophageal diverticulum - Active upper GI bleed	- History of radiation to neck and mediastinum - History of GI surgery - Recent upper GI bleed - Barrert's esophagus - History of dysphagia - Restriction of neck mobility (severe cervical arthritis, atlantoaxial joint disease) - Symptomatic hiatal hernia - Esophageal varices - Crohn's/dysplasia, thrombocytopenia - Active esophagitis - Active peptic ulcer disease

GI, Gastrointestinal.
Modified from Hilberath et al.²⁶



Tolérance de l'ETO

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

Complications de l'ETO (1)

- ❖ Respect des contre-indications +++
- ❖ Introduction de la sonde d'ETO sous contrôle de la vue (ventilés)
- ❖ Hüttemann et al. : 2 504 ETO en réanimation ; 2,6% complications (2006)
- ❖ 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 +++

Complications de l'ETO (2)

TABLE II.—Complications of TEE in the ICU (21 studies with n=2 508 examinations). With permission from Hüttemann et al.¹⁰

Category	Details	N.
Airway	Displacement of tracheostomy tube (1), pulmonary aspiration during tracheal intubation before TEE (1)	2
Ventilation	Respiratory failure (1), transient hypoxia (4)	5
Circulation	Hypotension (15), hypertension (4), increase in pulmonary artery pressure (1)	20
Arrhythmias	Atrial flutter, atrial fibrillation (5), VES (1)	6
Cardiac arrest	Circumstances not further specified (1), due to abruptly discontinued inotropic support but successful resuscitation - not related to TEE study (1)	2
Seizures	Grand mal seizure (1)	1
Vomitus	(1)	1
Coughing	(7)	7
Oropharyngeal mucosal lesions	Superficial mucous lesion (1), self-terminating oral blood suffusion (15), oropharyngeal bleeding (1)	17
Total		61 (2.6%)

ASE GUIDELINES AND STANDARDS

Guidelines for Performing a Comprehensive Transesophageal Echocardiographic Examination: Recommendations from the American Society of Echocardiography and the Society of Cardiovascular Anesthesiologists

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(Am Soc Echocardiogr 2013;26:1-44)

Table 7 List of complications reported with TEE and the incidence of these complications during diagnostic TEE and intraoperative TEE^{13,14,15}

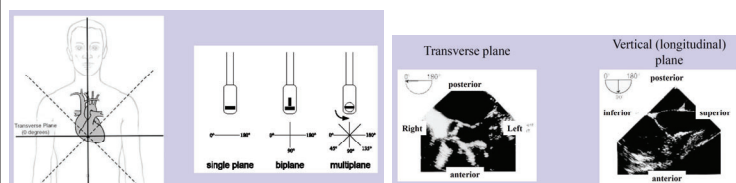
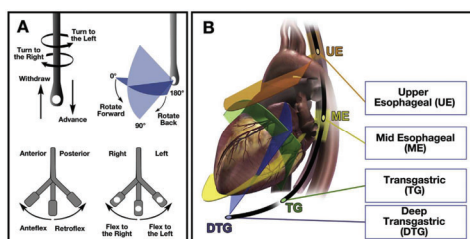
Complication	Diagnostic TEE	Intraoperative TEE
Overall complication rate	0.18-2.8% (refs 24,25)	0.2% (ref 7)
Mortality	<0.01-0.02% (refs 24,25,27)	0% (ref 7)
Major morbidity	0.2% (ref 27)	0-1.2% (refs 7,28,29)
Major bleeding	<0.01% (ref 24)	0.03-0.8% (refs 7,28)
Esophageal perforation	<0.01 (ref 24)	0-0.3% (refs 7,28,29)
Heart failure	0.05% (ref 29)	
Arrhythmia	0.06-0.3% (refs 7,28,30)	
Tracheal intubation	0.02% (ref 30)	
Endotracheal tube malposition		0.03% (ref 7)
Laryngospasm	0.14% (ref 27)	
Bronchospasm	0.06-0.07% (refs 24,30)	
Dysphagia	1.8 % (ref 31)	
Minor pharyngeal bleeding	0.01-0.2% (refs 24,25,27)	0.01% (ref 7)
Severe dysphagia		0.1% (ref 7)
Hoarseness	12% (ref 31)	
Lip injury	13% (ref 31)	
Dental injury	0.1% (ref 31)	0.03% (ref 7)

