

# Cœur pulmonaire aigu et ETT

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Réanimation  
CHU Nîmes

# Compétences échocardiographiques en réanimation



CHEST

Consensus Statement

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

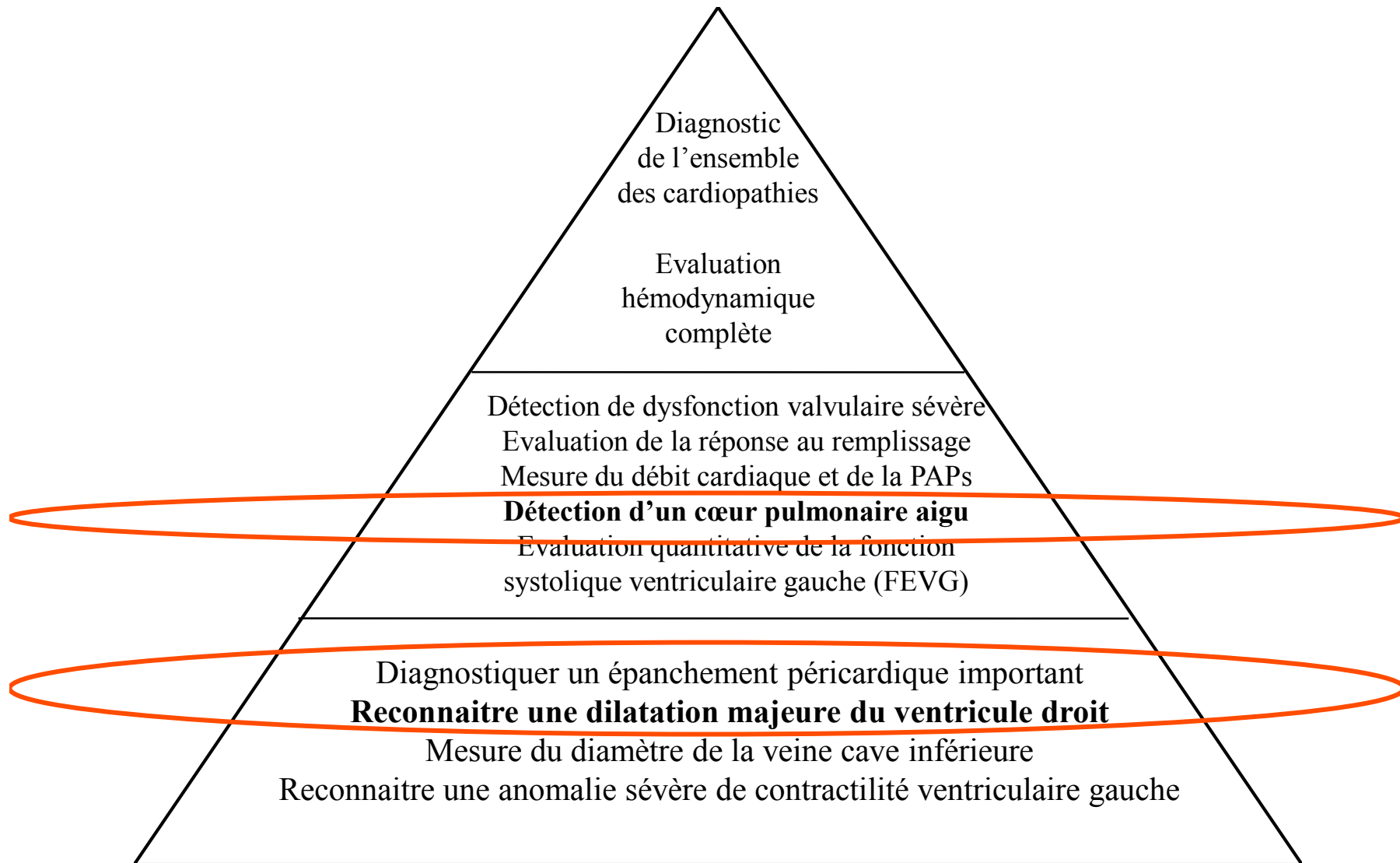
*Paul H. Mayo, MD; Yannick Beaulieu, MD; Peter Doelken, MD;  
David Feller-Kopman, MD; Christopher Harrod, MS; Adolfo Kaplan, MD;  
John Orapello, MD; Antoine Vieillard-Baron, MD; Olivier Axler, MD;  
Daniel Lichtenstein, MD; Eric Maury, MD; Michel Slama, MD;  
and Philippe Vignon, MD*

**Table 7—Competence in Basic CCE: Required  
Cognitive Skills in Recognition of Clinical Syndromes**

| Clinical Syndromes | Echocardiographic Findings                                                                                                                                                        |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| RV failure         | Acute cor pulmonale: RV dilatation<br>and paradoxical septal motion*<br>Isolated RV dilatation suggestive of<br>RV infarct<br>Associated findings: dilated,<br>noncollapsible IVC |
| Tamponade          | Pericardial effusion (regardless of<br>size)†<br>Right atrial/RV diastolic collapse<br>Associated findings: dilated,<br>noncollapsible IVC                                        |

**Chest 2009**

# Echocardiographie en réanimation : pyramide des compétences



## Quiz. Au cours de l'embolie pulmonaire :

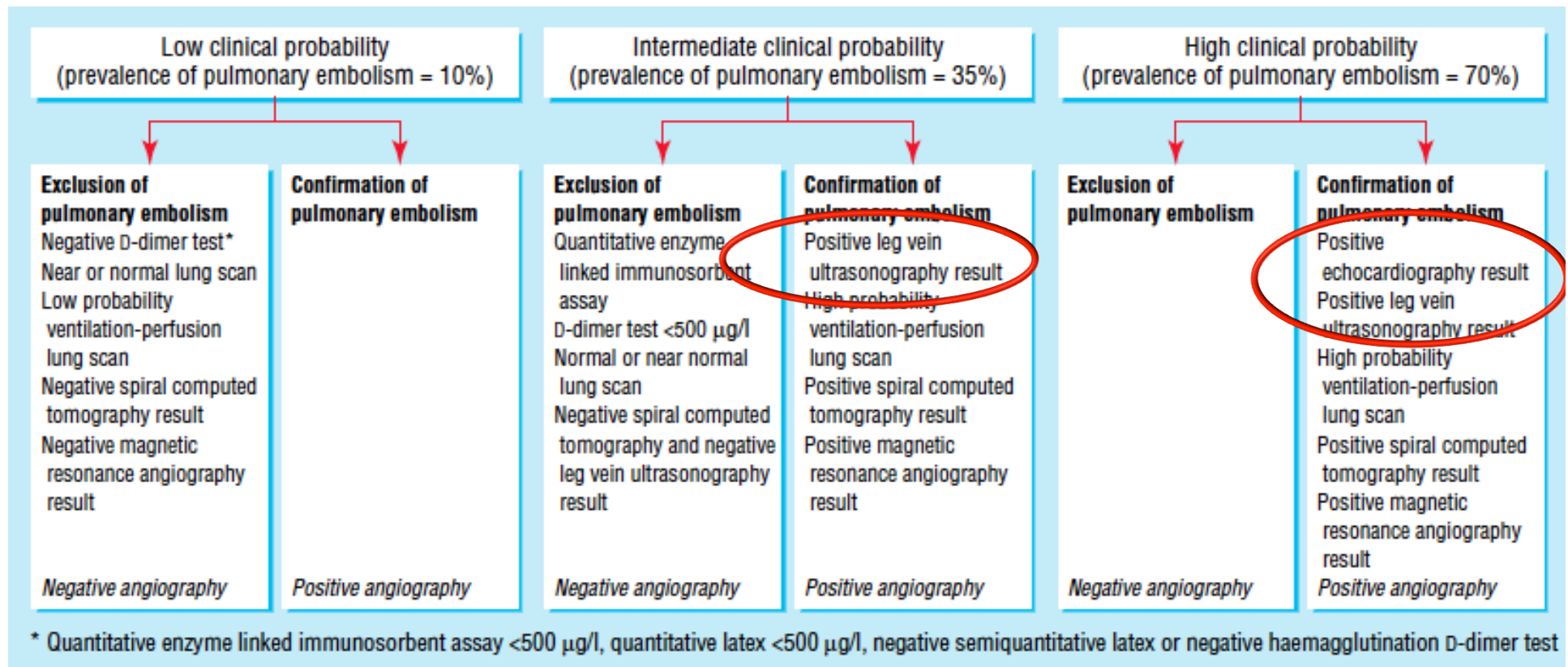
- ① L'échographie permet le plus souvent d'affirmer le diagnostic
- ② L'échographie trans oesophagienne est impérative
- ③ La performance diagnostique de l'échographie dépend de la gravité clinique
- ④ Le niveau d'HTAP est en général modéré si le cœur est sain
- ⑤ L'échographie veineuse « 4 points » peut permettre un diagnostic indirect d'EP lorsque la probabilité clinique est forte

# Embolie pulmonaire : établir la probabilité diagnostique

| Eléments                                      | Points |
|-----------------------------------------------|--------|
| Antécédents de TVP ou EP                      | +1.5   |
| Pouls > 100 / min                             | +1.5   |
| Chirurgie/immobilisation récente              | +1.5   |
| Signes de TVP                                 | +3     |
| Diagnostic alternatif moins probable que l'EP | +3     |
| Hémoptysie                                    | +1     |
| Cancer                                        | +1     |
| <b>Probabilité clinique</b>                   |        |
| Faible                                        | 0-1    |
| Moyenne                                       | 2-6    |
| Forte                                         | ≥7     |

Wells et al Thromb Haemost 2000  
Van Belle et al JAMA 2006

# Systematic review and meta-analysis of strategies for the diagnosis of suspected pulmonary embolism



Roy et al Br J Med 2005

# Échographie 4 points - Intérêt

## Recherche de TVP = échographie 4 points

- ▣ 220 suspicions de TVP
- ▣ Contrôle Échographie 2 points sur suspicion TVP
- ▣ Comparé à angiographie veineuse
- ▣ Seul critère:

