

**08h45 – 09h00 : Accueil des participants**

09h00 – 09h30 : Concept des pressions de remplissage du ventricule gauche

09h30 – 10h30 : Le Ventricule Droit

**10h30 – 11h00 : Pause**

11h00 – 12h00 : Ateliers pratiques

**12h00 – 13h00 : Pause repas**

13h00 – 14h00 : Détresse respiratoire

14h00 – 15h00 : Etat de choc

15h00 – 16h00 : Ateliers pratiques

16h00 – 17h00 : Quizz interactif



# Echographie cardiaque et hémodynamique avancée

## Détresse Respiratoire



GE HealthCare

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*Médecin Urgentiste*

*AP-HM Hôpital La Timone Adultes*

*Marseille*

**Hôpitaux**  
Universitaires  
de Marseille | **ap.**  
**hm**



Faculté des sciences  
médicales et paramédicales  
Aix Marseille Université

# Dyspnée et urgences

Europe et Asie  
Patients > 18 ans

	Total [ <i>n</i> (%)]	AANZDEM [ <i>n</i> (%)]	EURODEM [ <i>n</i> (%)]	<i>P</i> value	OR (95% CI)
<i>N</i> (%)	5569	3044 (54.7)	2525 (45.3)		
Age (median [Q1–Q3]) (years)	68 (51–80) missing data <i>n</i> = 25	67 (49–80)	69 (53–80)	0.01	
Male	2719 (49.0) missing data <i>n</i> = 21	1495 (49.2)	1224 (48.8)	NS	1.02 (0.91–1.13)
ED diagnoses					
Lower respiratory tract infection	1389 (24.9)	616 (20.2)	773 (30.6)	< 0.001	0.58 (0.51–0.65)
Heart failure	962 (17.3)	455 (14.9)	507 (20.1)	< 0.001	0.63 (0.55–0.73)
COPD exacerbation	882 (15.8)	415 (13.6)	467 (18.5)	< 0.001	0.70 (0.60–0.81)
Asthma	584 (10.5)	387 (12.7)	197 (7.8)	< 0.001	1.52 (1.27–1.82)
Other	2022 (36.3)	1171 (38.5)	851 (33.7)	< 0.001	1.24 (1.10–1.38)
Comorbidities					
Chronic heart failure	1102 (20.5) missing data <i>n</i> = 196	522 (17.2)	580 (24.7)	< 0.001	0.63 (0.55–0.73)
Diabetes mellitus	1246 (23.0) missing data <i>n</i> = 149	697 (23.0)	549 (22.9)	NS	1.01 (0.89–1.14)
Hypertension	2541 (46.9) missing data <i>n</i> = 152	1405 (46.4)	1136 (47.6)	NS	0.95 (0.85–1.06)
Atrial fibrillation/flutter	873 (16.1) missing data <i>n</i> = 157	468 (15.5)	405 (17.0)	NS	0.90 (0.77–1.04)
COPD	1477 (27.3) missing data <i>n</i> = 164	721 (23.9)	756 (31.7)	< 0.001	0.67 (0.60–0.76)
Smoker	935 (17.9) missing data <i>n</i> = 336	389 (12.9)	546 (24.7)	0.001	0.45 (0.39–0.52)
Asthma	1117 (20.6) missing data <i>n</i> = 143	685 (22.6)	432 (18.0)	0.03	1.33 (1.16–1.53)

## Dyspnée et urgences

514 patients > 65a

### Diagnosis of causes of acute respiratory failure by experts, and mortality

Diagnosis	Number of patients (%)	Mortality <sup>a</sup> , %
Cardiogenic Pulmonary Edema	219 (43)	21 [16–27]
Community-acquired pneumonia	181 (35)	17 [12–23]
Exacerbation of chronic respiratory disease	164 (32)	12 [8–18]
Pulmonary embolism	93 (18)	15 [9–24]
Bronchitis	23 (4)	4 [0–21]
Acute asthma	15 (3)	0 [0–20]
Others	78 (15)	24 [16–34]
No diagnosis	8 (2)	0 [0–32]