ASE GUIDELINES AND STANDARDS

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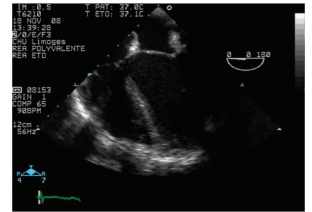
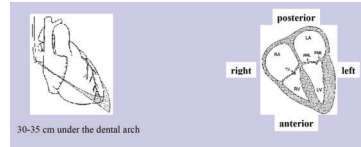
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(J Am Soc Echocardiogr 2013;26:1-44)





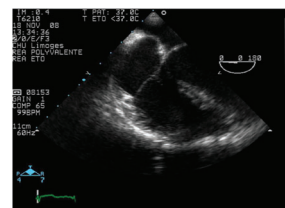
Vue transoesophagienne quatre cavités



Vue transoesophagienne quatre cavités

Vue transoesophagienne centrée sur le VD

- Vue de référence
qui débute en
règle chaque
examen

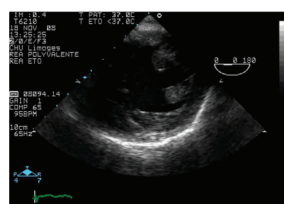


1. Evaluation fonction systolique du VD
2. Evaluation d'une HVD
3. Examen de l'oreillette droite.



Vue transgastrique petit axe

Vue transgastrique petit axe



1. Evaluation de la taille et de la fonction systolique des deux ventricules
2. Anomalie de contraction segmentaire (3 territoires coronaires représentés)
3. Cinétique du septum interventriculaire (surcharge de pression / volume du VD)
4. Epanchement péricardique.

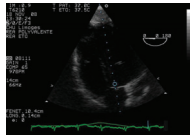
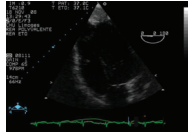
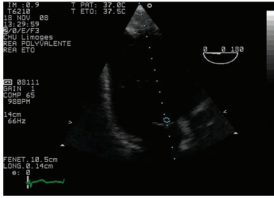
ETT vs ETO

Vues ETT

Vues ETO

Vues transversales (5)

Vue transgastrique profonde 5 cavités



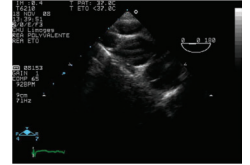
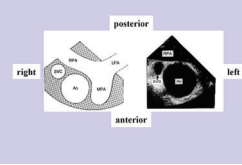
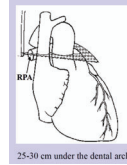
ETT vs ETO

Vues ETT

Vues ETO

Vues transversales (6)

Vue transoesophagienne des vaisseaux de la base



ETT vs ETO

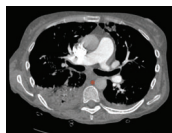
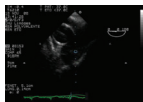
Vues ETT

Vues ETO

Vues transversales (7)

Vue transoesophagienne des vaisseaux de la base

1. Evaluation de la taille des gros vaisseaux (AP, aorte ascendante, veine cave supérieure)
2. Evaluation des variations respiratoires de la veine cave supérieure
3. Recherche d'embolie enclavé dans l'artère pulmonaire droite
4. Profil Doppler dans l'artère pulmonaire.