**=>Compressibilité de la veine fémorale et poplitée**

*Lensing et al NEJM 1989*

## Échographie 4 points - Intérêt

|                     | Angiographie | Contrôle<br>Échographie<br>2 points |         |        |
|---------------------|--------------|-------------------------------------|---------|--------|
| Normale             | 143          | 142                                 | Se 99%  |        |
| Thrombose proximale | 66           | 66                                  | Sp 100% | Sp 91% |
| Thrombose distale   | 11           | 4                                   | Sp 36%  |        |

Lensing et al NEJM 1989



# Échographie 4 points - Intérêt

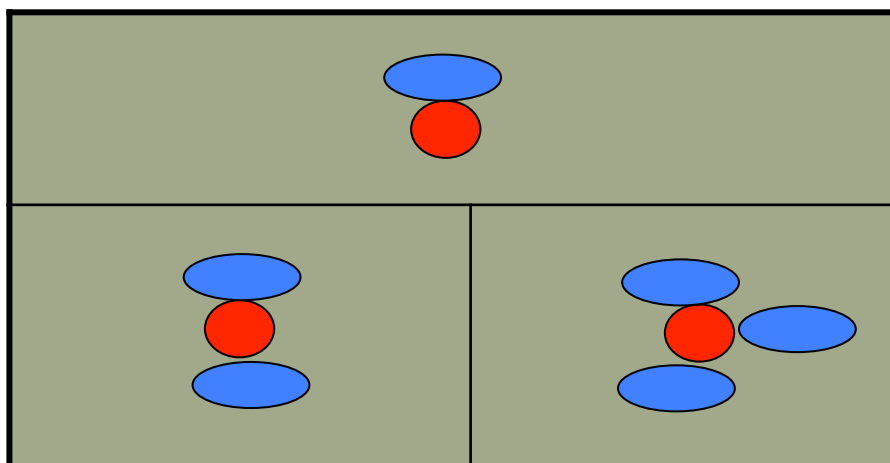
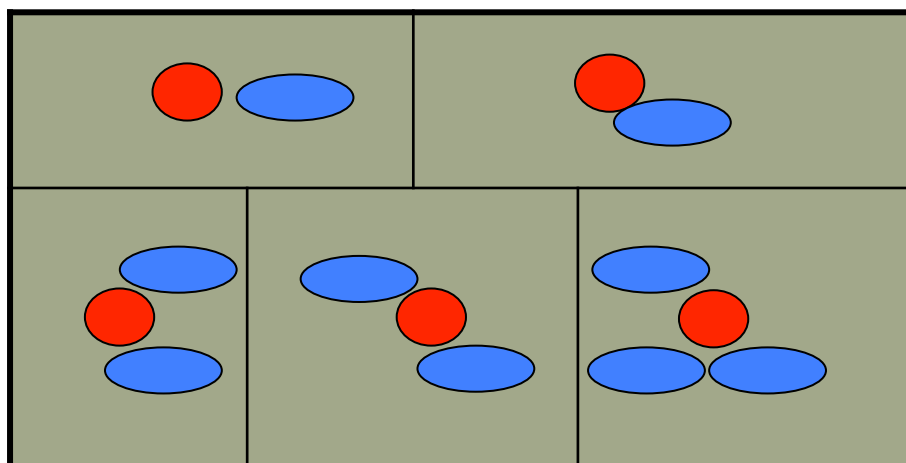
## Echographie 4 points par un non radiologue

- ❑ 8 internes des urgences. Formation de 2 heures
- ❑ Patients avec suspicion clinique de TVP sans ATCD thrombotique
- ❑ Comparé à Echo Doppler par radiologue ou TDM

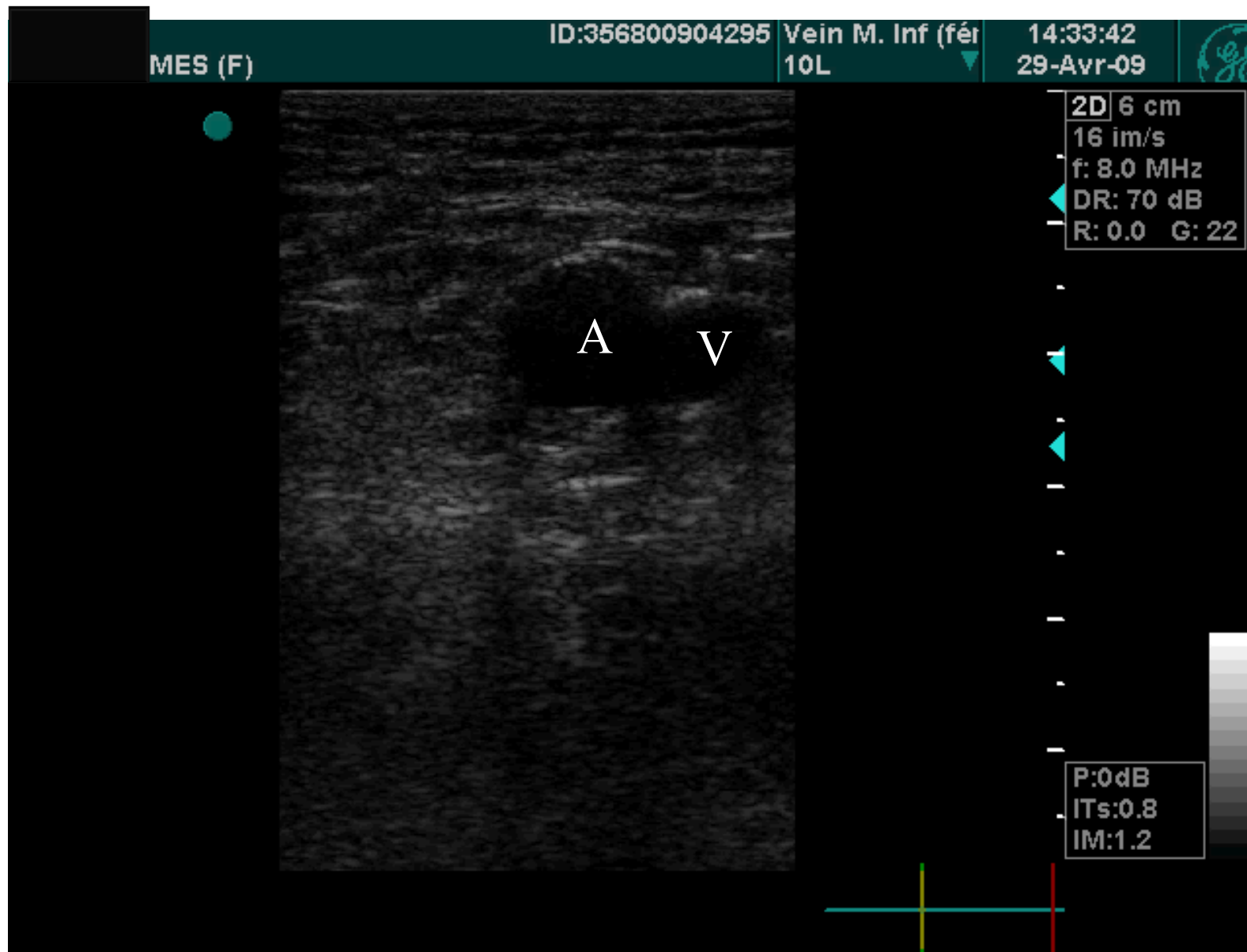
| Contrôle Échographie<br>2 points |    | Contrôle<br>radiologue |    |         |
|----------------------------------|----|------------------------|----|---------|
| Normale                          | 45 | Normale                | 45 | Se 100% |
|                                  |    | Thrombose              | 0  |         |
| Thrombose                        | 27 | Normale                | 4  | Sp 92%  |
|                                  |    | Thrombose              | 23 |         |

*Jang et al Acad Emerg Med 2004*

## Recherche de TVP proximale : Echographie 4 points



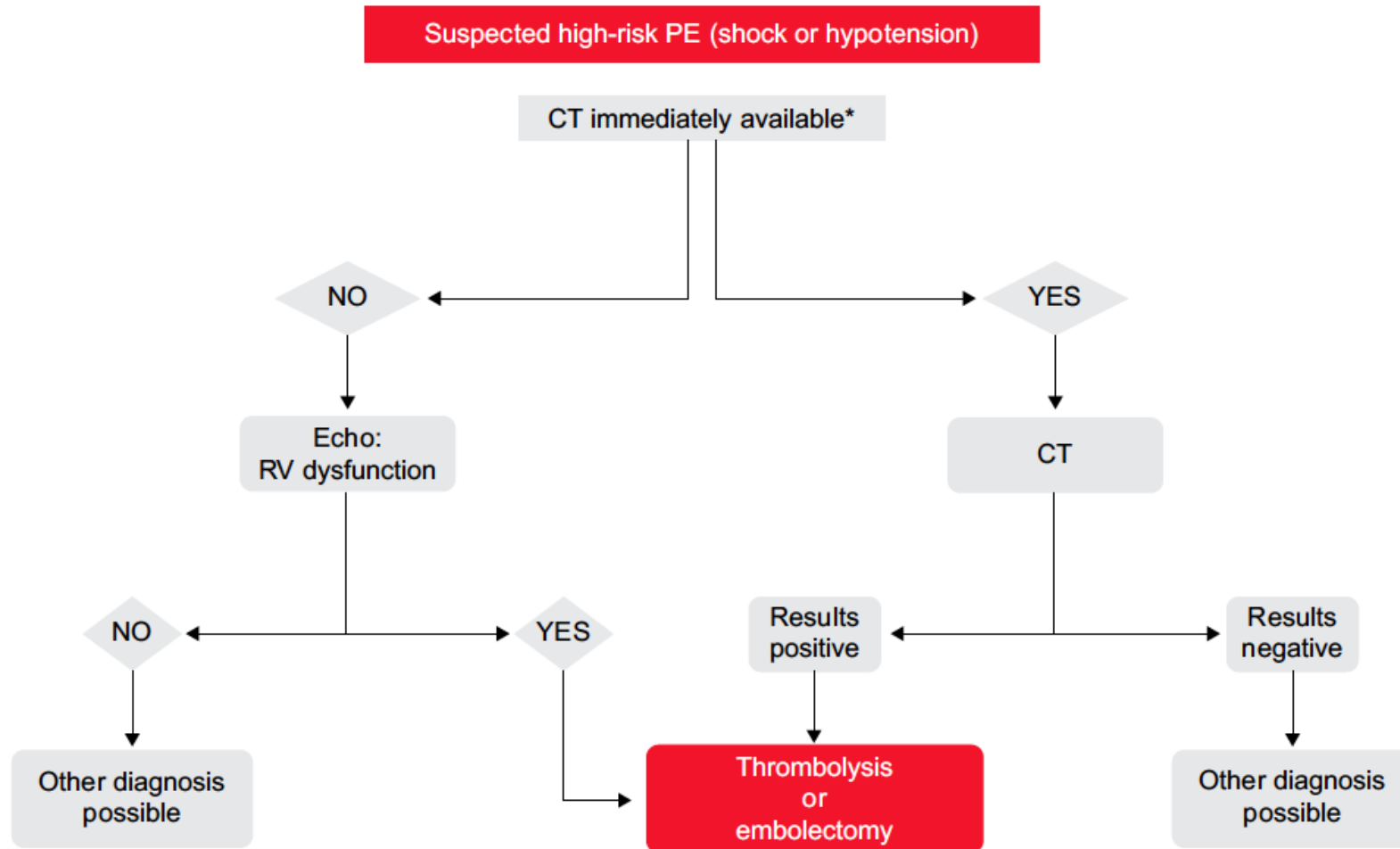
## Recherche de TVP proximale : Echographie 4 points