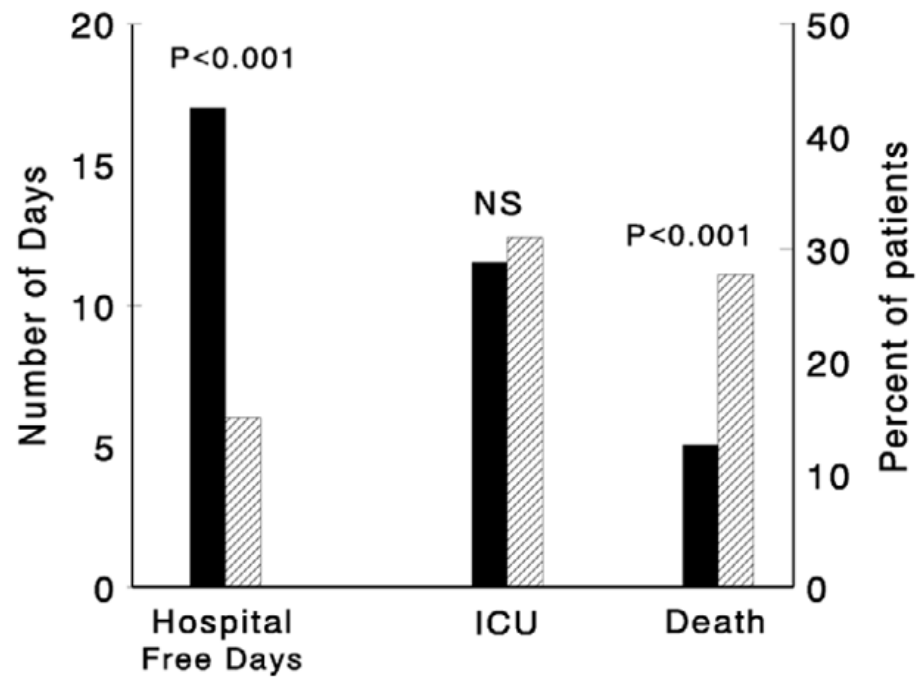
47% diagnostic mixte

mortalité 16%



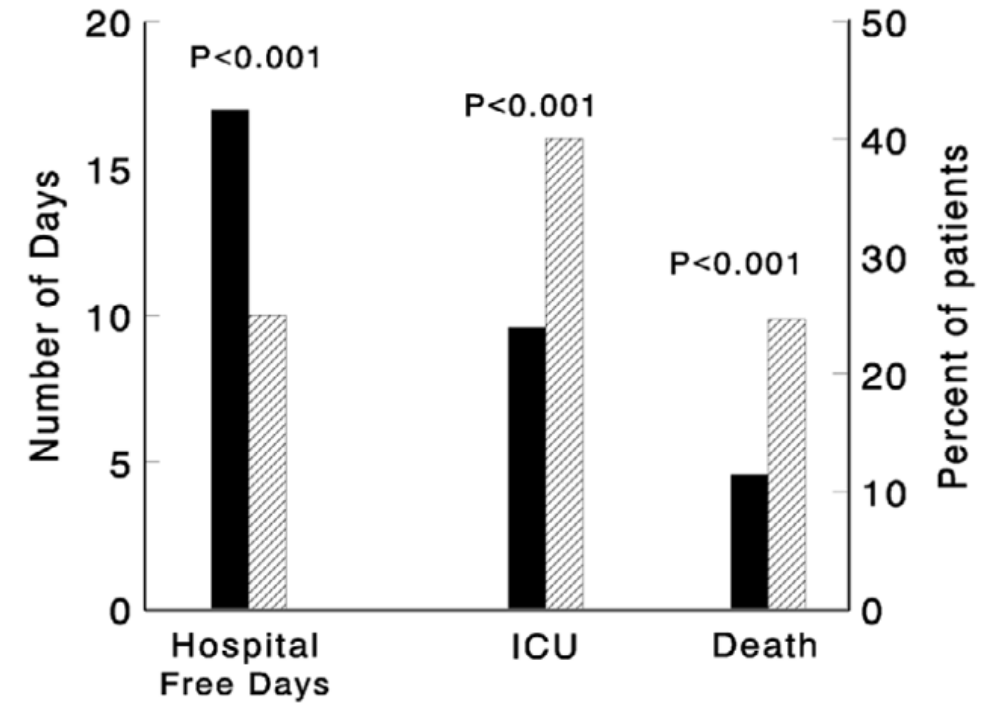
## Dyspnée et urgences

(a) Emergency Diagnosis



20% diagnostics erronés

(b) Emergency Treatment



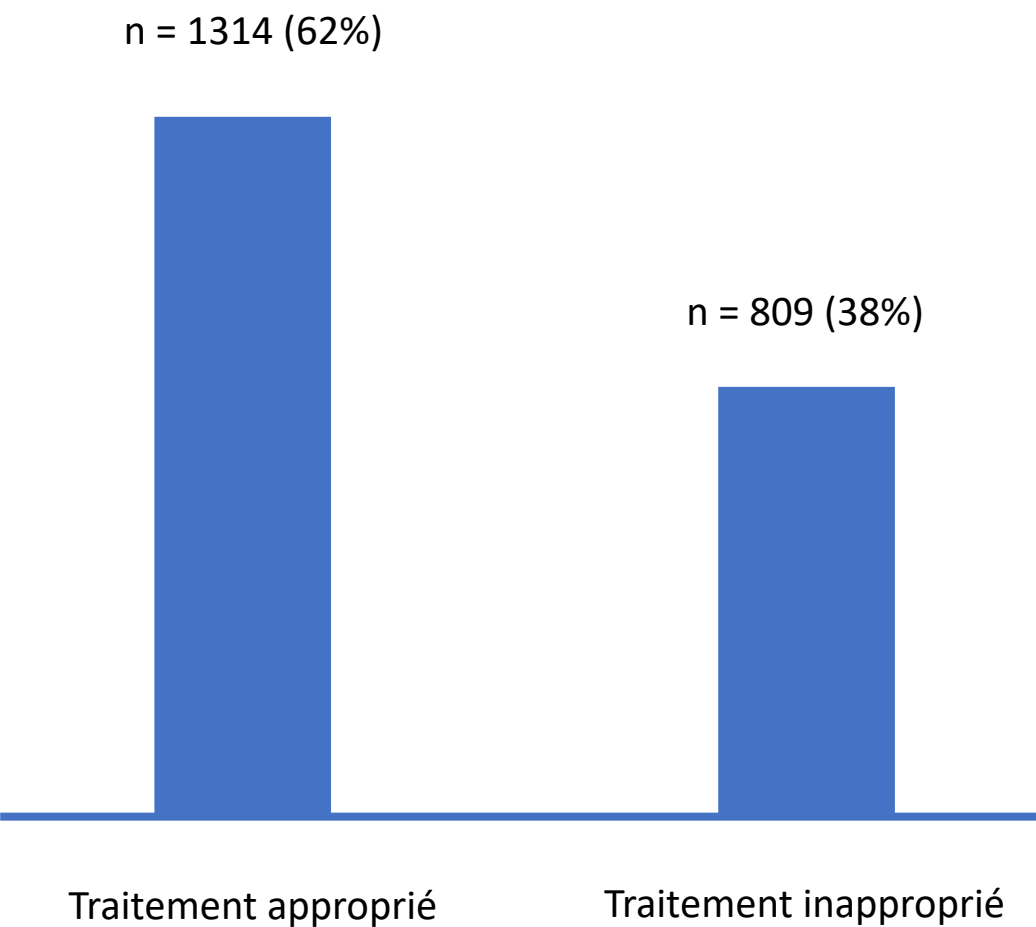
32% traitements inadaptés

## Dyspnée et urgences

### Performance diagnostique : Anamnèse + Clinique + ECG + Radio Thoracique

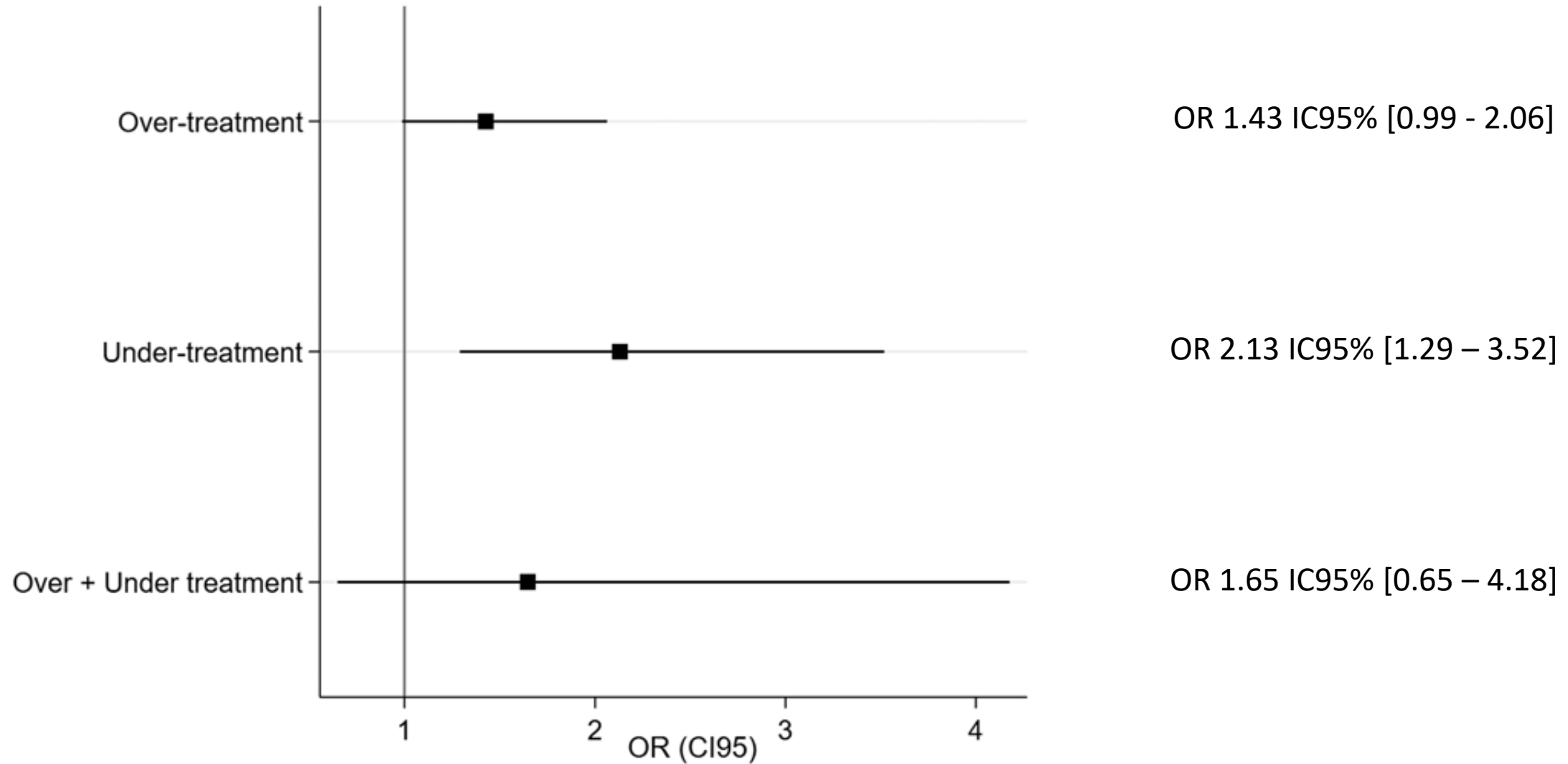
Diagnosis	Sensitivity	Specificity	Positive predictive value	Negative predictive value	Accuracy
CPE	0.71 [0.65–0.77]	0.80 [0.75–0.84]	0.74 [0.70–0.87]	0.78 [0.72–0.82]	0.76 [0.72–0.80]
CAP	0.86 [0.80–0.90] <sup>a</sup>	0.76 [0.71–0.80]	0.66 [0.59–0.71] <sup>a</sup>	0.91 [0.87–0.93] <sup>a</sup>	0.79 [0.75–0.82]
Acute exacerbation of CRD	0.71 [0.64–0.78]	0.83 [0.79–0.87]	0.66 [0.59–0.73] <sup>a</sup>	0.86 [0.82–0.89] <sup>a</sup>	0.81 [0.78–0.84] <sup>a</sup>
Pulmonary embolism	0.75 [0.66–0.83]	0.78 [0.74–0.82]	0.43 [0.36–0.51] <sup>a</sup>	0.93 [0.90–0.96] <sup>a</sup>	0.78 [0.74–0.81]
Asthma	0.67 [0.42–0.85]	0.97 [0.95–0.98] <sup>a</sup>	0.42 [0.24–0.61] <sup>a</sup>	0.99 [0.98–1.00] <sup>a</sup>	0.96 [0.94–0.98] <sup>a</sup>

