

Choc obstructif 2 Tamponnade

TUSAR 3/12/24

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Primer

Cardiac tamponade

nature reviews disease primers

<https://doi.org/10.1038/s41572-023-00446-1>

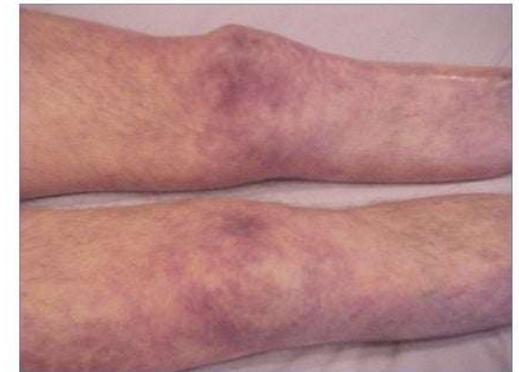


Choc Obstructif

Type de choc	Débit cardiaque	PC
Hypovolémique	↘	↘
Distributif (septique)	↗ ↔ ↘	↔
Obstructif (embolie pulmonaire)	↘	↗
Cardiogénique	↘	↗

Obstructif

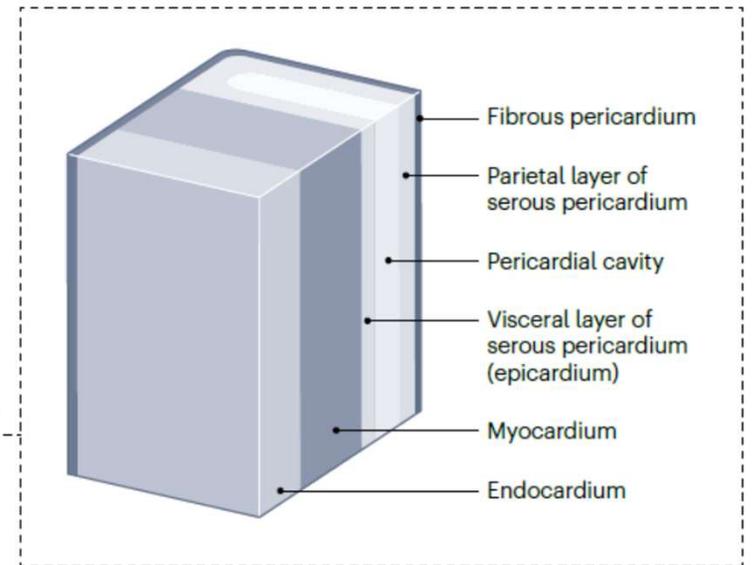
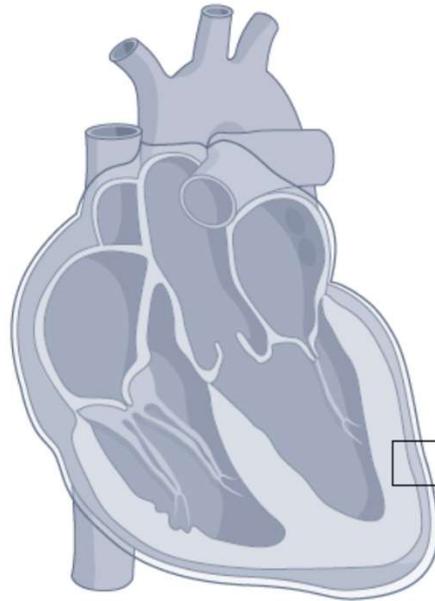
- Tamponnade
- Embolie pulmonaire massive
- Pneumothorax sous-tension
- Sténose aortique décompensée
- Embolie gazeuse massive



Cardiogénique	Obstructif	Distributif	Mixte
<ul style="list-style-type: none"> • ↓ Contractilité <ul style="list-style-type: none"> – Infarctus – Myocardite – Contusion myocardique • Arythmies <ul style="list-style-type: none"> – Tachycardie – Bradycardie • Insuffisance diastolique • Dysfonction valvulaire aiguë • Rupture myocardique 	<ul style="list-style-type: none"> • Tamponnade • Embolie massive • Pneumothorax sous-tension • Sténose aortique décompensée • Embolie gazeuse massive 	<ul style="list-style-type: none"> • Hypoxémies <ul style="list-style-type: none"> – Cyanure, CO – Ischémie-reperfusion • Endocrinopathies <ul style="list-style-type: none"> – Hypothyroïdie – Hypocorticisme – Hypoglycémie • Intoxications <ul style="list-style-type: none"> – Médicaments – Toxiques • Acidose sévère • Hypothermie sévère 	

Anatomie

Pericardium Functions
Restrain in chest
Constrain filling
Ventricular interdependence
Protection
Fluid lubrication



Physiologie

a Rapid pericardial effusion

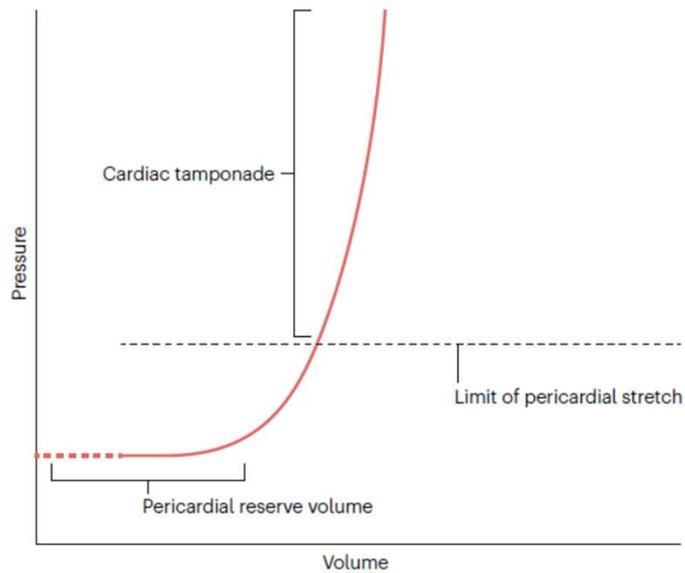
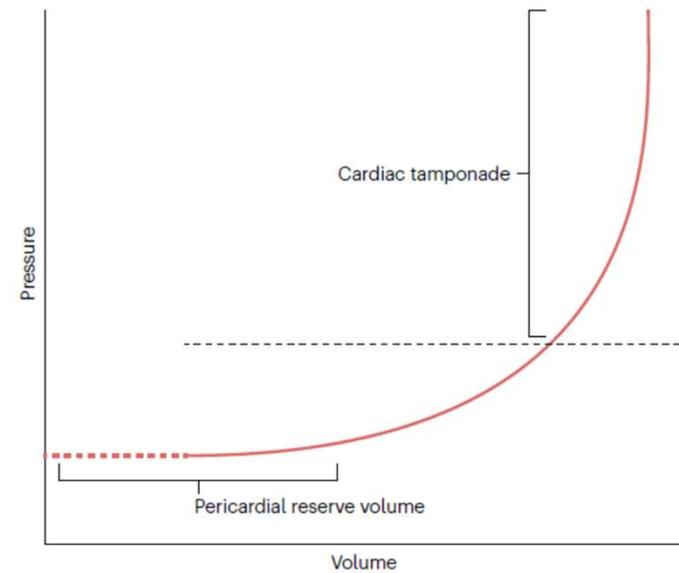