## Recherche de TVP proximale : Echographie 4 points



# Embolie pulmonaire et ETT : intérêt si choc



*Konstantinides et al NEJM 2008*  
*Konstantinides et al Hellenic J Cardiol 2010*

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**ETT et EP = cœur pulmonaire aigu**

**Dilatation aiguë du VD**

ET

**Septum paradoxal**

ET

**Le plus souvent, HTAP modérée (PAPs < 45-50 mmHg)**

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# Dilatation du VD : quantification

Normal



$\text{STDVD}/\text{STDVG} < 0,6$

Dilatation modérée



$0,6 < \text{STDVD}/\text{STDVG} < 1$

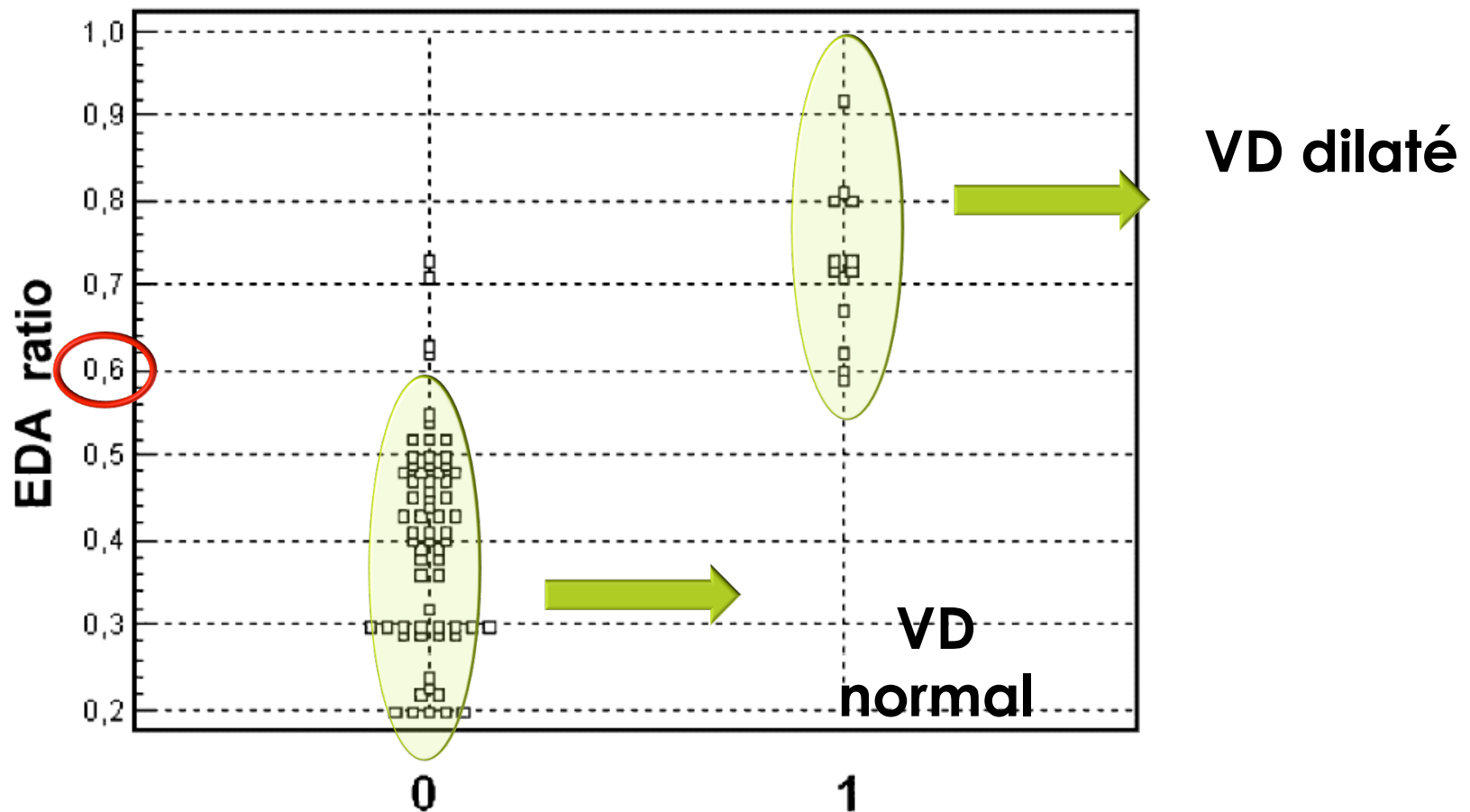
Dilatation majeure



$\text{STDVD}/\text{STDVG} > 1$

*Jardin et al Chest 1997*

## Dilatation du ventricule droit : évaluation qualitative ?



**Fig. 3** Individual values of RV size, assessed on a long-axis view as the ratio of the end-diastolic area of the right ventricle over the end-diastolic area of the left ventricle (*EDA ratio*), in the two qualitative groups: *grade 0* normal RV size; *grade 1* moderately enlarged right ventricle





## Prognostic Value of Echocardiographic Right/Left Ventricular End-Diastolic Diameter Ratio in Patients With Acute Pulmonary Embolism\*

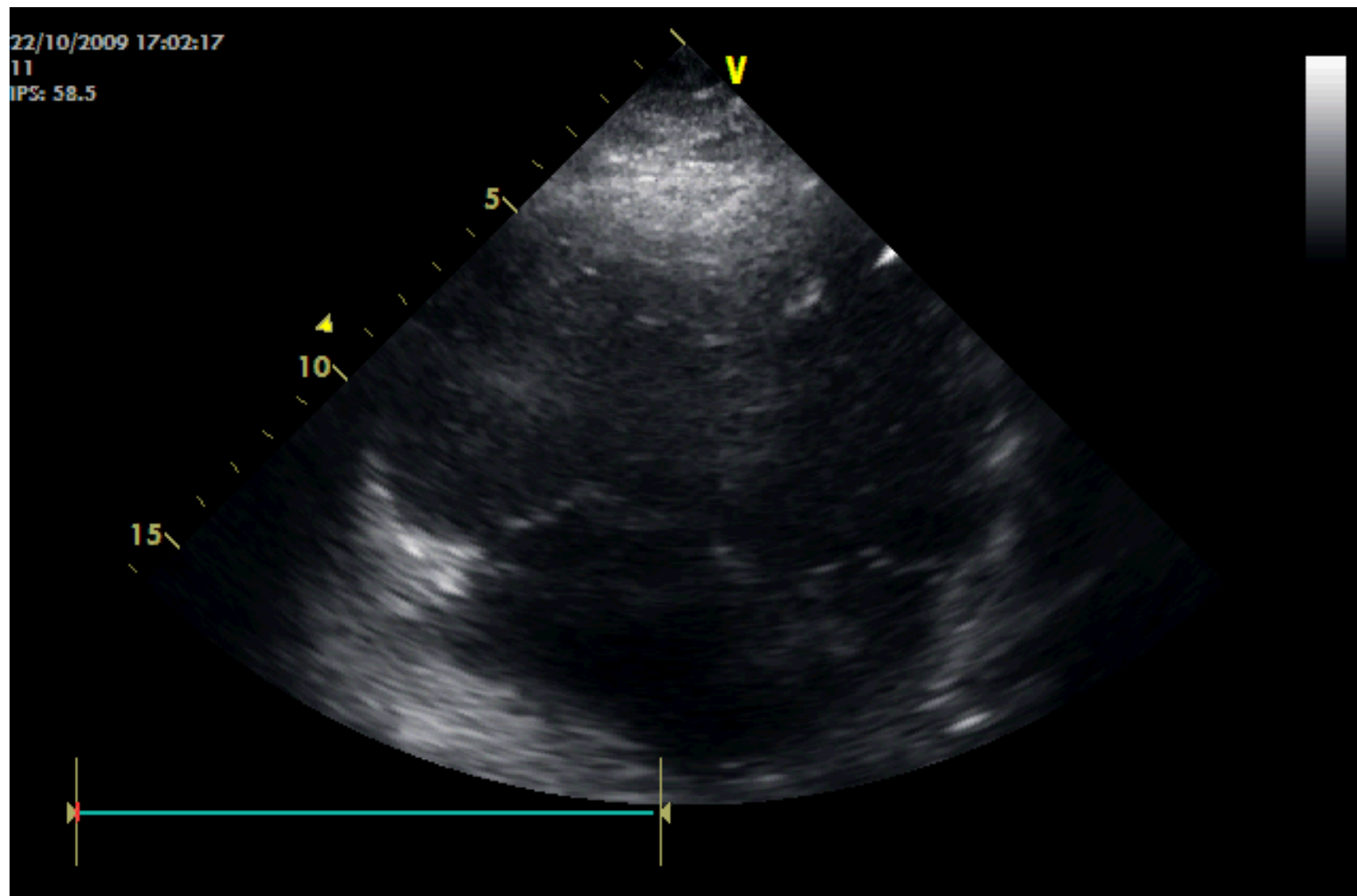
Results From a Monocenter Registry of 1,416 Patients