2123 patients dyspnéiques > 15 ans

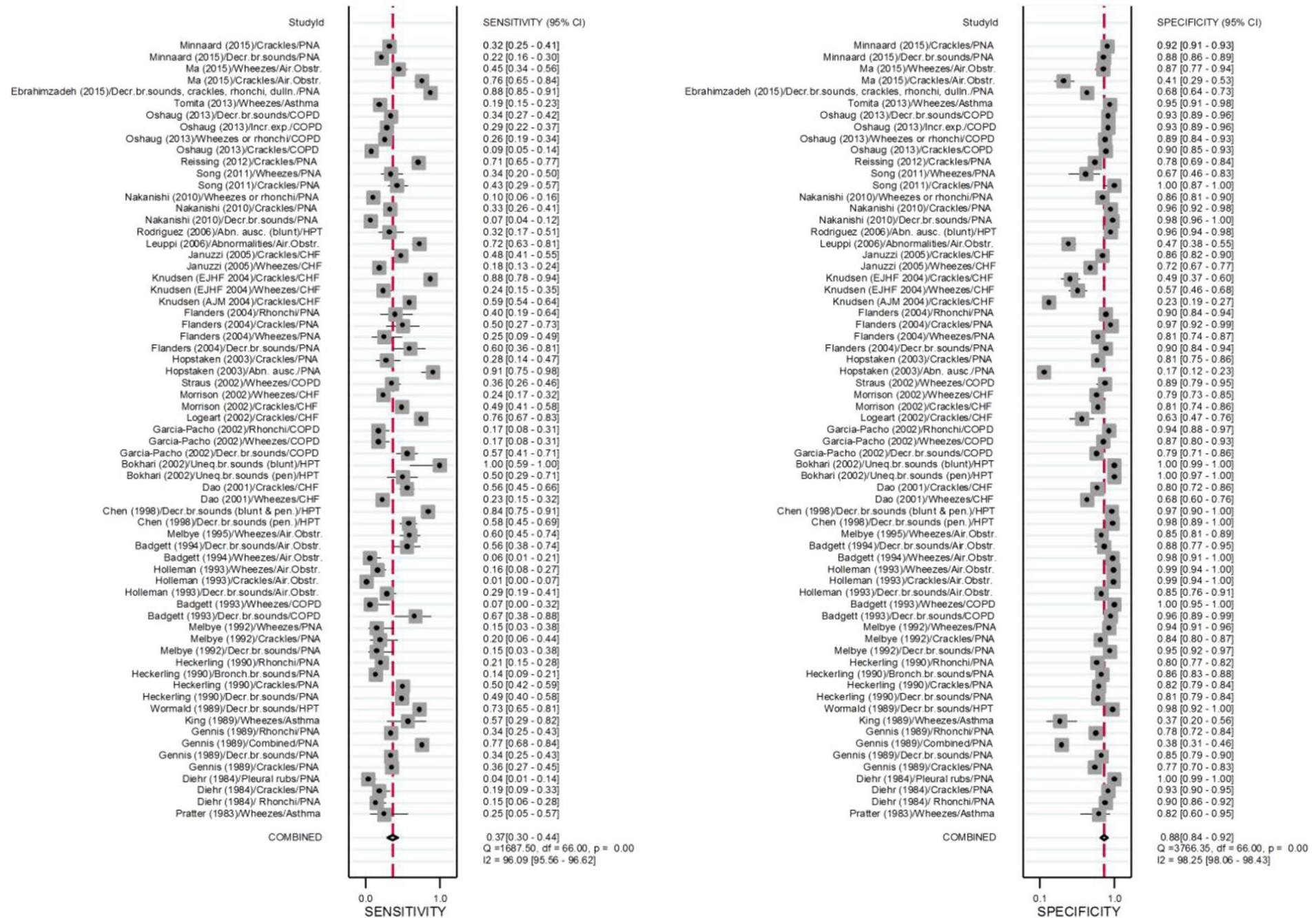


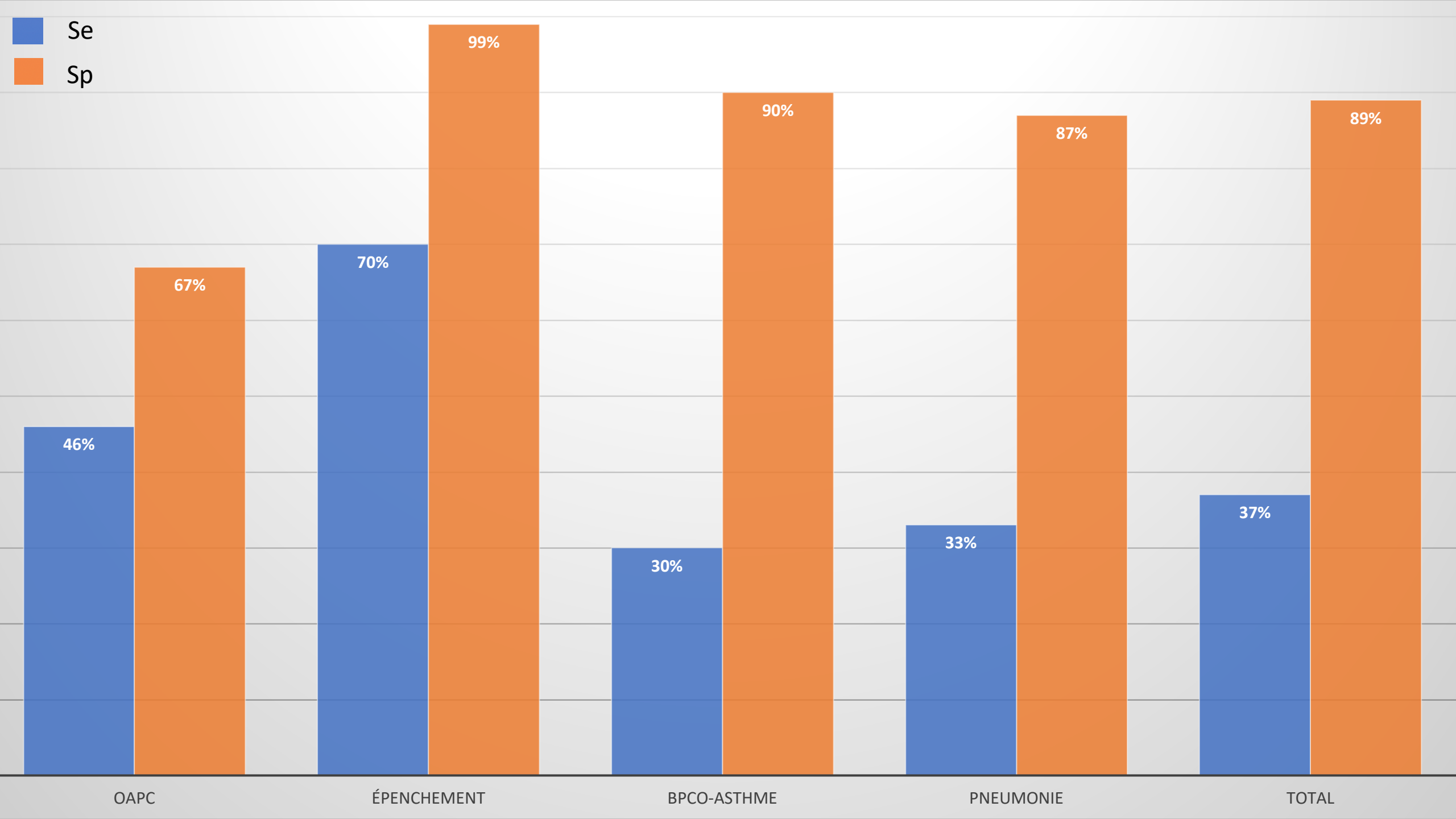
	OR	(95%CI)
Age >75 years	1.46	(1.18–1.81)
Heart disease	1.32	(1.07–1.62)
Lung disease	1.47	(1.21–1.78)
SpO <sub>2</sub> <90%	1.64	(1.37–2.02)
Bilateral rale	1.25	(1.01–1.56)
Focal cracklings	1.32	(1.05–1.66)
Wheezing	1.62	(1.31–2.03)