Fig. 2 | Pressure–volume curves depicting acute and chronic pericardial effusion. a, Rapid fluid accumulation in iatrogenic acute pericardial effusion due to, for example, perforation of coronary arteries during percutaneous coronary intervention, myocardial perforation during endomyocardial biopsy or pacemaker lead placement, electrophysiology procedures or trauma. When the effusion reaches the maximum pericardial reserve volume,

b Slow pericardial effusion



any further increase in fluid and, consequently, in the rate of expansion will exceed the limit of pericardial stretch. **b,** Slow fluid accumulation in chronic pericardial effusion^{10,88}. Pericardial stretching over an extended period of time results in a shift in the pressure–volume curve to the right (stress relaxation). Therefore, slowly developing effusions might not necessarily result in cardiac tamponade. Reprinted with permission from ref. 208, Oxford University Press.

Estimation

Tableau 1 : Quantification des épanchements péricardiques : évaluation semi-quantitative en coupe PSGA, mode TM ou bidimensionnel. *PSGA = coupe parasternale grand axe, TM = temps-mouvement*

- *Grade 1* : Décollement systolique postérieur < 10 mm avec cinétique du péricarde pariétal postérieur conservée en TM. (Volume estimé < 100 ml)
- *Grade 2* : Décollement systolique postérieur < 10 mm avec péricarde pariétal postérieur rectiligne en TM. (Volume estimé 100 ml)
- *Grade 3* : Décollement systolo-diastolique < 10 mm en diastole et décollement antérieur. (Volume estimé 100 – 500 ml)
- *Grade 4* : Décollement systolo-diastolique > 10 mm en diastole et décollement antérieur. (Volume estimé > 500 ml)

Severity	Width (mm)	Volume (cc)	Localization
Small	< 5	< 200	Behind posterior wall
Medium	5–20	200–500	Lateral and apical extension
Large	> 20	> 500	Circumferential

Interdépendance ventriculaire

Stade de Pré-tamponnade = compétition entre OD et VD

OD : « cavité faible »

Systole : vidange des ventricules permet un remplissage passif de l'OD

Télédiastole/protosystole (CIV) : ↗ pression intrapéricardique => Collapsus OD

Collapsus OD significatif si > 1/3 cycle cardiaque et/ou si touche 2/3 de l'OD

Stade de Tamponnade= compétition entre VD et VG via le SIV

Télédiastole : Enfacement du VD concomitant du collapsus de l'OD

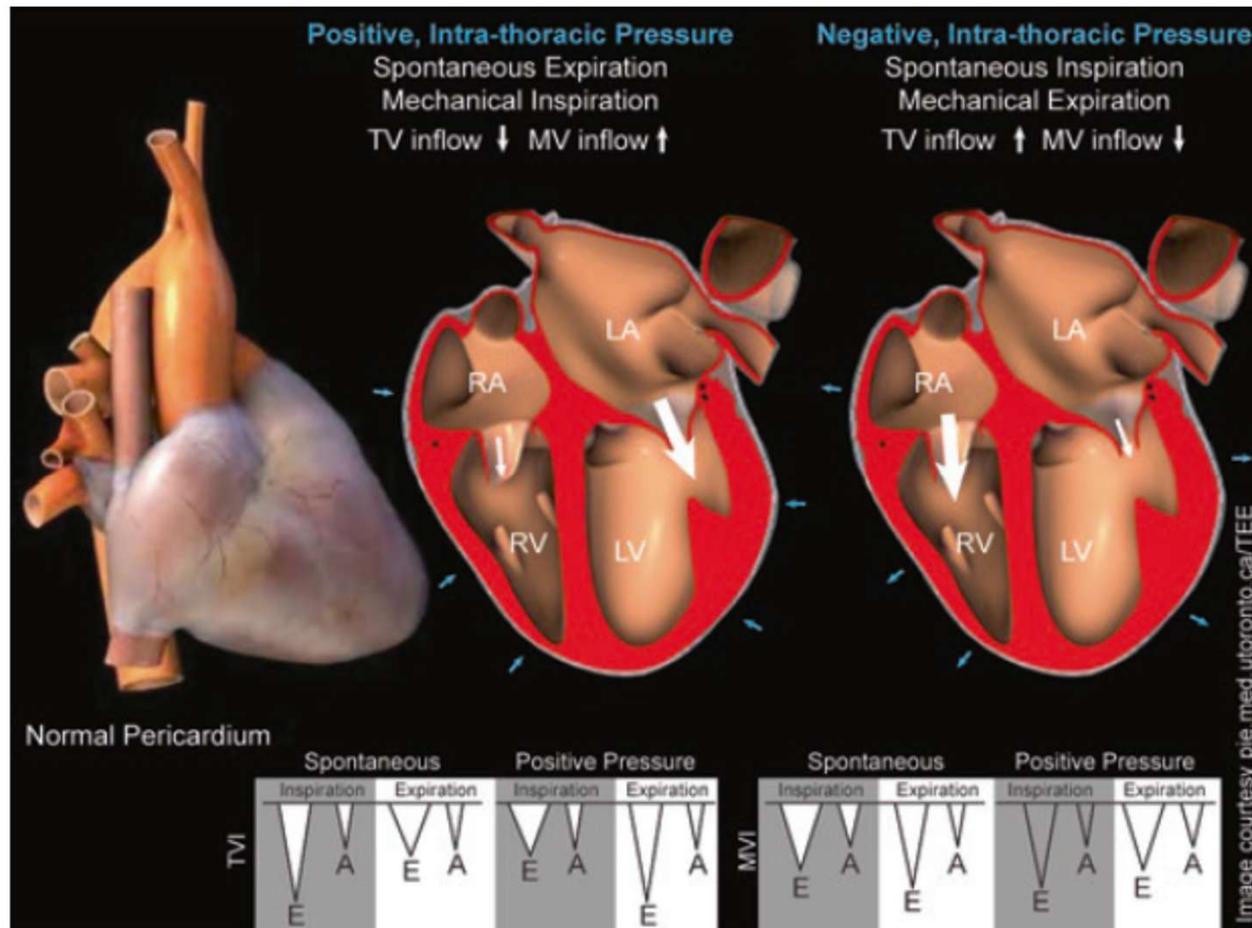
Le remplissage du VG est au dépend du VD