*Benoît Frémont, MD; Gérard Pacouret, MD; David Jacobi, MD; Raphaël Puglisi, MD; Bernard Charbonnier, MD; and Axel de Labriolle, MD*

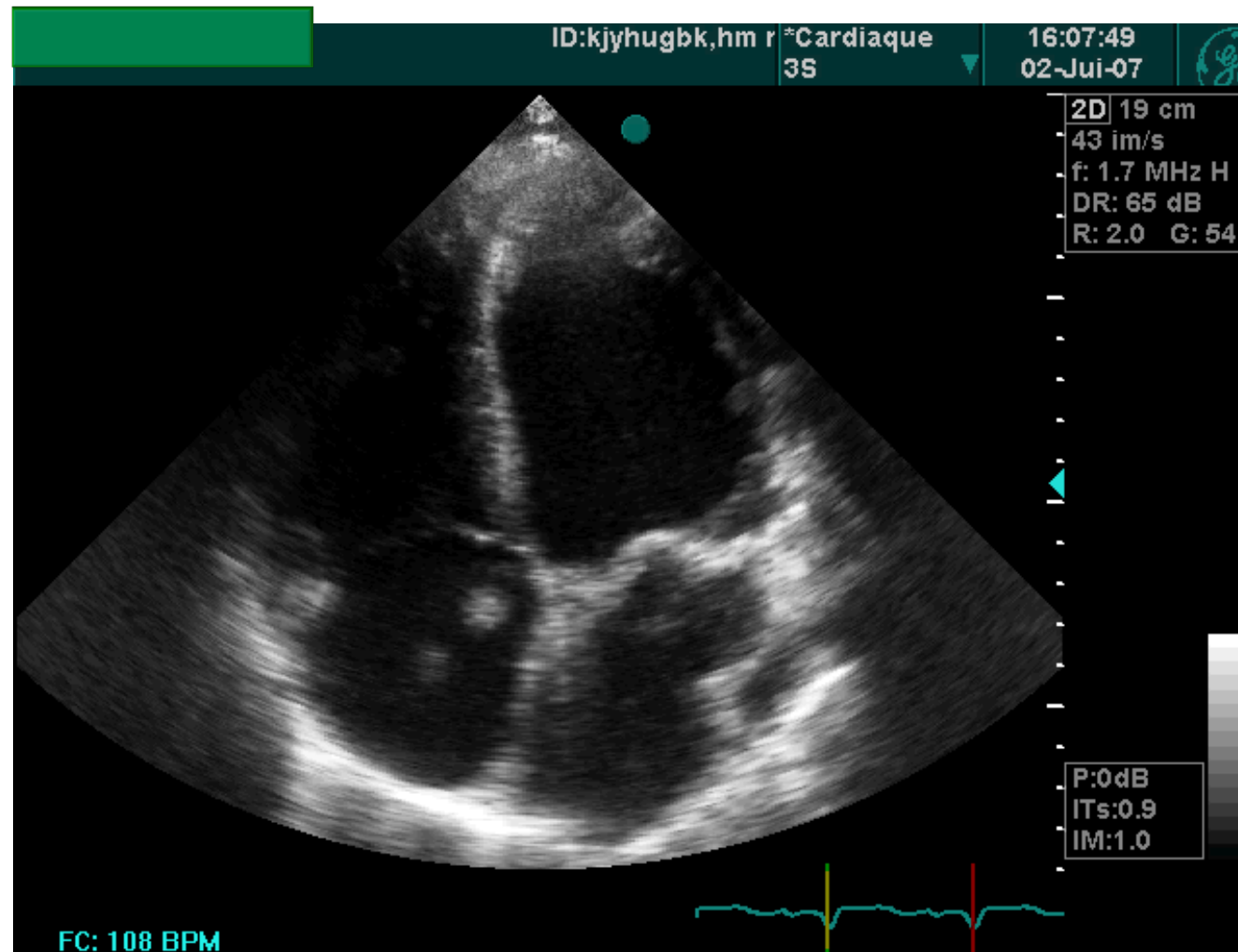
*(CHEST 2008; 133:358–362)*

**Table 3—Multivariate Analysis for Risk Factors of In-hospital Mortality in the Study Population**

| Variables                               | OR    | 95% CI     | p Value      |
|-----------------------------------------|-------|------------|--------------|
| RV/LV ratio $\geq 0.9$                  | 2.66  | 1.68–5.99  | 0.01*        |
| History of left-heart failure           | 8.99  | 3.06–26.33 | $< 0.0001^*$ |
| Systolic arterial pressure $< 90$ mm Hg | 10.73 | 3.50–32.81 | $< 0.0001^*$ |
| Thrombolysis                            | 1.33  | 0.58–3.05  | 0.49         |



VD dilaté?