## Dyspnée et urgences



> 14000 patients





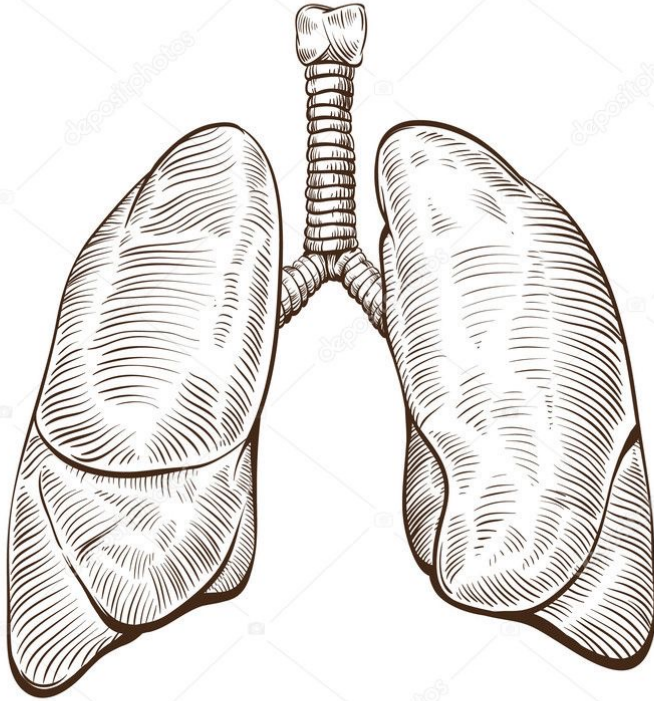
# Take a deep breath : the stethoscope is dying