Collapsus OG tardif (rare ≈ 25% cas)

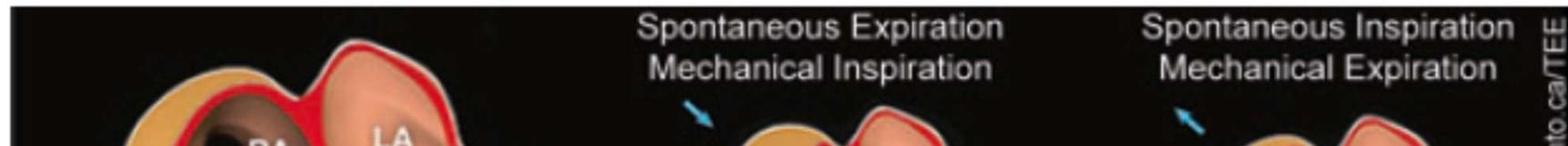
ADIASTOLIE

PVC = POD = PtdVD = PAPO = POD = PtdVG= Pression PERICARDIQUE

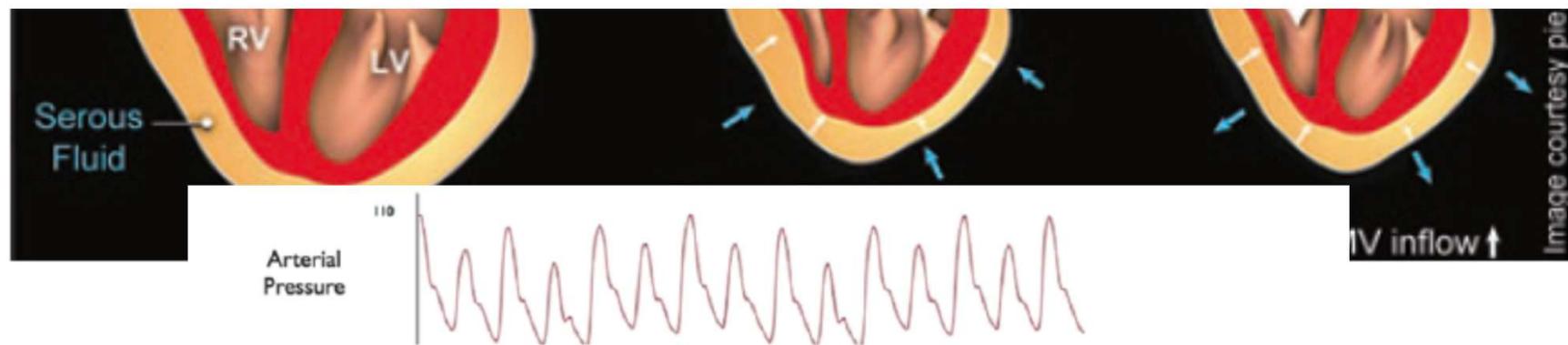
Interdépendance ventriculaire



Interdépendance ventriculaire



Inspiratory decrease of systolic blood pressure > 10mmHg



Imazio M. Myopericardial Diseases 2016; Springer

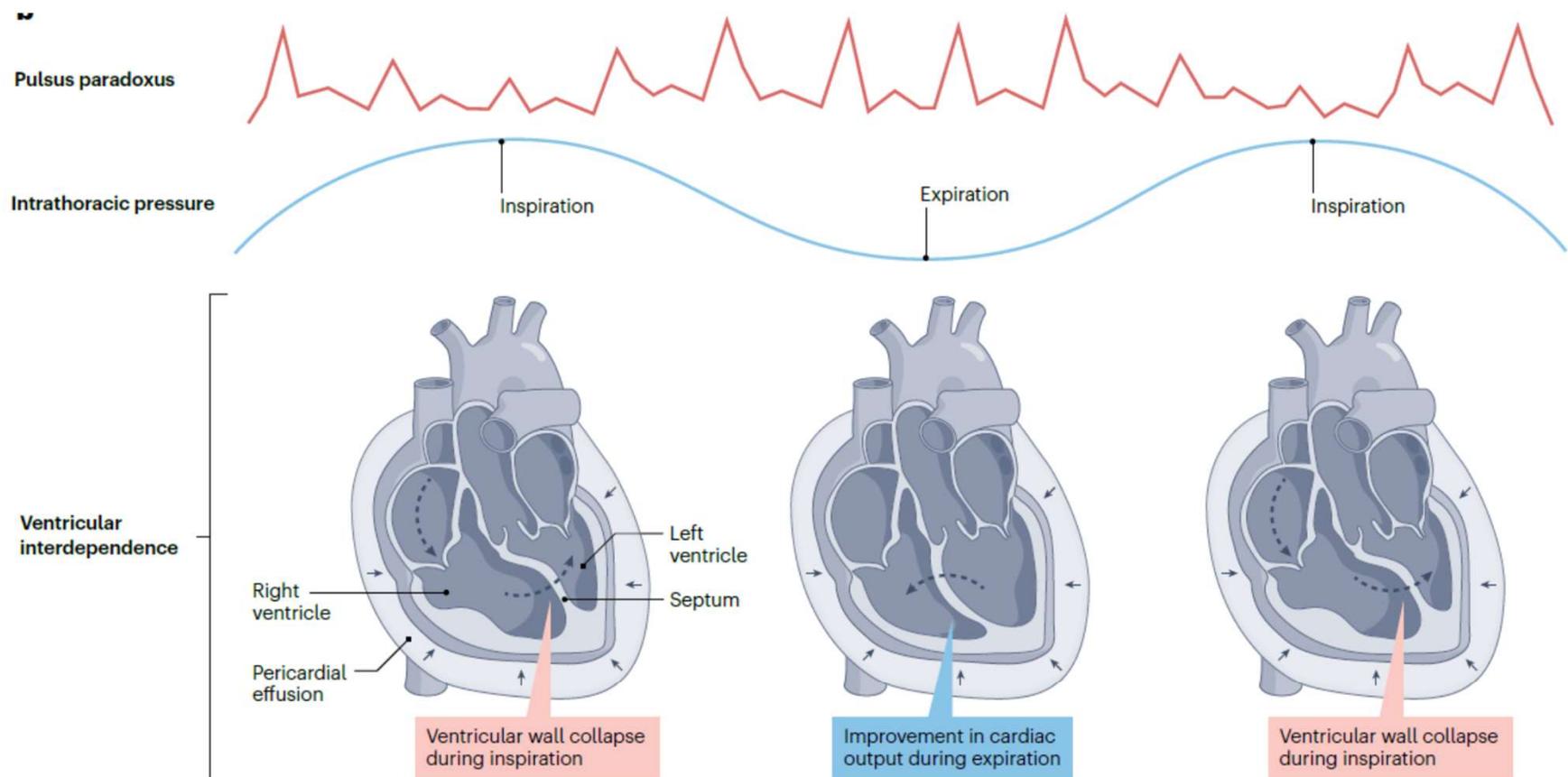
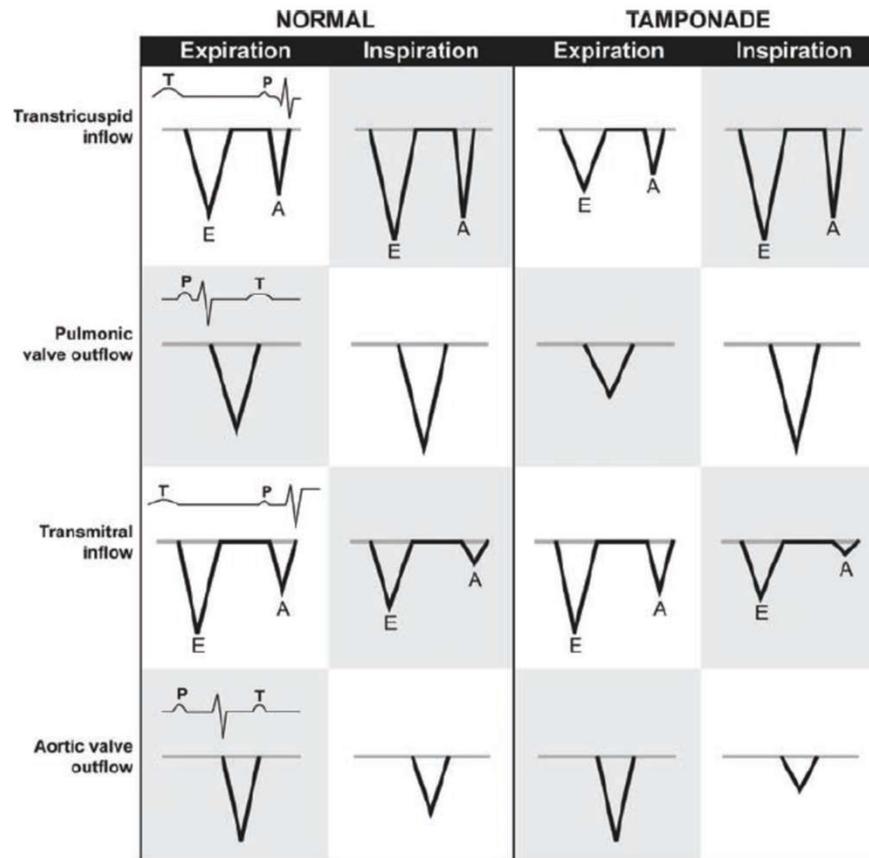


Fig. 1 | Anatomical changes to the heart during cardiac tamponade.
a, Schematic of the heart depicting the layers of the pericardium and excessive intrapericardial pressure during cardiac tamponade. **b**, The basic pathogenetic mechanisms of cardiac tamponade. Progressive intrapericardial accumulation of fluid leads to increased intrapericardial pressure and compression of the heart. Diastolic filling and cardiac output are subsequently impaired, resulting in haemodynamic compromise, circulatory shock and, eventually, cardiac

arrest. Owing to ventricular interdependence, expansion of the right ventricle during inspiration compresses the left ventricle, resulting in decreased filling and a drop in stroke volume with a decrease in systolic blood pressure (pulsus paradoxus). During expiration, the left ventricle is filled by the restoration of pulmonary venous return but the right ventricle is compressed and systemic venous return is interrupted. Part **b** adapted with permission from ref. 207, © The Authors.