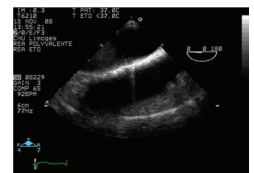
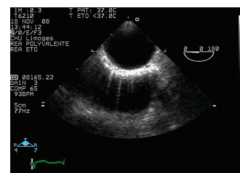
ETT vs ETO

Vues ETT

Vues ETO

Vues transversales (8)

Vue transoesophagienne de l'aorte descendante & crosse

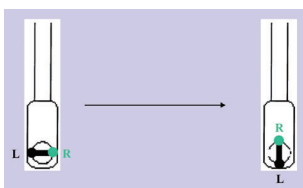


ETT vs ETO

Vues ETT

Vues ETO

Vues longitudinales (1)



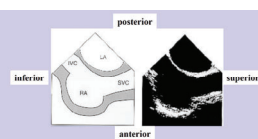
ETT vs ETO

Vues ETT

Vues ETO

Vues longitudinales (2)

Vue transoesophagienne bicavale



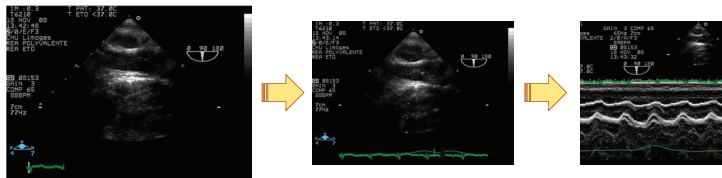
ETT vs ETO

Vues ETT

Vues ETO

Vues longitudinales (3)

Vue transoesophagienne longitudinale de la VCS



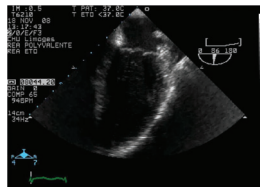
ETT vs ETO

Vues ETT

Vues ETO

Vues longitudinales (4)

Vue transoesophagienne 2 cavités



1. Mesure FEVG
2. Evaluation contractilité parois antérieure et inférieure
3. Evaluation d'une IM
4. Examen de l'auricule gauche.

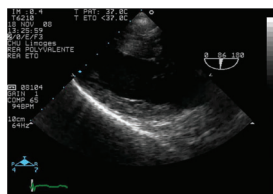
ETT vs ETO

Vues ETT

Vues ETO

Vues longitudinales (5)

Vue transgastrique grand axe



1. Evaluation fonction systolique VG
2. Examen des piliers mitraux
3. Evaluation d'une IM.

ETT vs ETO

Vues ETT

Vues ETO

Vues longitudinales (6)

Vue aorte descendante & crosse

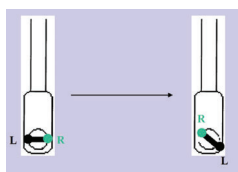


ETT vs ETO

Vues ETT

Vues ETO

Vues obliques (1)



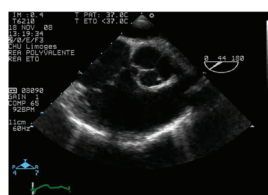
ETT vs ETO

Vues ETT

Vues ETO

Vues obliques (2)

Vue des cavités droites à 40-60°

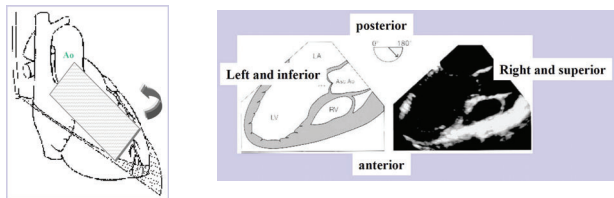


1. Evaluation fonction systolique VD
2. Evaluation d'une IT
3. Evaluation valve aortique (petit axe).



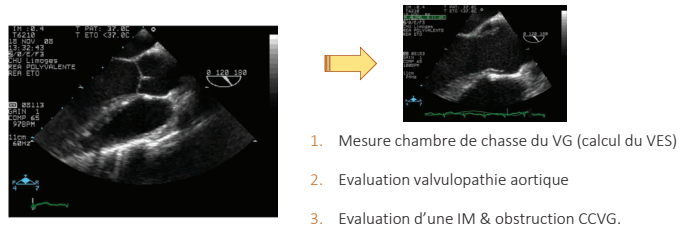
Vues obliques (3)