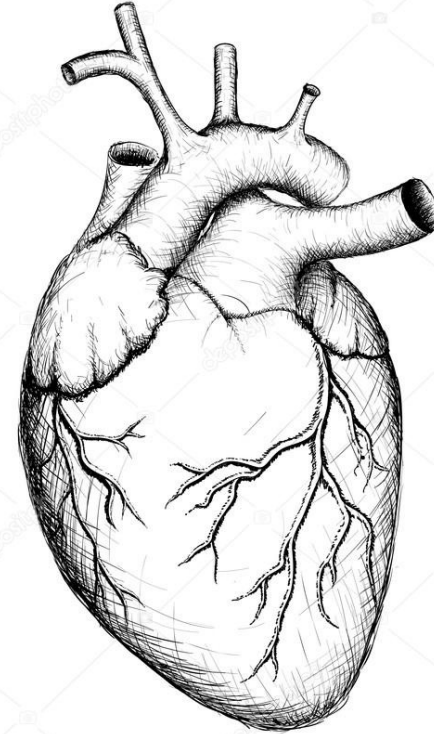
The Guardian - 2014



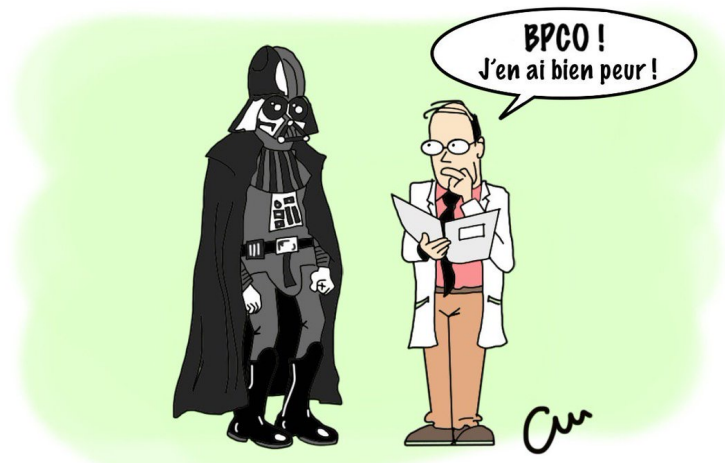
1



2







Œdème Cardiogénique



Profil B

Pneumopathie Infectieuse



Tous sauf A

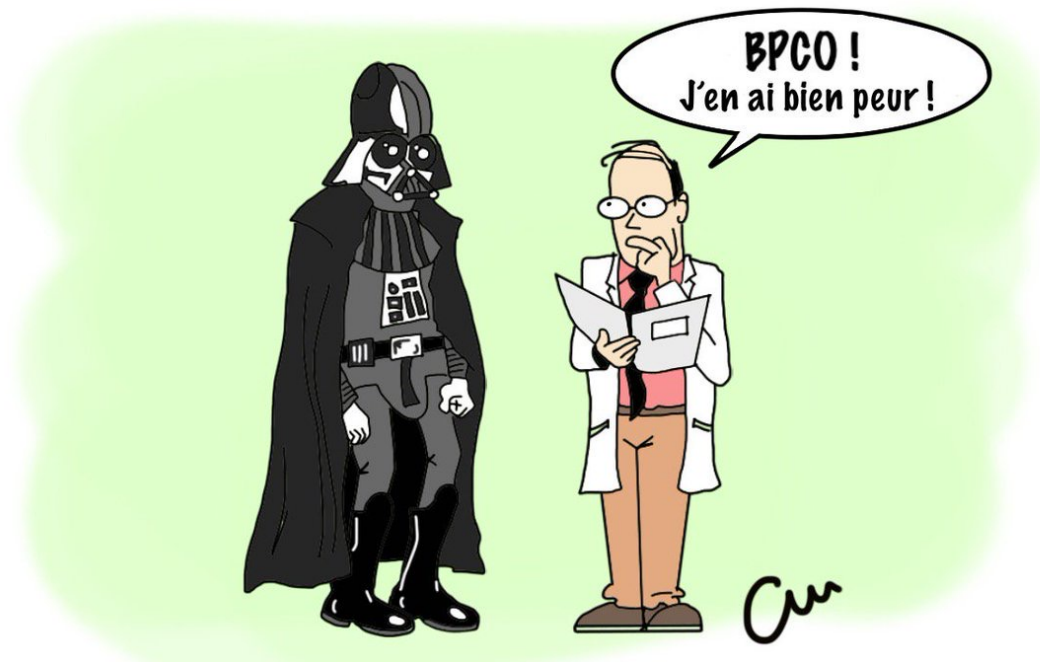
BPCO / Asthme



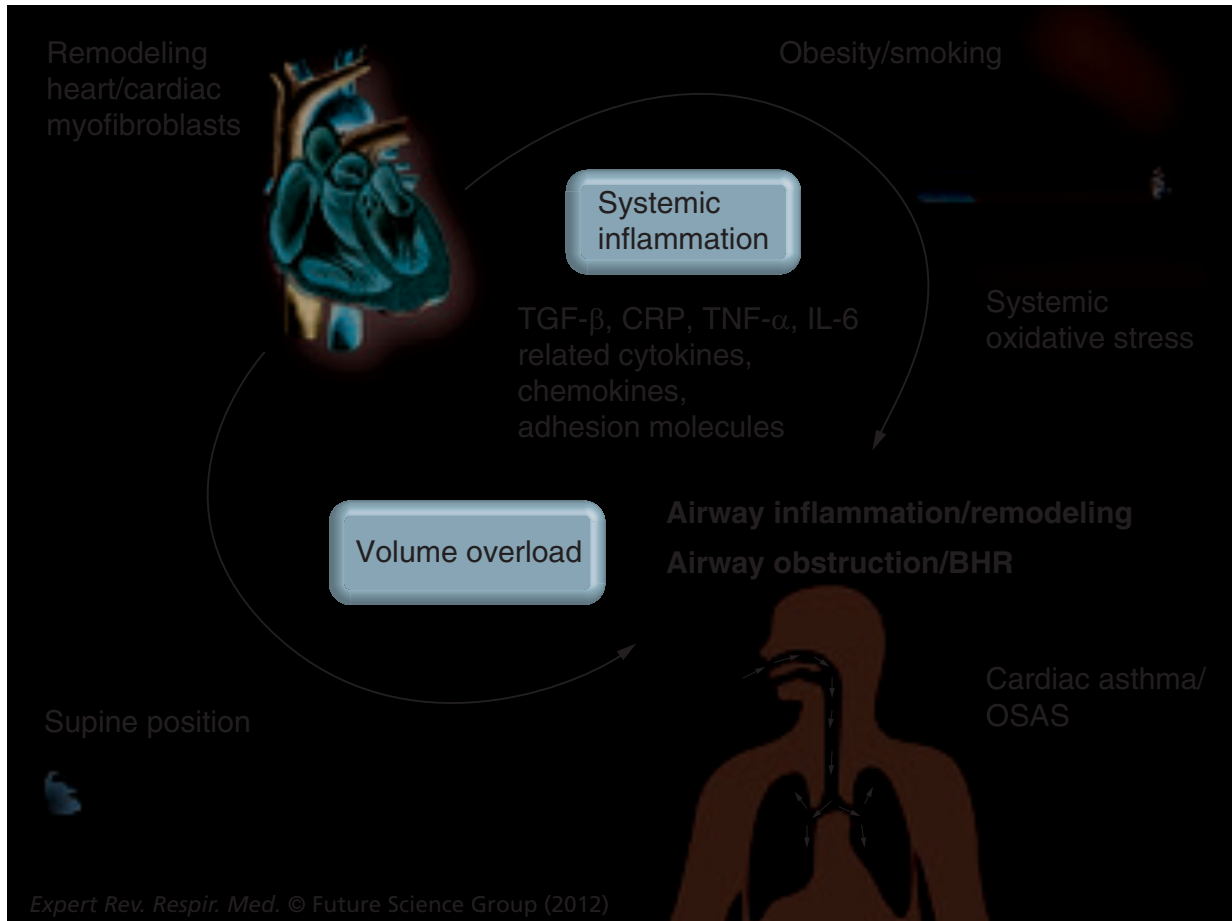
Profil A

## Exacerbation de BPCO

« Une exacerbation de la BPCO est un événement aigu caractérisé par une aggravation des symptômes respiratoires du patient qui va au-delà des variations normales de la journée et qui conduit à un changement de traitement »



# Asthme cardiaque



## Définition :

wheezing (sifflement) + toux + orthopnée

## Prévalence :

35% des ICA > 65a

## Mortalité

similaire autres ICA

BPCO vs Insuffisance cardiaque

Intensive Care Med (1998) 24: 1331–1334  
© Springer-Verlag 1998

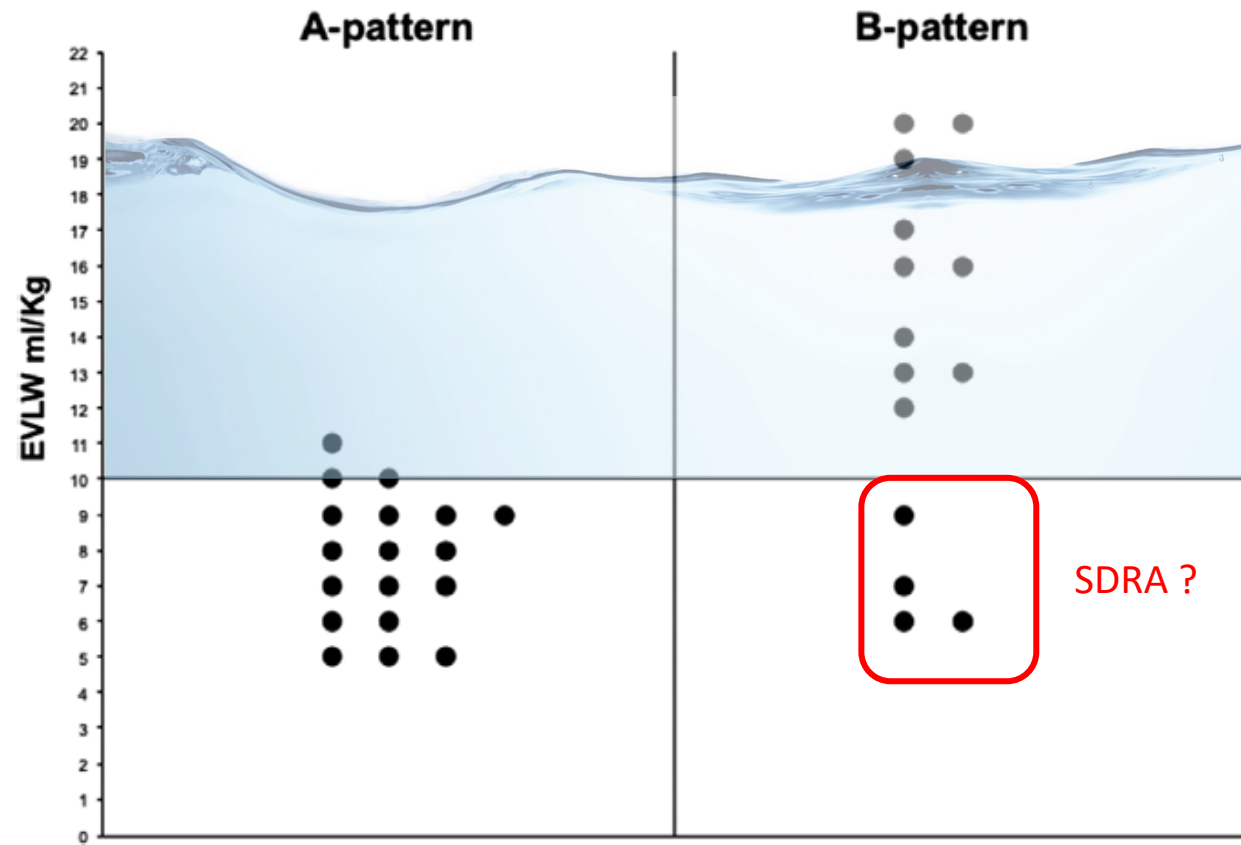
BRIEF REPORT

D. Lichtenstein  
G. Mezière

A lung ultrasound sign allowing bedside  
distinction between pulmonary edema and  
COPD: the comet-tail artifact

Ultrasound	Pulmonary edema group	COPD group	Control group
Positive test			
Diffuse pattern	38	1	1
Lateral pattern (both lungs)	2	1	0
Negative test			
Lateral pattern (one lung)	0	2	0
Localized anterior location	0	0	1
Last intercostal space location	0	13	20
Absence of comet-tail artifact	0	9	58
Total	40	26	80
	100%	8%	1%