Interdépendance ventriculaire



Diagnostic

Faisceau d'arguments

- Clinique

Sign/ Symptom	Levine et al, ⁶ 1991 (N = 50)	Cooper et al, ⁴⁶ 1995 (N = 30)
 Dyspnea	88	87
Fever		25
Chest pain		20
Cough	10	7
Lethargy		3
Palpitations		3

JAMA. 2007;297:1810-1818

Faisceau d'arguments

- Clinique

Pathologie cardiaque pré-existante = tolérance abaissée
Troubles fonction diastolique, hypovolémie

Faisceau d'arguments

- Paraclinique

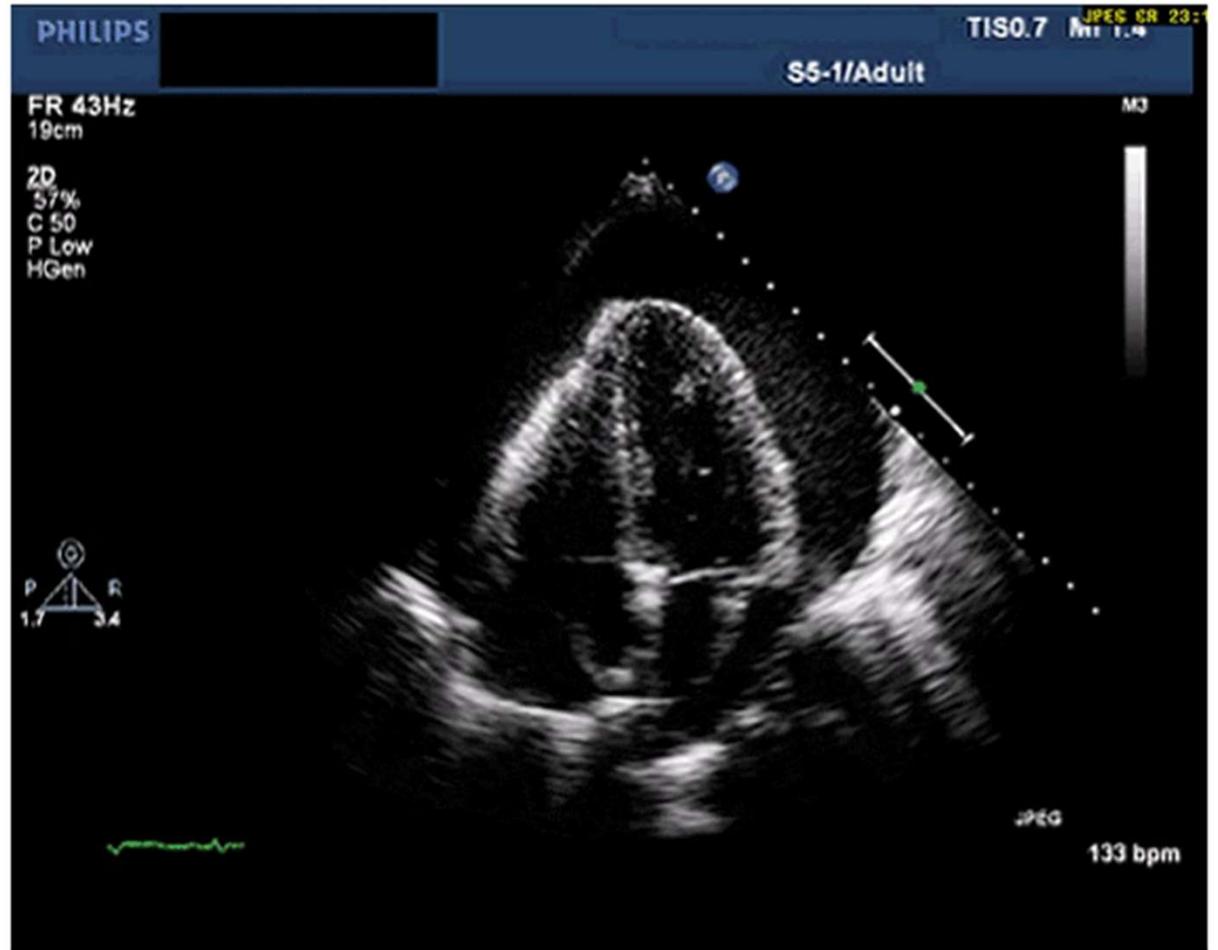
Source	Patients, No.	Cardiomegaly, %
Guberman et al, ²⁵ 1981	53	95
Singh et al, ⁸ 1984	16	94
Levine et al, ⁶ 1991	50	68
Gibbs et al, ⁴⁷ 2000	46	100
Pooled sensitivity (95% CI)		89 (73-100)

Abbreviation: CI, confidence interval.

79

	Reddy et al, ³⁴ 1978 (N = 19)	Guberman et al, ²⁵ 1981 (N = 53)*	Singh et al, ⁸ 1984 (N = 16)	Levine et al, ⁶ 1991 (N = 50)	Cooper et al, ⁴⁶ 1995 (N = 23)	Gibbs et al, ⁴⁷ 2000 (N = 46)*	Pooled Sensitivity (95% CI)
Low voltage		40	50	56	22	39	42 (32-53)
Atrial arrhythmia	0	9		4			6 (1-11)
Electrical alternans		21		16			
ST-segment elevation		30	18				
PR-segment depression				18			