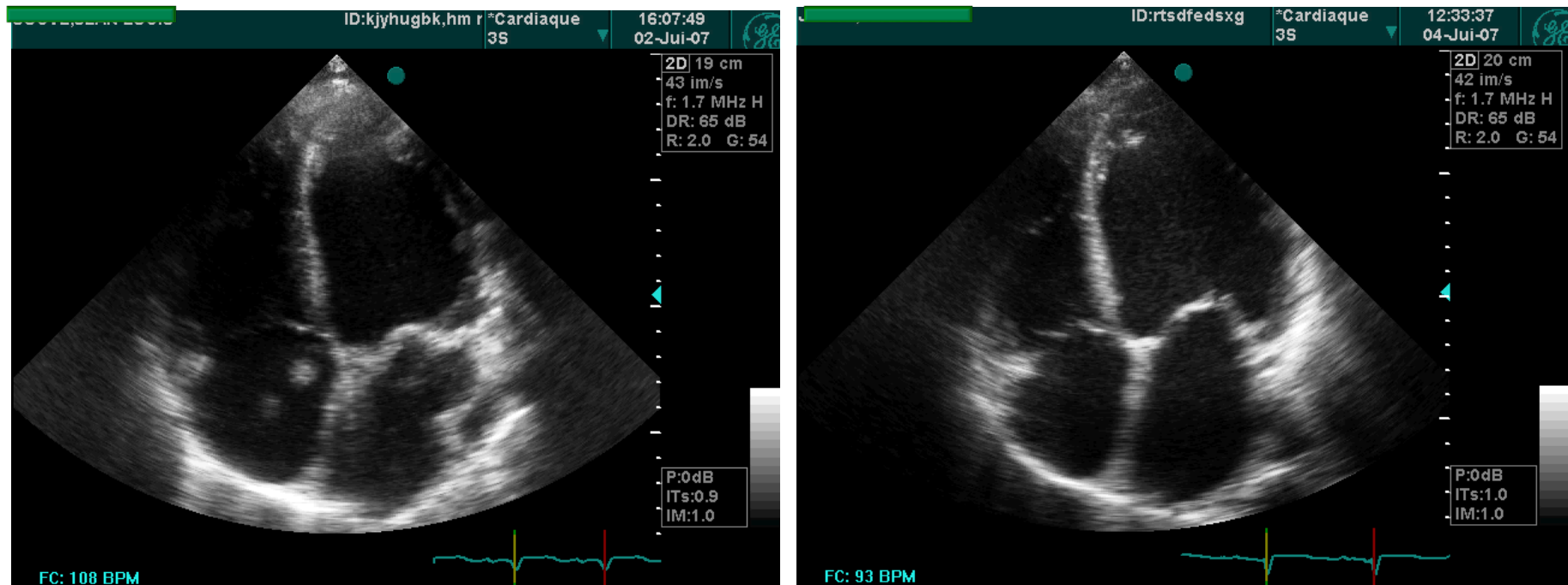


Patient de 45 ans, coronarien, FEVG de base 40%, ECG normal, choc et dyspnée

# Quiz. Chez ce patient :

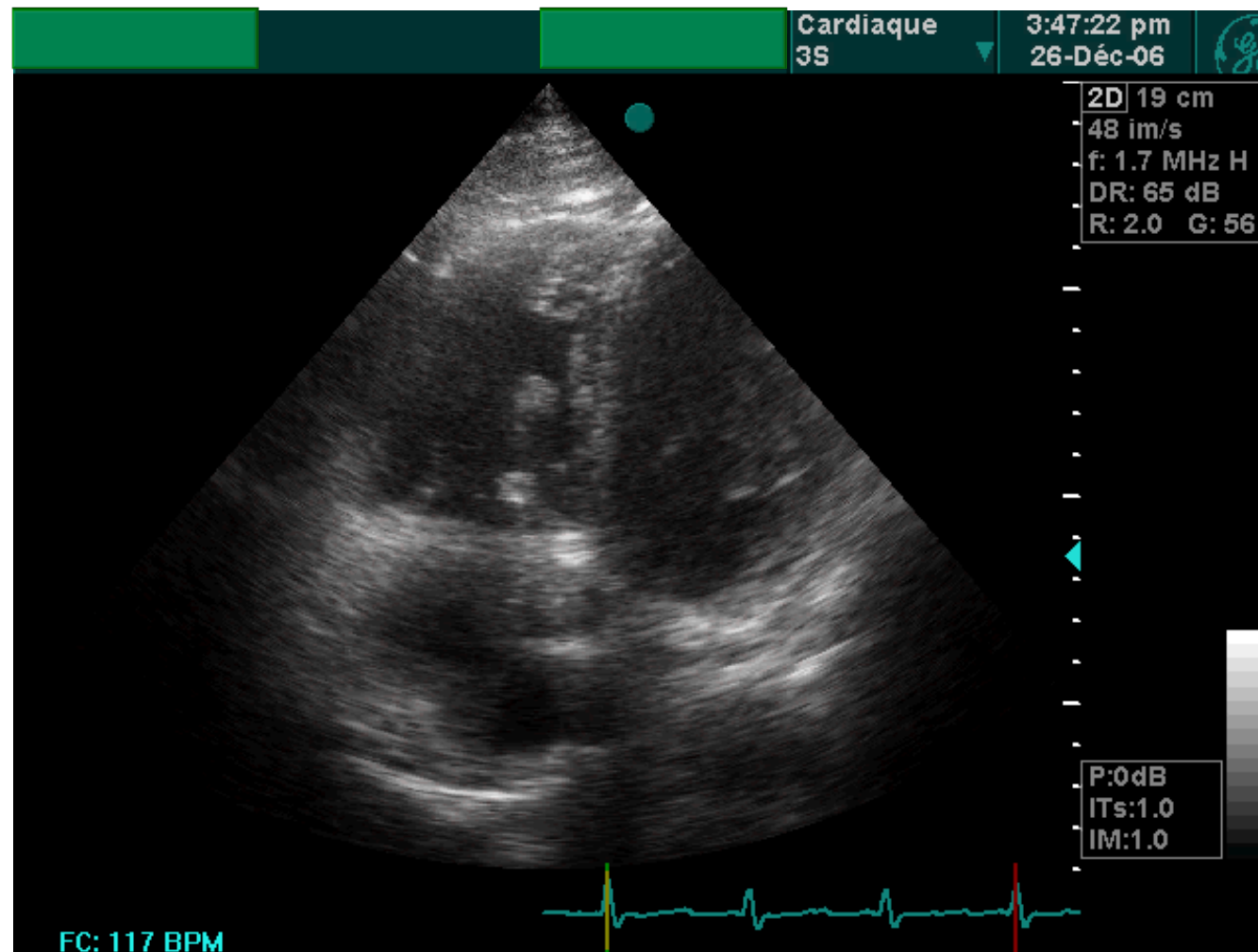
- ① Il n'y a pas d'EP, c'est un choc cardiogénique « gauche »
- ② Il existe une dilatation du ventricule droit
- ③ L'histoire clinique et l'ETT permettent une forte suspicion d'EP
- ④ Il faut impérativement compléter l'exploration par un angioscanner ou une ETO

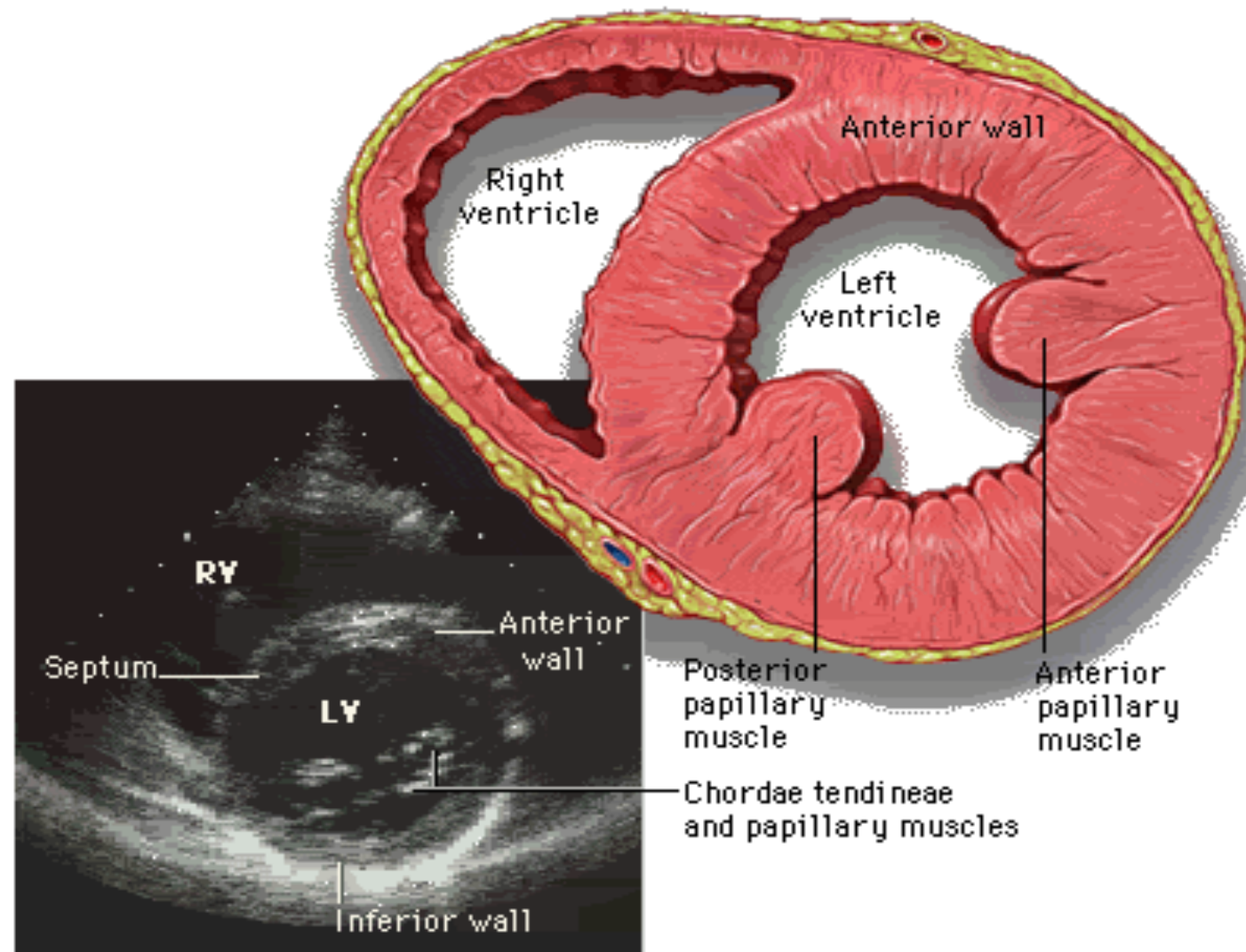
## Récupération rapide du VD après fibrinolyse