## BPCO vs Insuffisance cardiaque



## BPCO vs Insuffisance cardiaque

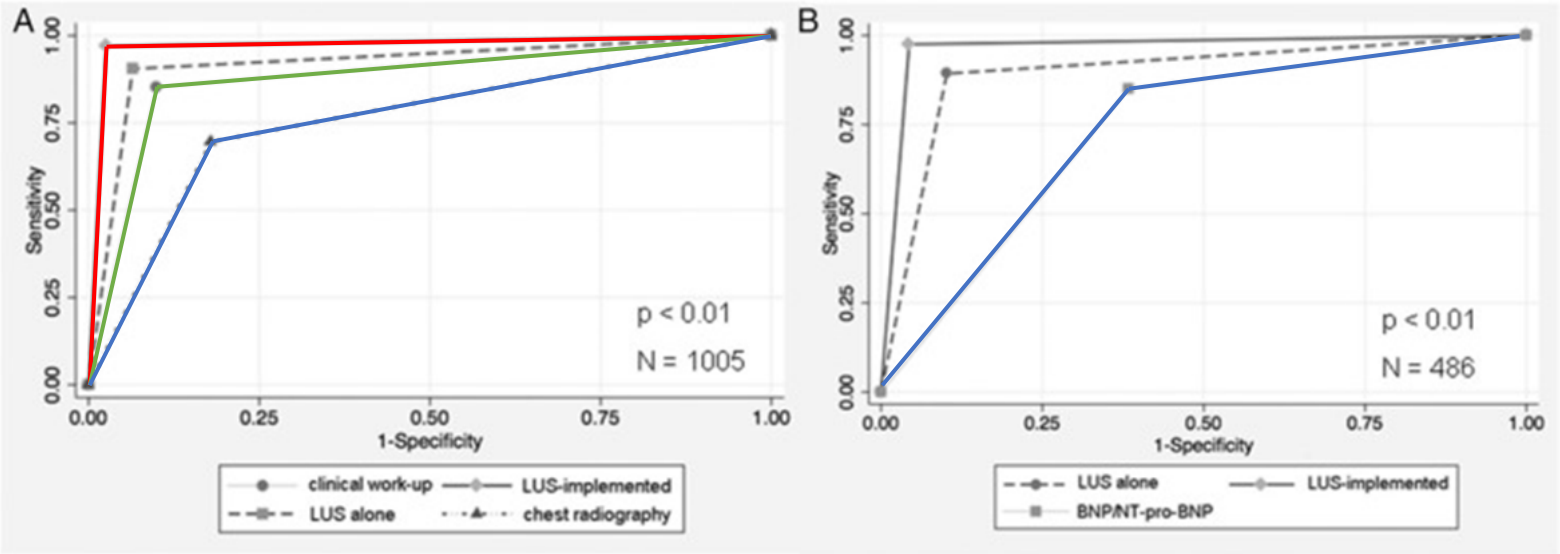
**Population** : 1007 patients dyspnéiques – 7 services d'urgences Italiens – 2 ans

**Objectif** : dyspnée cardiaque ou non-cardiaque ?

		Sensitivity	Specificity	PPV	NPV	LR+	LR-	p	
No. = 1005	Clinical work-up	85.3% (81.8-88.4)	90% (87.2-92.4)	88% (84.6-90.8)	87.8% (84.8-90.4)	8.6	0.2	< .01	
	LUS-implemented	97% (95-98.3)	97.4% (95.7-98.6)	97% (95-98.3)	97.4% (95.7-98.6)	37.5	0.03		
	LUS-alone	90.5% (87.4-93)	93.5% (91.1-95.5)	92.3% (89.4-94.6)	92% (89.4-94.1)	14	0.1	< .01	
	Chest radiography	69.5% (65.1-73.7)	82.1% (78.6-85.2)	76.8% (72.5-80.8)	75.9% (72.5-79.3)	3.9	0.4		
No. = 486	LUS-implemented	97.5% (94.9-99)	95.6% (91.9-98)	96.8% (94-98.5)	96.6% (93.1-98.6)	22.3	0.02	< .01	
	BNP/NT-pro-BNP	85% (80.3-89)	61.7% (54.6-68.3)	75.1% (69.9-79.7)	75.1% (67.9-81.5)	2.2	0.2		
	LUS-alone	89.3% (85.1-92.7)	89.8% (84.8-93.6)	92.3% (88.4-95.1)	86% (80.7-90.4)	8.8	0.11		< .01

BPCO vs Insuffisance cardiaque

Indice de reclassification = **19.1%**



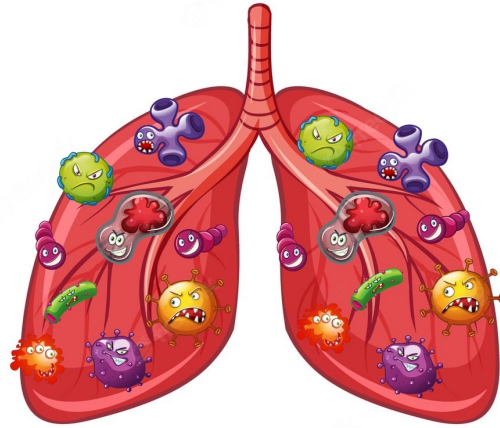
	Area under curve (AUC)	
Clinical work-up	0.876	p < 0.01
LUS-implemented	0.972	
LUS-alone	0.920	p < 0.01
Chest radiography	0.758	

	Area under curve (AUC)	
LUS-implemented	0.966	p < 0.01
LUS-alone	0.895	
BNP/NT-pro-BNP	0.733	