Swinging heart



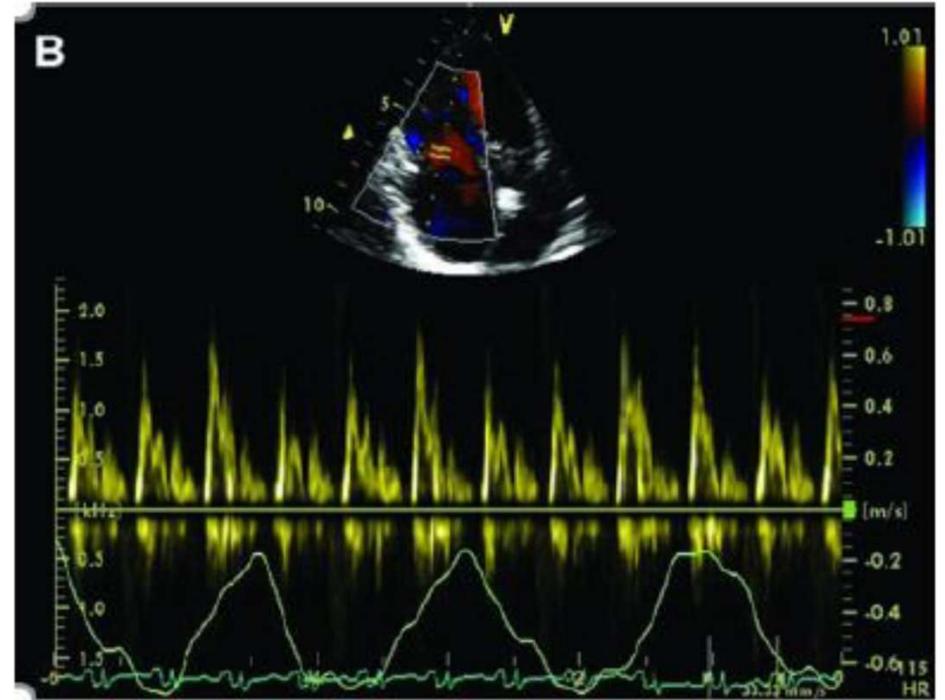
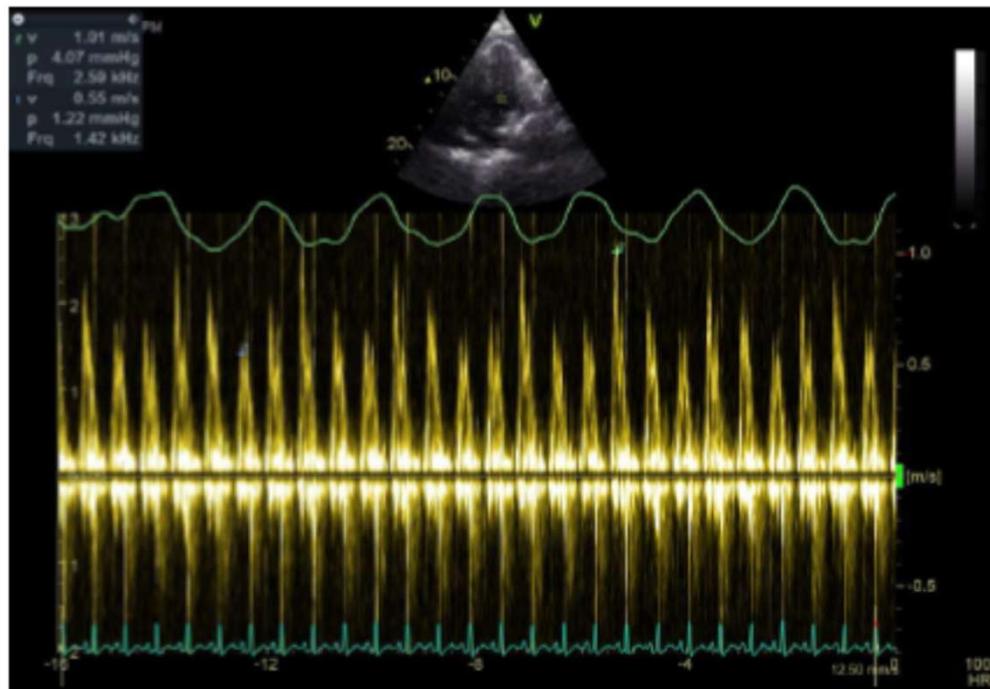
Faisceau d'arguments

- Paraclinique
 - Echographique

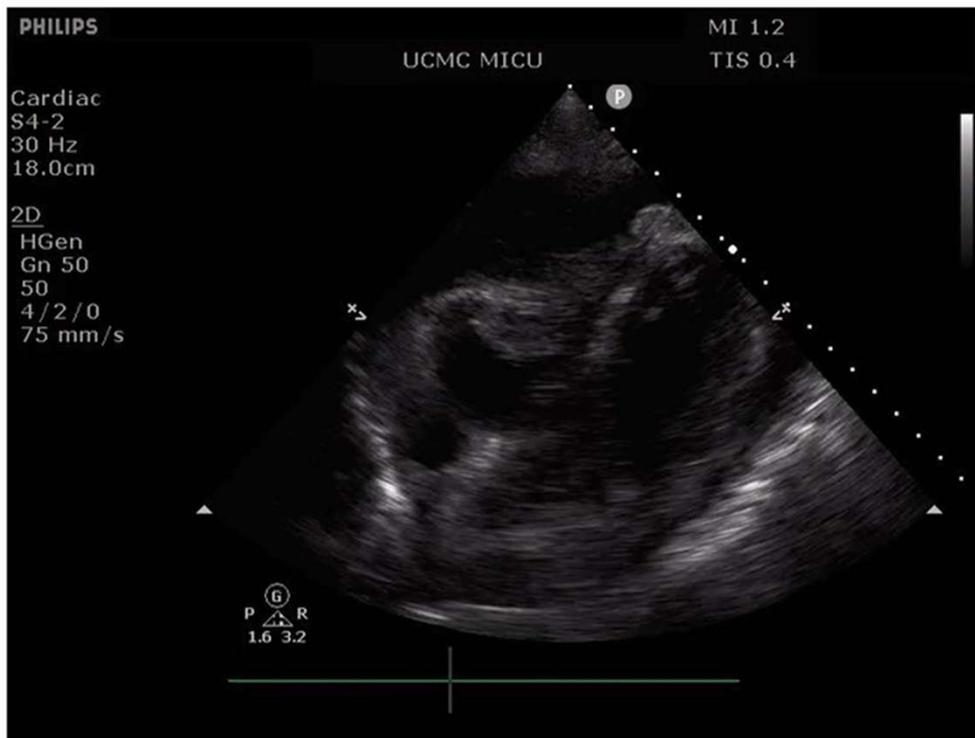
Echocardiographic feature	Sensitivity	Specificity
Large pericardial effusion with swinging heart	n.a.	n.a.
Diastolic collapse of the right atrium (RA)	50–100 %	33–100 %
Duration of diastolic collapse of the RA as ratio on the cardiac cycle length >0.34	>90 %	100 %
Diastolic collapse of the right ventricle	48–100 %	72–100 %
Respiratory changes of the mitral E velocity >25 %, tricuspid E velocity >40 %	n.a.	n.a.
Inferior vena cava plethora (dilatation >20 mm and <50 % reduction of diameter with respiratory phases)	97 %	40 %