Vue transoesophagienne de la chambre de chasse du VG à 120°



Vues obliques (4)

Vue transoesophagienne de la chambre de chasse du VG à 120°



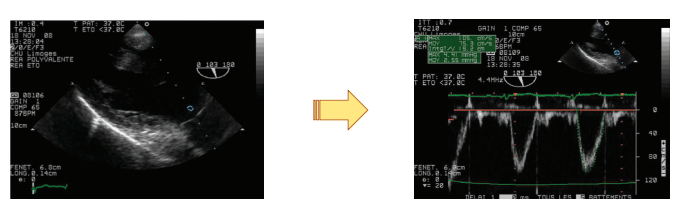
Vues obliques (5)

Vue transoesophagienne de la chambre de chasse du VG à 120°



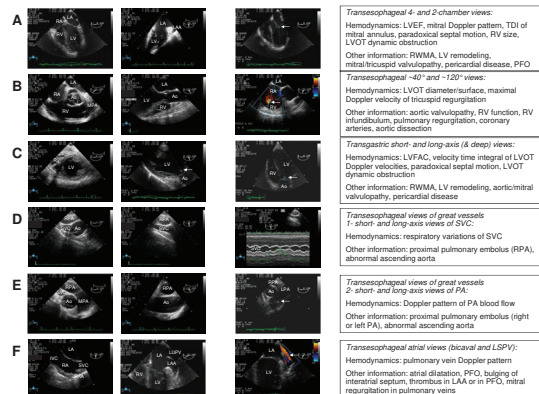
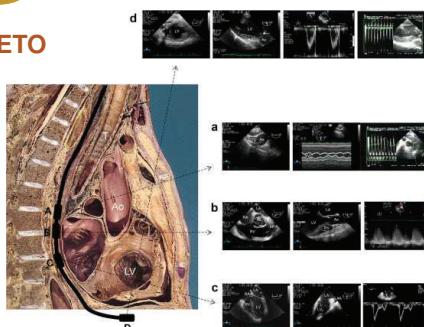
Vues obliques (6)

Vue transgastrique de la chambre de chasse du VG à 120°



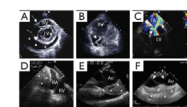
Niveau avancé : ETT & ETO

WHAT'S NEW IN INTENSIVE CARE
Ten reasons for performing
hemodynamic monitoring using
transesophageal echocardiography
Philippe Vigorou^{1,2,3}, Tobias M. Meis⁴ and Antoine Vieillard-Baron^{1,2}
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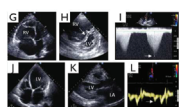


- ❖ Toujours finir en examinant l'aorte thoracique (descendante et croisée)
- ❖ Toute coupe supplémentaire utile selon les anomalies constatées
- ❖ 4 cavités : repère
- ❖ Séquence type.

ETT & ETO : quelles vues pour quels paramètres ?



Expedite diagnosis of life-threatening conditions (hypotension, shock, cardiac arrest)

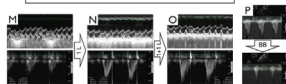


Accurately identify patients with increased risk of mortality (during sepsis, APDS, cardiac arrest...)

Critical care echocardiography (acute circulatory / respiratory failure)

Serially assess efficacy and tolerance of therapeutic interventions (fluid resuscitation, inotropes, ventilator settings, guidance of invasive procedures...)

Confirms adequacy of ongoing therapeutic strategy (avoid inefficient and potentially detrimental therapy)



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