# SYMPTOMS OF PNEUMONIA



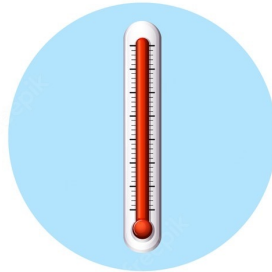
Chest Pain



Headache



Pallor Of The Skin



Heat



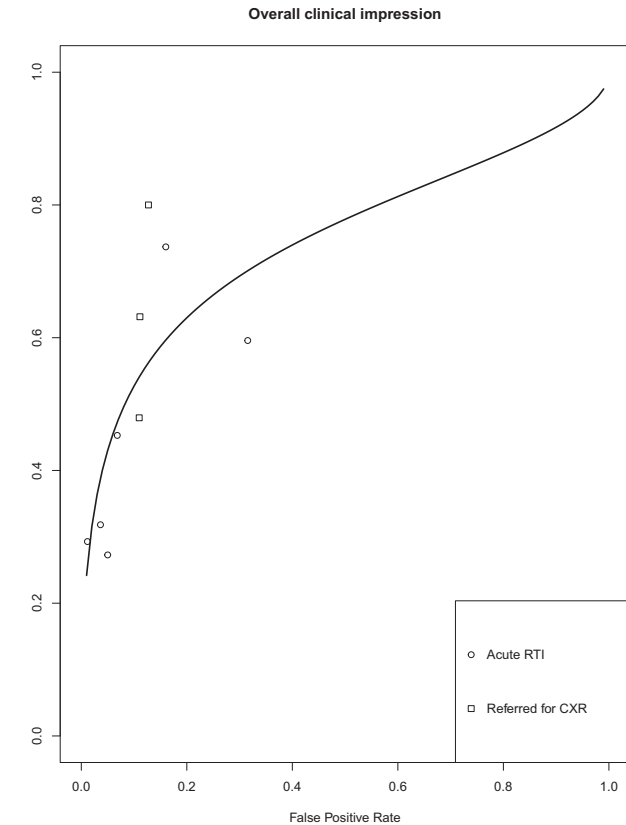
Sputum Cough



# Pneumopathie infectieuse – Clinique

Sign or symptom	Studies (patients)	Sensitivity (95% CI)	Specificity (95% CI)	LR+ (95% CI)	LR– (95% CI)	Diagnostic odds ratio (95% CI)	AUROC
Symptoms							
Pleuritic chest pain	3 (1245)	0.32 (0.26-0.39)	0.87 (0.65-0.96)	2.76 (0.97-7.133)	0.81 (0.70-1.02)	3.56 (0.95-9.77)	
Fever (subjective)	8 (4907)	0.63 (0.50-0.74)	0.55 (0.38-0.71)	<b>1.47 (1.26-1.71)</b>	<b>0.68 (0.58-0.80)</b>	<b>2.10 (1.48-2.87)</b>	0.623
Chills	7 (2453)	0.55 (0.43-0.67)	0.62 (0.50-0.72)	<b>1.44 (1.26-1.65)</b>	<b>0.73 (0.63-0.83)</b>	<b>2.00 (1.58-2.49)</b>	0.610
Coryza and rhinorrhea absent	4 (1106)	0.60 (0.40-0.77)	0.57 (0.22-0.66)	<b>1.43 (1.11-2.00)</b>	<b>0.71 (0.56-0.86)</b>	<b>2.07 (1.31-3.13)</b>	
Sputum (bloody)	4 (1582)	0.13 (0.06-0.27)	0.90 (0.84-0.94)	1.33 (0.80-2.06)	0.96 (0.84-1.02)	1.41 (0.78-2.47)	
Dyspnea	10 (5626)	0.63 (0.48-0.75)	0.51 (0.31-0.71)	<b>1.30 (1.07-1.65)</b>	<b>0.75 (0.66-0.85)</b>	<b>1.75 (1.28-2.34)</b>	0.598
Sore throat absent	3 (782)	0.60 (0.49-0.70)	0.52 (0.28-0.75)	1.29 (0.75-1.77)	0.81 (0.57-1.34)	1.78 (0.65-3.83)	
Chest pain	8 (5031)	0.51 (0.33-0.69)	0.58 (0.37-0.76)	<b>1.21 (1.05-1.42)</b>	<b>0.86 (0.78-0.94)</b>	<b>1.41 (1.13-1.74)</b>	0.549
Headache	3 (1188)	0.65 (0.46-0.81)	0.42 (0.21-0.65)	1.19 (0.93-1.49)	0.85 (0.67-1.08)	1.35 (0.90-1.94)	
Sputum (any)	6 (4441)	0.71 (0.60-0.81)	0.35 (0.21-0.51)	1.11 (0.96-1.32)	0.84 (0.63-1.11)	1.37 (0.87-2.07)	
Myalgias	3 (1424)	0.49 (0.41-0.56)	0.57 (0.45-0.68)	1.10 (0.91-1.45)	0.92 (0.77-1.10)	1.26 (0.82-1.86)	
Sputum (purulent)	3 (1365)	0.52 (0.35-0.70)	0.52 (0.39-0.65)	1.09 (0.90-1.26)	0.92 (0.73-1.08)	1.21 (0.83-1.71)	
Cough	7 (1866)	0.88 (0.82-0.93)	0.16 (0.07-0.34)	1.07 (0.97-1.27)	0.77 (0.41-1.37)	1.57 (0.71-3.01)	
Signs							
Egophony	3 (1116)	0.05 (0.03-0.10)	0.99 (0.95-0.99)	<b>6.17 (1.34-18.0)</b>	<b>0.96 (0.93-0.99)</b>	<b>6.46 (1.36-18.9)</b>	
Dullness to percussion	7 (1932)	0.14 (0.10-0.19)	0.94 (0.88-0.97)	<b>2.62 (1.14-5.30)</b>	<b>0.92 (0.87-0.98)</b>	<b>2.89 (1.17-5.90)</b>	NC
Confusion	4 (1596)	0.11 (0.08-0.15)	0.95 (0.92-0.97)	<b>2.15 (1.36-3.34)</b>	<b>0.94 (0.90-0.98)</b>	<b>2.29 (1.39-3.63)</b>	
Crackles	12 (5898)	0.42 (0.32-0.52)	0.79 (0.68-0.86)	<b>2.00 (1.54-2.58)</b>	<b>0.74 (0.66-0.82)</b>	<b>2.70 (1.95-3.63)</b>	0.611
Decreased breath sounds	6 (4322)	0.25 (0.20-0.32)	0.87 (0.78-0.92)	<b>1.96 (1.23-3.02)</b>	<b>0.87 (0.79-0.95)</b>	<b>2.29 (1.31-3.73)</b>	
Abnormal lung exam (any finding)	8 (2875)	0.60 (0.40-0.78)	0.67 (0.42-0.85)	<b>1.90 (1.26-2.91)</b>	<b>0.61 (0.47-0.75)</b>	<b>3.18 (1.83-2.08)</b>	0.669
Rhonchi	5 (2375)	0.23 (0.16-0.32)	0.87 (0.78-0.92)	<b>1.76 (1.26-2.41)</b>	<b>0.89 (0.83-0.95)</b>	<b>1.99 (1.35-2.81)</b>	
Toxic or ill appearance	5 (4162)	0.42 (0.22-0.65)	0.70 (0.43-0.88)	<b>1.46 (1.08-2.15)</b>	<b>0.83 (0.71-0.94)</b>	<b>1.77 (1.17-2.64)</b>	
Pleural rub	5 (1885)	0.07 (0.04-0.11)	0.97 (0.91-0.992)	3.02 (0.74-8.02)	0.96 (0.91-1.02)	3.20 (0.72-8.81)	
Wheeze (any)	8 (2519)	0.25 (0.19-0.32)	0.75 (0.68-0.92)	1.00 (0.82-1.22)	1.00 (0.94-1.07)	1.00 (0.77-1.30)	

**AUC = 0.74**  
**Se 50% ; Sp 92%**



## Pneumopathie infectieuse – Clinique

Age	18-44 ans (n = 780)	≥ 75 ans (n = 280)
Toux	90%	84%
Dyspnée	75%	66%
Douleur Pleurale	60%	46%
Fièvre	85%	53%
Frissons	85%	52%
Céphalées	75%	32%
Myalgies	67%	25%
Tachypnée	36%	65%

Pneumopathie infectieuse – Radiographie du Thorax

Radiographic Assessment (Radiologist 2)	Radiographic Assessment (Radiologist 1)			
	No	Possible	Probable	Definite
No, No. (%)	17 (6.0)* <u>  </u>	19 (6.7)	5 (1.8)	0 (0.0)
Possible, No. (%)	7 (2.5)	21 (7.4)* <u>  </u>	16 (5.7)	6 (2.1)
Probable, No. (%)	6 (2.1)	10 (3.5)	20 (7.1)* <u>  </u>	15 (5.3)
Definite, No. (%)	4 (1.4)	11 (3.9)	20 (7.1)	105 (37.2)* <u>  </u>

Concordance totale = 57,7 %  
Kappa = 0,38 (IC 95 % = 0,31 à 0,46)