n.a. not available

Interdépendance ventriculaire



Collapsus cavités cardiaques



Différentiel

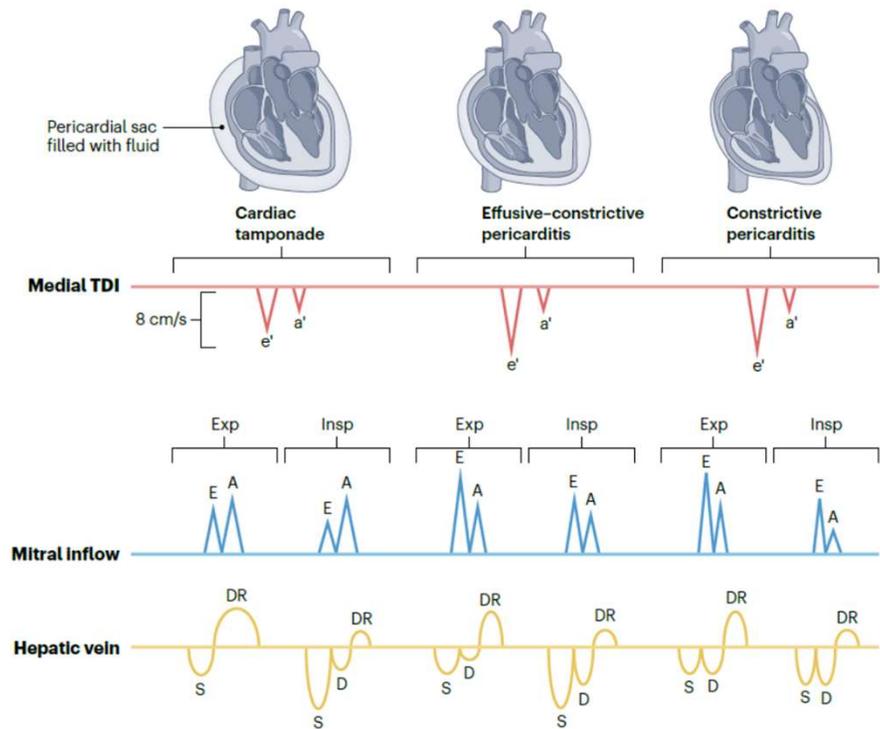
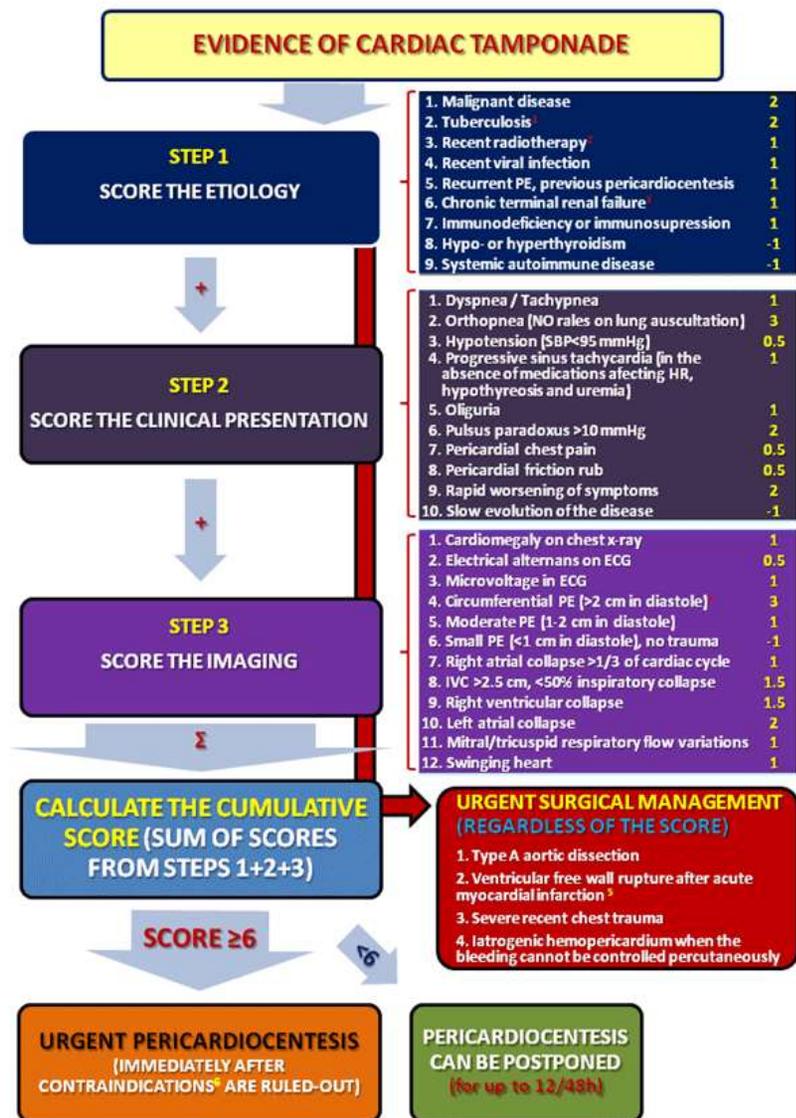


Fig. 5 | Echocardiography in the differential diagnosis of cardiac tamponade. Schematic of mitral annulus tissue Doppler imaging (TDI), mitral inflow and hepatic vein Doppler velocities in cardiac tamponade, effusive-constrictive pericarditis and constrictive pericarditis. D, diastolic forward flow; DR, diastolic flow reversal; Exp, expiration; Insp, inspiration; S, systolic forward flow. Adapted with permission from ref. 104, Oxford University Press.

Triage



EVIDENCE OF CARDIAC TAMPONADE

STEP 1

SCORE THE ETIOLOGY

- | | |
|--|----|
| 1. Malignant disease | 2 |
| 2. Tuberculosis ¹ | 2 |
| 3. Recent radiotherapy ² | 1 |
| 4. Recent viral infection | 1 |
| 5. Recurrent PE, previous pericardiocentesis | 1 |
| 6. Chronic terminal renal failure ¹ | 1 |
| 7. Immunodeficiency or immunosuppression | 1 |
| 8. Hypo- or hyperthyroidism | -1 |
| 9. Systemic autoimmune disease | -1 |



STEP 2
SCORE THE CLINICAL PRESENTATION



1. Dyspnea / Tachypnea	1
2. Orthopnea (NO rales on lung auscultation)	3
3. Hypotension (SBP<95 mmHg)	0.5
4. Progressive sinus tachycardia (in the absence of medications affecting HR, hypothyreosis and uremia)	1
5. Oliguria	1
6. Pulsus paradoxus >10 mmHg	2
7. Pericardial chest pain	0.5
8. Pericardial friction rub	0.5
9. Rapid worsening of symptoms	2
10. Slow evolution of the disease	-1