Patient de 45 ans, coronarien, ECG normal, choc et dyspnée

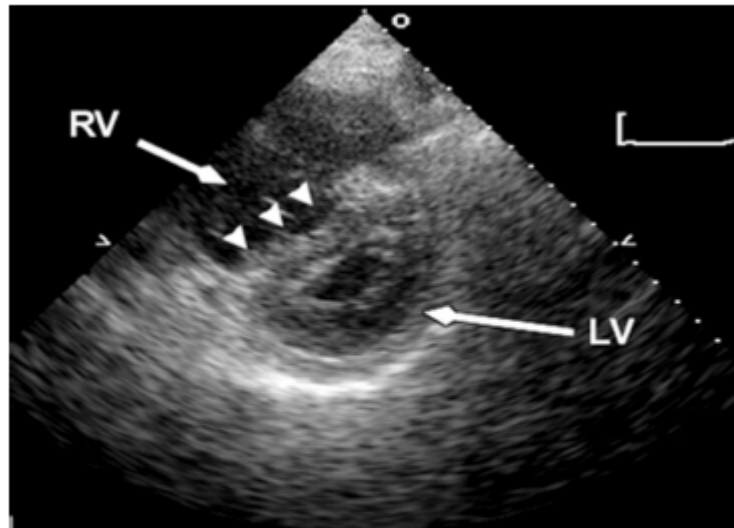
# Thrombus OD



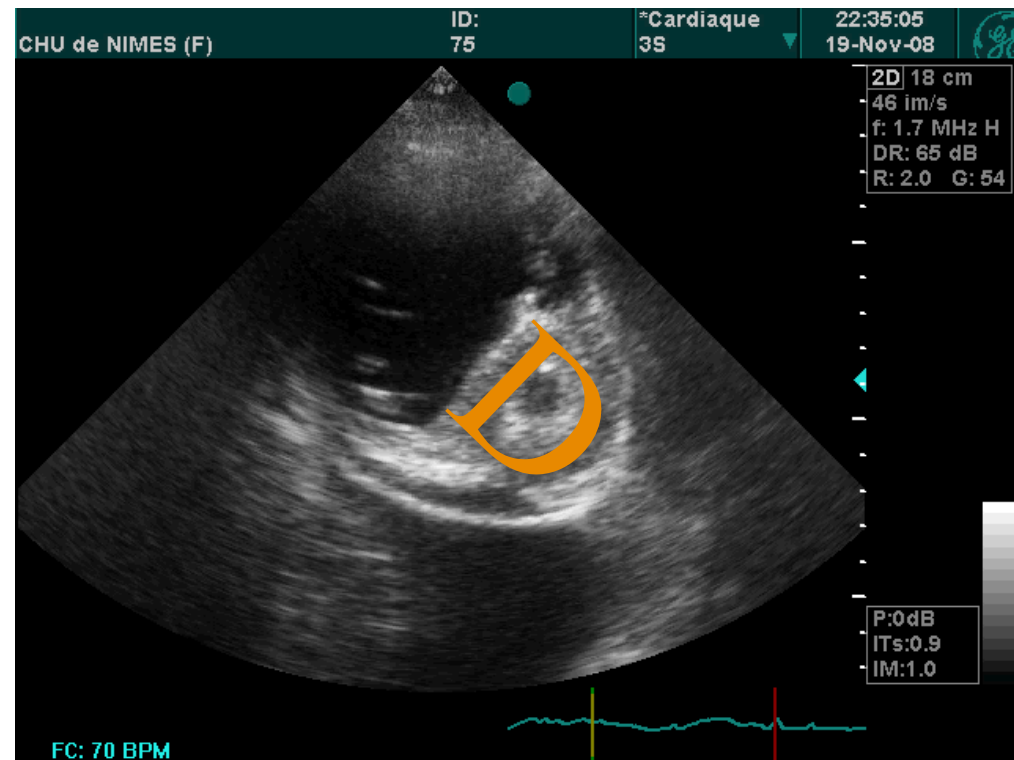




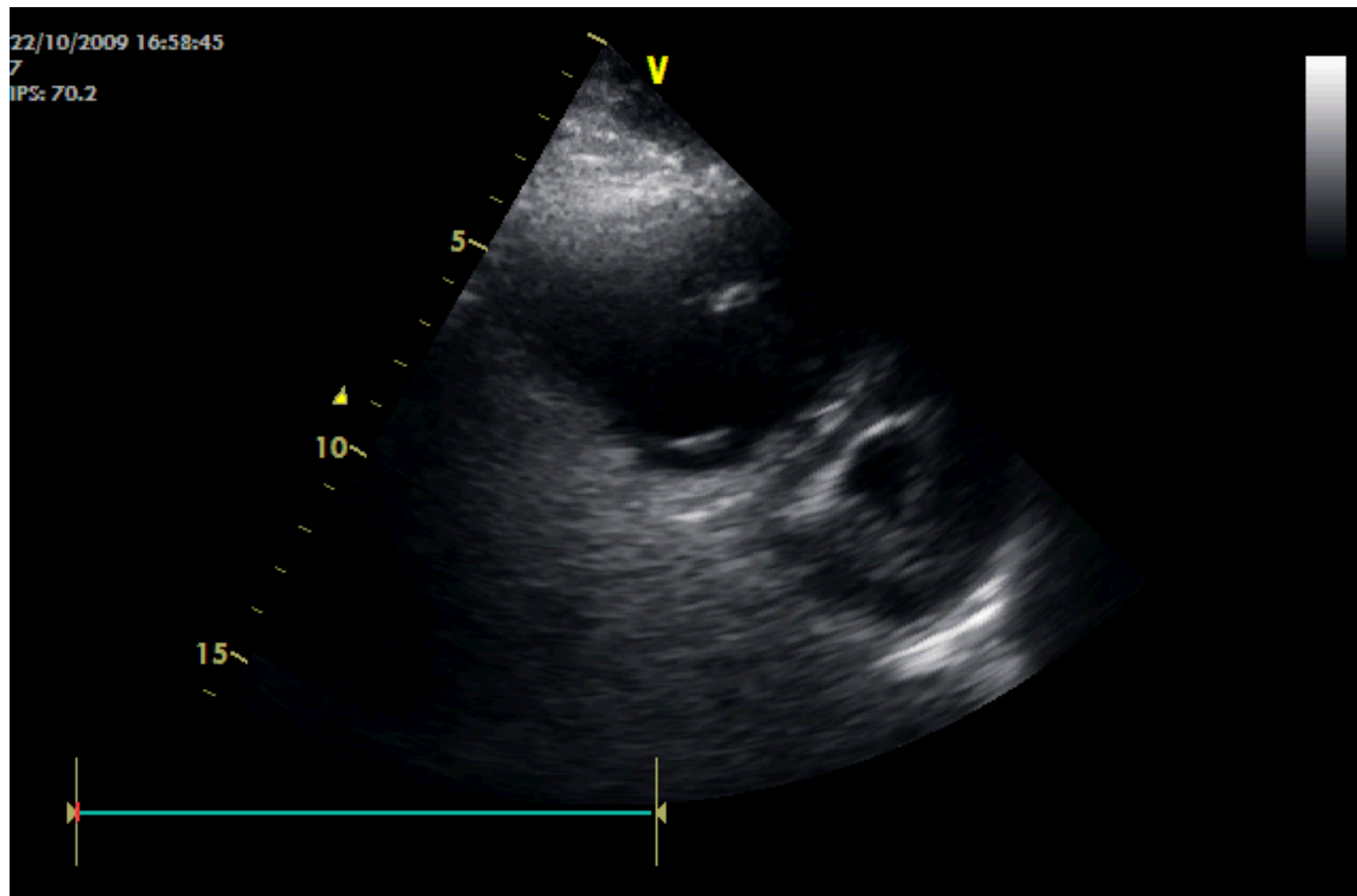
# Septum paradoxal : « the D sign »



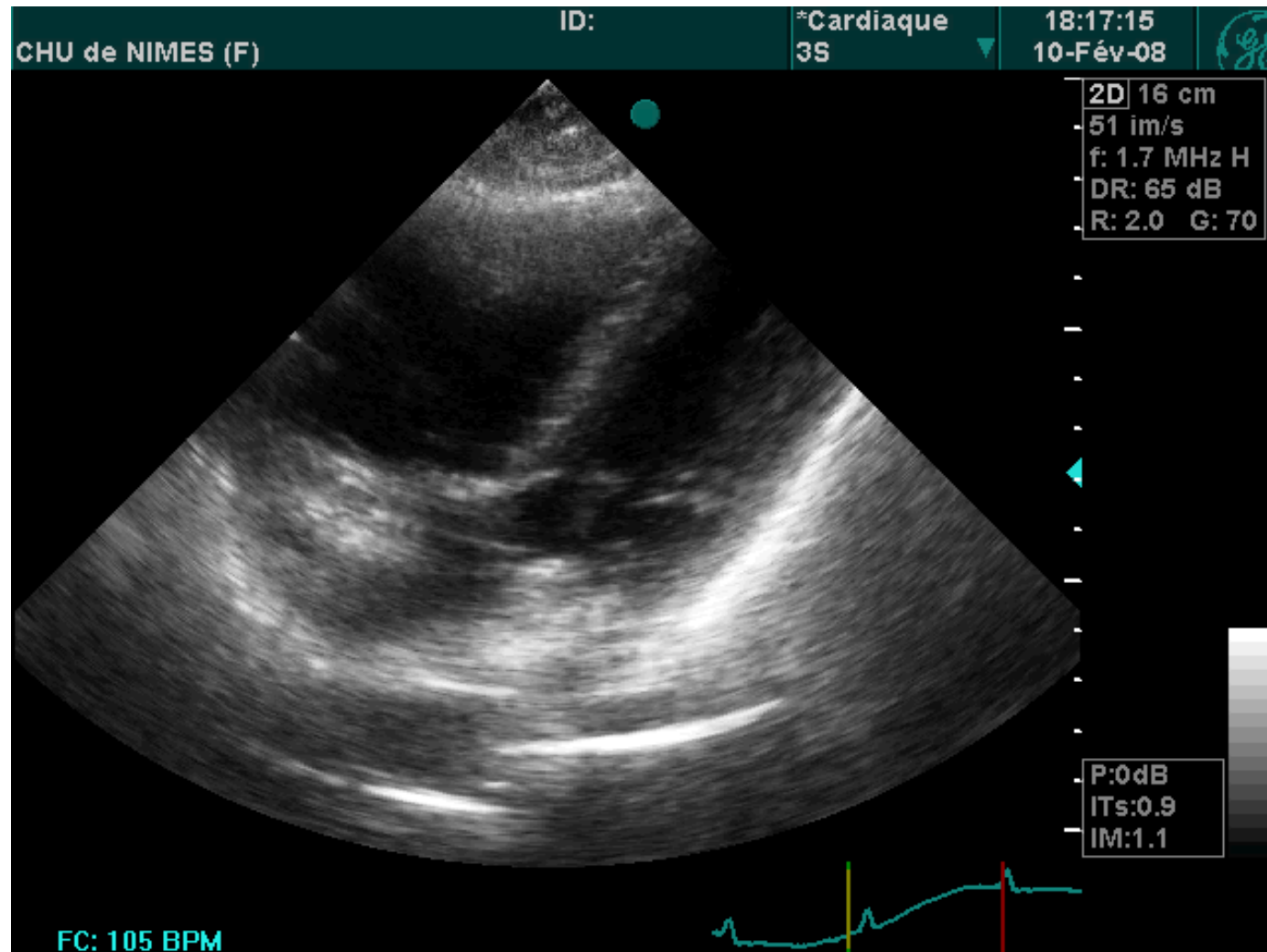
**Figure 4.** Note the “D” shape of the LV in the parasternal short-axis view manifested here by flattening of the interventricular septum.