STEP 3

SCORE THE IMAGING

Σ

1. Cardiomegaly on chest x-ray	1
2. Electrical alternans on ECG	0.5
3. Microvoltage in ECG	1
4. Circumferential PE (>2 cm in diastole)	3
5. Moderate PE (1-2 cm in diastole)	1
6. Small PE (<1 cm in diastole), no trauma	-1
7. Right atrial collapse >1/3 of cardiac cycle	1
8. IVC >2.5 cm, <50% inspiratory collapse	1.5
9. Right ventricular collapse	1.5
10. Left atrial collapse	2
11. Mitral/tricuspid respiratory flow variations	1
12. Swinging heart	1

**CALCULATE THE CUMULATIVE
SCORE (SUM OF SCORES
FROM STEPS 1+2+3)**

**URGENT SURGICAL MANAGEMENT
(REGARDLESS OF THE SCORE)**

1. Type A aortic dissection
2. Ventricular free wall rupture after acute myocardial infarction⁵
3. Severe recent chest trauma
4. Iatrogenic hemopericardium when the bleeding cannot be controlled percutaneously

SCORE ≥ 6

6

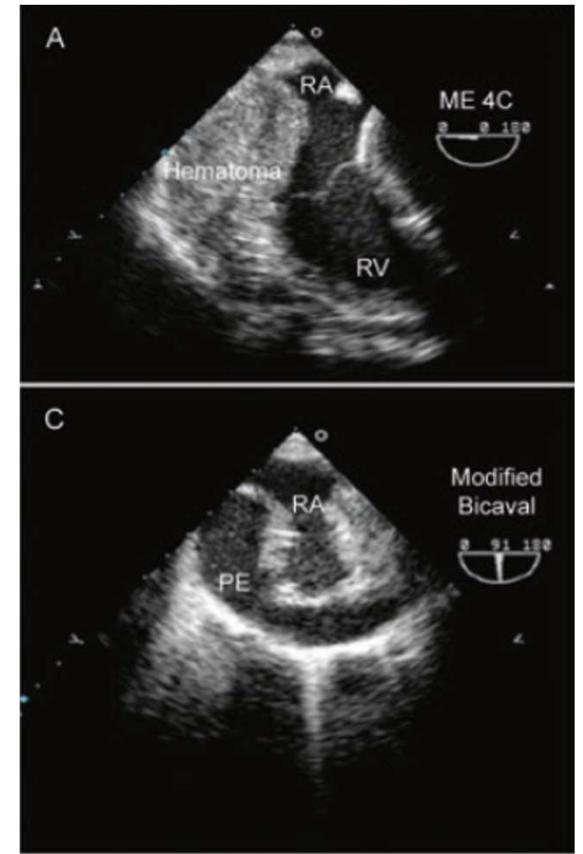
**URGENT PERICARDIOCENTESIS
(IMMEDIATELY AFTER
CONTRAINDICATIONS⁵ ARE RULED-OUT)**

**PERICARDIOCENTESIS
CAN BE POSTPONED
(for up to 12/48h)**

Post-op

Particularités post-opératoires

- Peuvent être très localisées +++ 1x2 cm
- Echo variable en fonction des caillots
- Tamponnade gauche possible
- ETO > ETT dans le contexte
- Evolutivité rapide



Résumé et conclusion

Physiopathologie	Conditions « physiologiques »	Interaction OD/VD	<ul style="list-style-type: none"> - Interaction VD/VG - Interaction respiratoire
Données cliniques	Tachycardie	Dyspnée	<ul style="list-style-type: none"> - Polypnée - Hypotension
Données échocardiographiques	Collapsus diastolique OD Transitoire	Collapsus diastolique OD	<ul style="list-style-type: none"> - Collapsus télédiastolique VD - Mouvements respiratoires du septum interventriculaire - Variation respiratoire des flux Doppler droit et gauche - Inversion profil mitral (E < A) - Dilatation VCI
Données hémodynamiques	<ul style="list-style-type: none"> - Augmentation progressive pression intra péricardique jusqu'à 15-20 mmHg - Egalisation progressive des pressions intra cardiaques - Diminution progressive du retour veineux/débit cardiaque - Adiaastolie 		
Prise en charge thérapeutique	<ul style="list-style-type: none"> - Expansion volémique - Surveillance clinique/échographique 	<ul style="list-style-type: none"> - Expansion volémique prudente - Support vasopresseur - +/- drainage péricardique 	<ul style="list-style-type: none"> - Drainage péricardique urgent (chirurgical ou percutané) - Expansion volémique prudente - Support vasopresseur

Take home message

Tamponade Clinical

Hypotension

Tachycardia

Low cardiac output

Acidosis

Low urine output

High CVP (=PAD)

Pulsus paradoxus

TEE Tamponade

Pericardial effusion

RA systolic collapse

RV diastolic collapse

Respiratory TV/MV

IVC plethora

Sévérité augmentent avec épanchement

Sources

**Perioperative
Two-Dimensional
Transesophageal
Echocardiography**
*A Practical Handbook
Second Edition*

Annette Vegas

**Transesophageal
Echocardiography**
Multimedia Manual

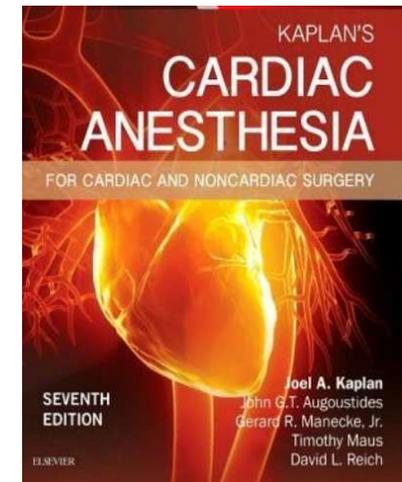
Second Edition

A Perioperative
Transdisciplinary Approach

André Y. Denault
Pierre Couture
Annette Vegas
Jean Buihieu
Jean-Claude Tardif

**Core Topics in Transesophageal
Echocardiography**

Robert Feneck
John Kneeshaw
Marco Ranucci



Merci de votre attention