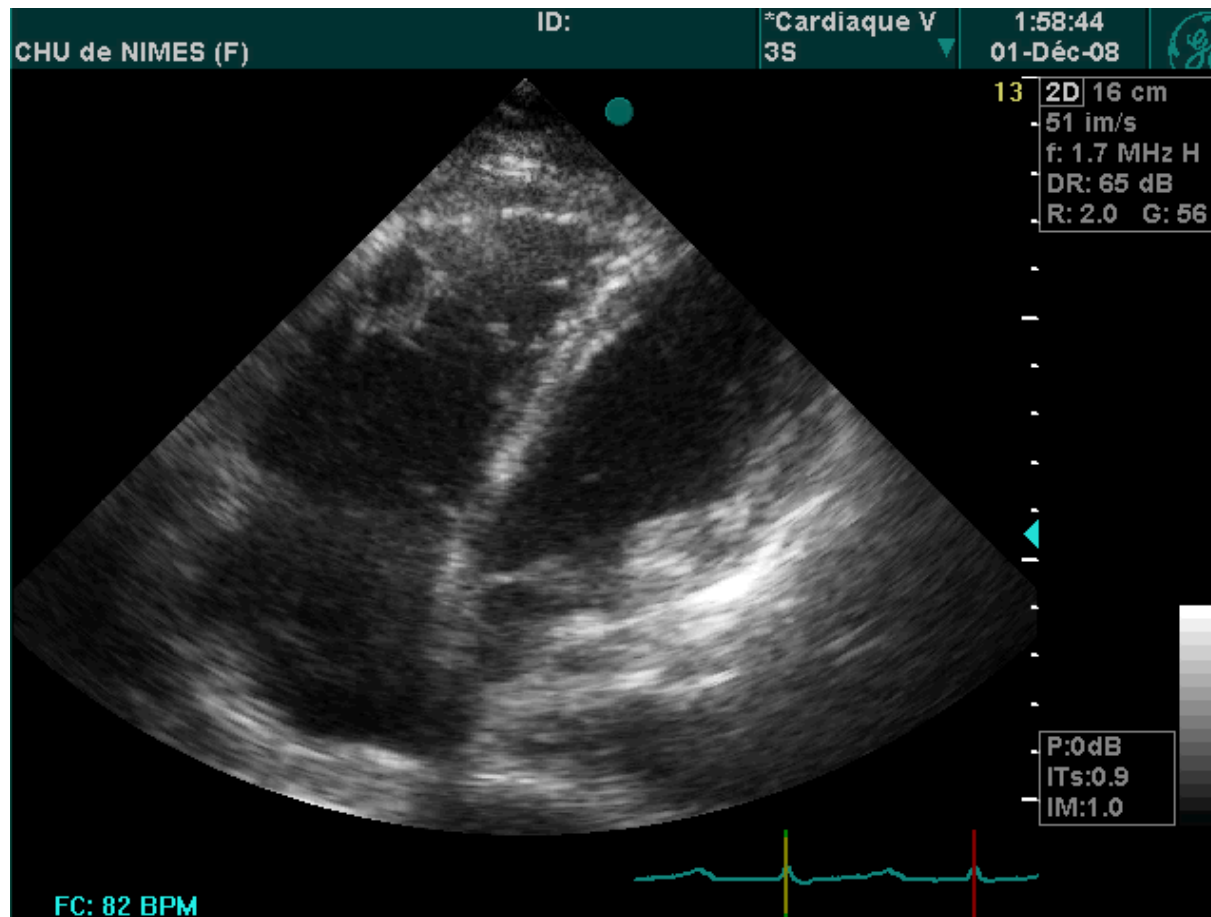




# Septum paradoxal en coupe 4 cav : VG en « doigt de gant »



# Signe de McConnell

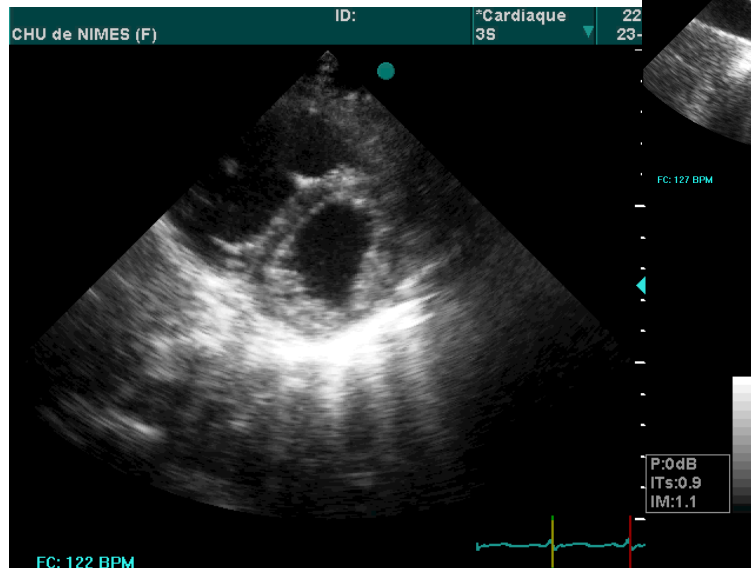
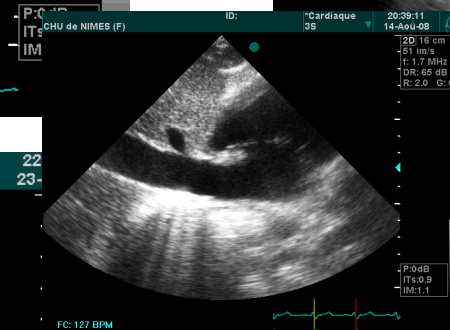
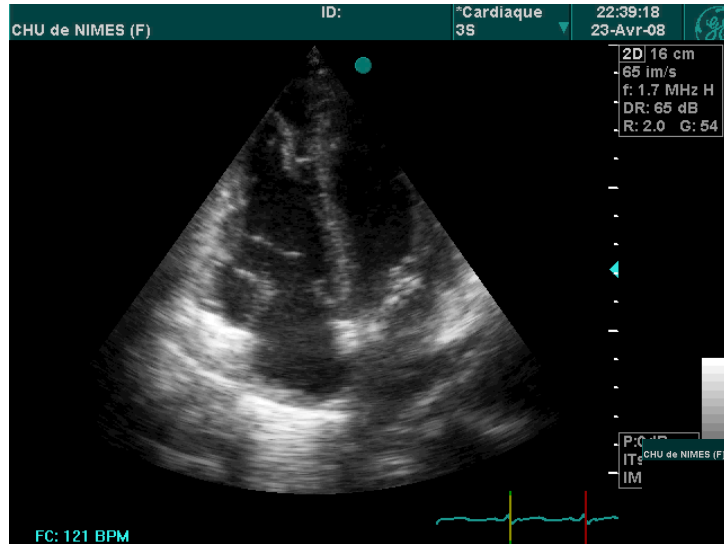


Normo ou hyper  
kinésie de la partie  
apicale de la paroi  
libre du VD

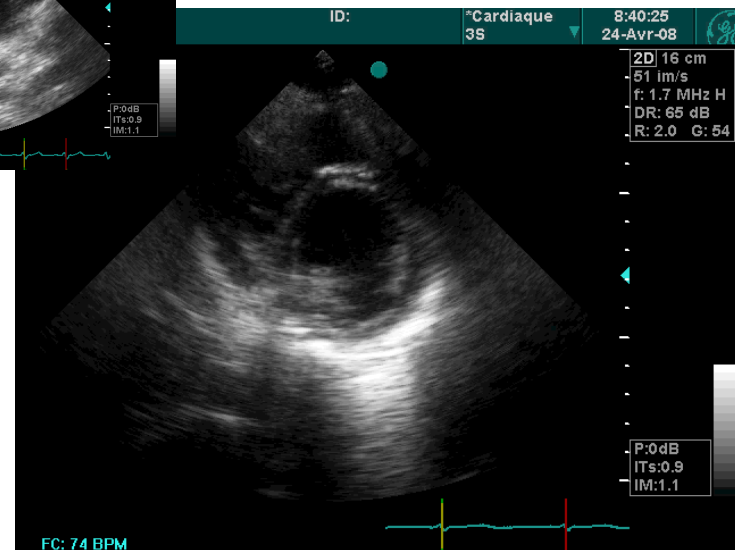
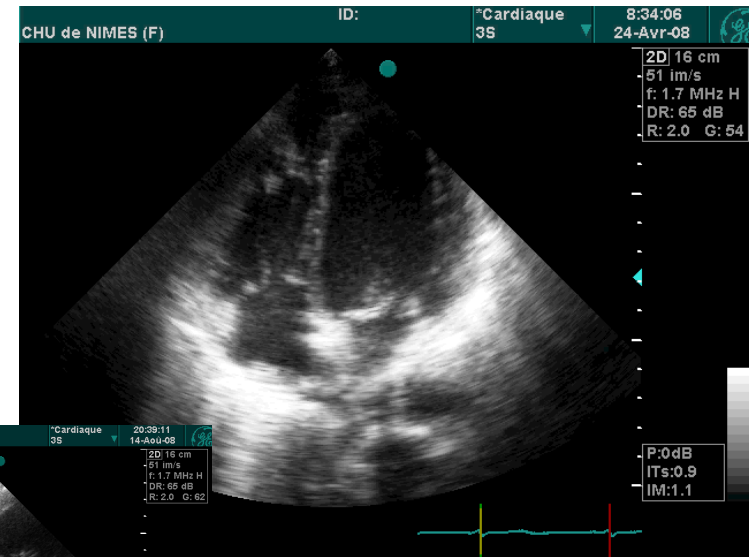
Hypo ou akinésie du  
reste de la paroi libre  
du VD

# Coeur pulmonaire aigu : patiente 40 ans péritonite, SDRA

J0



J1



## Proximal pulmonary emboli modify right ventricular ejection pattern

A. Torbicki\*, M. Kurzyna\*, M. Ciurzynski\*\*, P. Pruszczyk\*\*, R. Pacho\*\*\*,  
A. Kuch-Wocial\*\*, M. Szulc\*\*

Eur Respir J 1999; 13: 616–621

- ▣ Comparaison profils échographiques de :
  - ▣ CPA / EP
  - ▣ CPC / BPCO
  - ▣ HTAP primitives

▣ ➔ signe du 60/60:

*PAPs < 60 mmHg Tacc < 60 msec*

▶ *plutôt EP!*

# Diagnostic différentiel = Cœur pulmonaire chronique

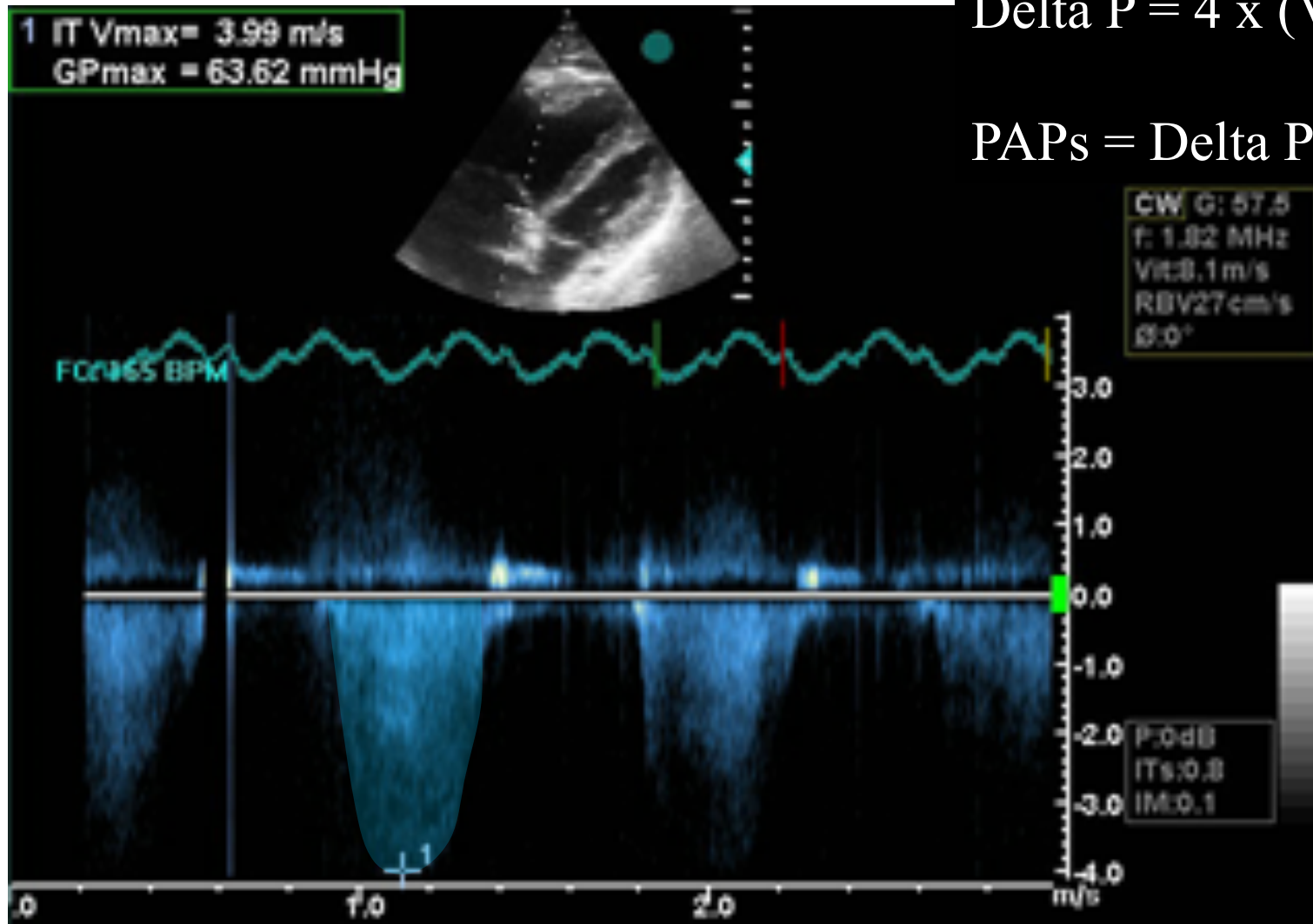
Arguments en faveur d'un CPC :

## Anamnèse

**Niveau d'HTAP élevé :  $V_{\max IT} > 3,5 \text{ m/s}$**

**Epaisseur de paroi libre du VD  $> 6 \text{ mm}$**

## Mesure du niveau d'HTAP : Vmax de la fuite tricuspidiennne



$$\Delta P = 4 \times (V_{\text{max IT}})^2$$

$$\text{PAPs} = \Delta P + \text{POD}$$

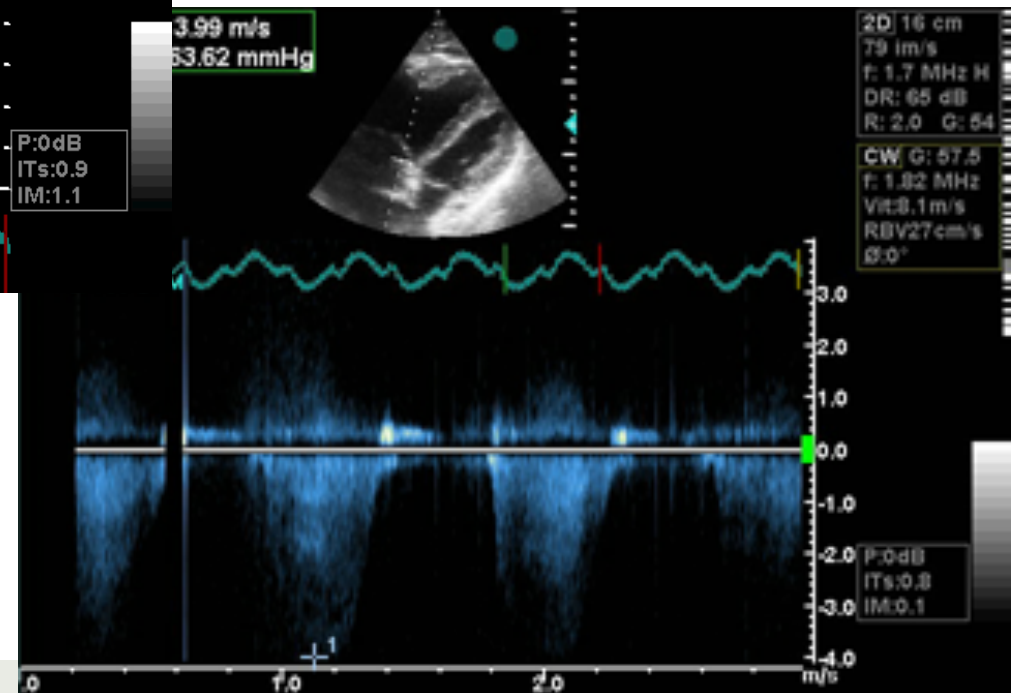
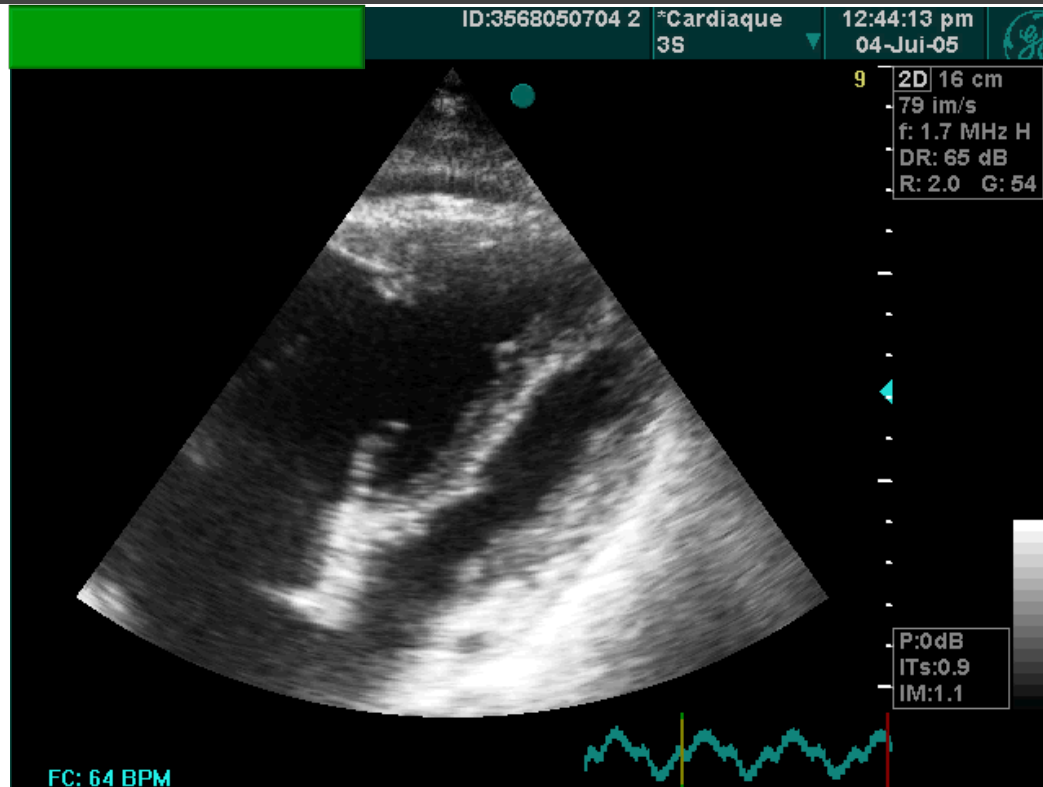
## Diamètre et variations respiratoires de la VCI et PVC: recettes classiques en ventilation spontanée

| Diamètre de la VCI (mm) | Variations respiratoires de la VCI (%) | Valeur de POD (mmHg) |
|-------------------------|----------------------------------------|----------------------|
| Bas : < 15              | Collapsus<br>inspiratoire de 100<br>%  | 0-5                  |
| Normal : 15-25          | >50<br>< 50                            | 6-10<br>11-15        |
| Elevé : > 25            | < 50<br>Absentes                       | 16-20<br>> 20        |

*Luthra A, Echo made easy Anshan eds 2007  
Wong SP, Practice of clinical echocardiography 2002  
Brennan JASE 2007*



# HTAP très élevée : cœur pulmonaire chronique probable



$$\Delta P = 4 \times V_{\max}^2$$
$$\text{PAPs} = \Delta P + \text{POD}$$

# Echocardiographie en réanimation : incontournable ?

## POINTS OF VIEW

### All intensivists need echocardiography skills in the 21st century

—— Critical Care and Resuscitation • Volume 9 Number 3 • September 2007

Ian M Seppelt

For a patient whose condition becomes unstable at 03:00, it is reasonable to expect a focused echo examination to answer the following questions:

- Is the heart working?
- Is it really full or really empty?
- Is there an acute valve rupture with torrential regurgitation?
- Is there an acute cardiac rupture or ventricular septal defect?
- Is there a tamponade?

Focused = 1 question simple  
1 réponse simple

There are thus three levels of echocardiography training for intensive care practice:

- Level 1— the focused clinical examination, 24 hours per day, to answer immediate clinical questions.
- Level 2 — the trained echocardiographer, with more advanced knowledge and skills, and ongoing maintenance of skills and quality assurance. Ideally there will be at least one of these in every ICU.
- Level 3 — the program director or researcher in critical care echocardiography.

Most intensive care trainees recognise and want this. The challenge for us now is to make it happen.

*Seppelt IM Crit Care Resusc 2007*