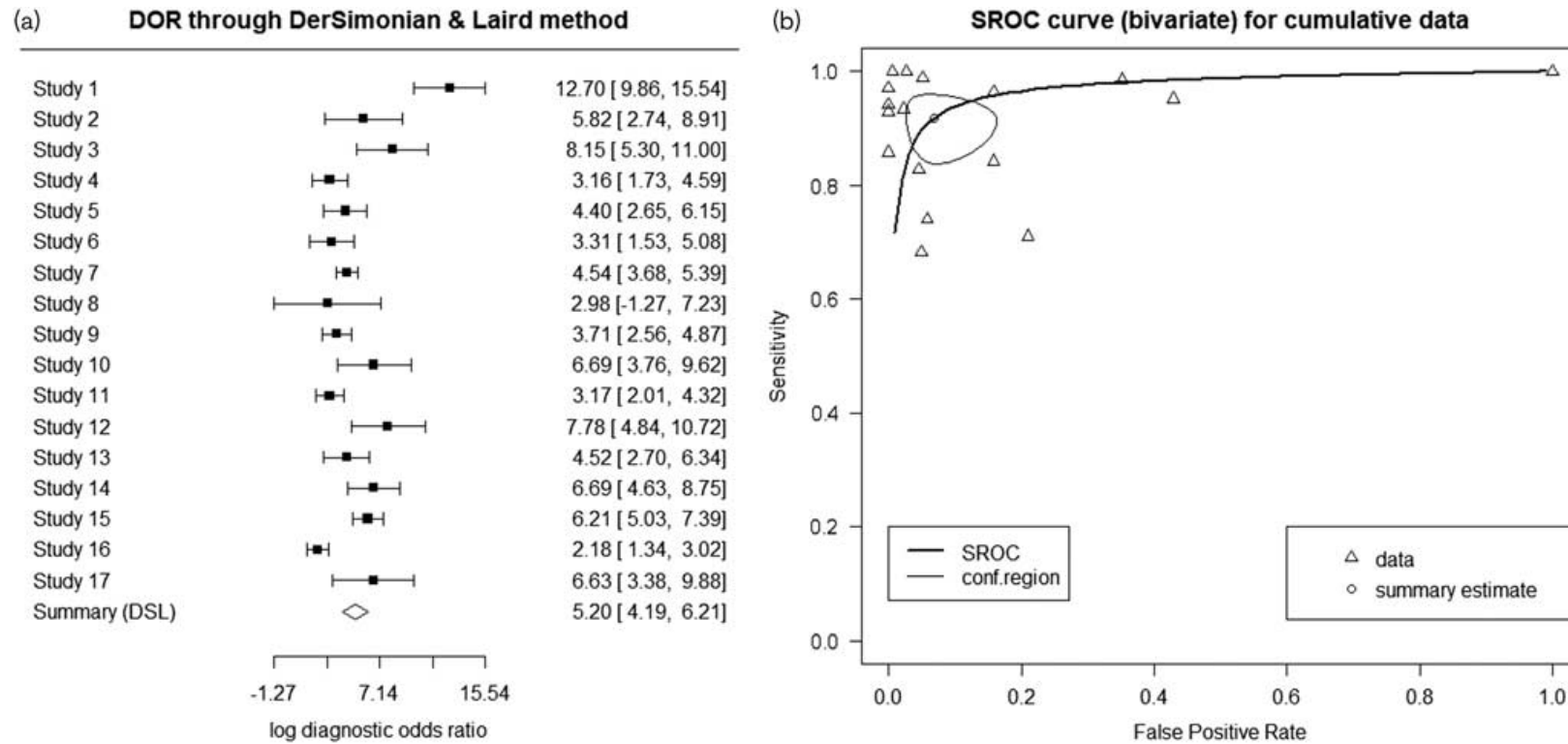
Albaum et al. Chest 1996

Praticiens	Concordance en cas de PAC (+)	Concordance en cas de PAC (-)	Kappa
Radiologue Sénior	56 %	96 %	0,71 (0,59-0,83)
Résident en Radio	36 %	94 %	0,50 (0,40-0,60)
Résident en Radio	36 %	95 %	0,50 (0,40-0,60)
Pneumologue Sénior	59 %	96 %	0,72 (0,60-0,84)
Médecin Généraliste	-	-	0,35

Melbye et al. Acta Radiol. 1992

# Pneumopathie infectieuse – Echographie pleuro-pulmonaire

- revue littérature
- 17 études : 5108 patients
- PAC adultes aux urgences



# Pneumopathie infectieuse

Dyspnée > 75 ans

Diagnosis, <i>n</i> (%)	Standard diagnosis approach	Chest ultrasonography	Adjudication committee
Cardiogenic pulmonary edema	54 (61%) $\kappa=0.40$ (0.21–0.58)	36 (40.5%) $\kappa=0.84$ (0.73–0.95)	43 (48%)
Community-acquired pneumonia	6 (7%) $\kappa=0.33$ (0.12–0.53)	24 (27%) $\kappa=0.80$ (0.66–0.94)	24 (27%)
COPD	10 (11%) $\kappa=0.42$ (0.11–0.73)	12 (13.5%) $\kappa=0.71$ (0.47–0.95)	7 (8%)
Pulmonary embolism	2 (2%) $\kappa=0.56$ (0.12–0.99)	9 (10%) $\kappa=0.69$ (0.41–0.97)	5 (5.5%)
Tamponade	1 (1%) $\kappa=0.66$ (0.041–1)	2 (2%) $\kappa=1$ (1–1)	2 (2%)
Pleural effusion	0 $\kappa=0$	1 (1%) $\kappa=1$ (1–1)	1 (1%)
Mixed/others/unknown	16 (18%) $\kappa=0.13$ (0.07–0.43)	5 (6%) $\kappa=0.82$ (0.25–0.93)	7 (8%)
Total	89 0.52 (0.43–0.61)	89 0.82 (0.75–0.88)	89

	Standard diagnosis approach		Chest ultrasound	
	Sensitivity	Specificity	Sensitivity	Specificity
Cardiogenic pulmonary edema	0.81 (0.66–0.91)	0.61 (0.45–0.75)	0.84 (0.69–0.93)	0.98 (0.92–1)
Community acquired pneumonia	0.25 (0.08–0.47)	1 (0.89–1)	0.83 (0.62–0.95)	0.83 (0.83–0.98)
COPD	0.57 (0.18–0.90)	0.93 (0.84–0.97)	1 (0.59–1)	0.94 (0.89–0.99)
Pulmonary embolism	0.4 (0.05–0.85)	1 (0.96–1)	1 (0.48–1)	0.96 (0.89–0.99)
Mixed	0.41 (0.1–0.75)	0.62 (0.5–0.75)	0.7 (0.4–0.8)	0.9 (0.65–0.97)
Global	0.59 (0.48–0.70)	0.88 (0.87–0.94)	0.86 (0.76–0.93)	0.96 (0.92–0.98)



Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

## Infectious Diseases Now

journal homepage: [www.sciencedirect.com/journal/infectious-diseases-now](https://www.sciencedirect.com/journal/infectious-diseases-now)



### Guidelines

Update of guidelines for management of community acquired pneumonia in adults by the French infectious disease society (SPILF) and the French-speaking society of respiratory diseases (SPLF). Endorsed by the French intensive care society (SRLF), the French microbiology society (SFM), the French radiology society (SFR) and the French emergency society (SFMU)

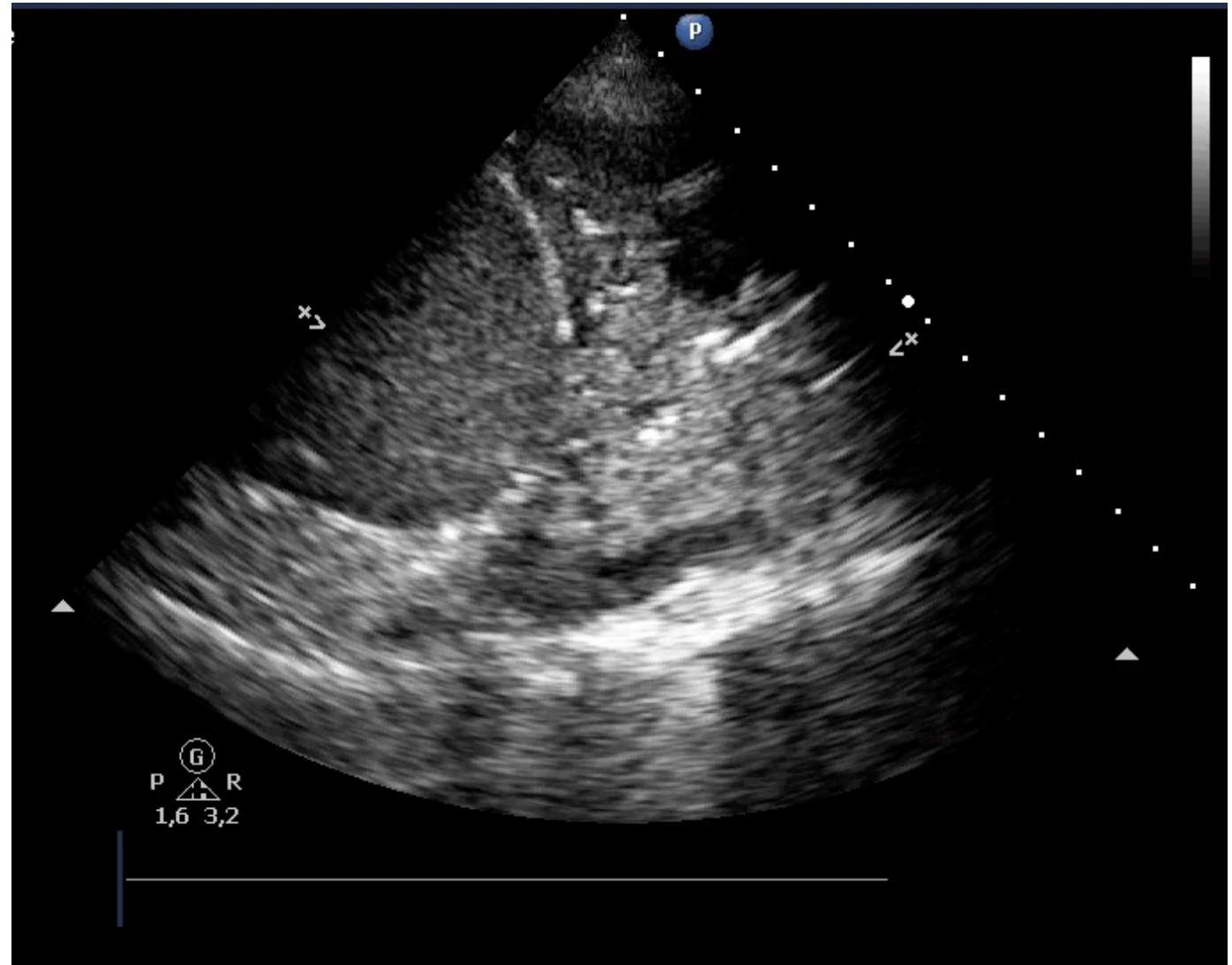
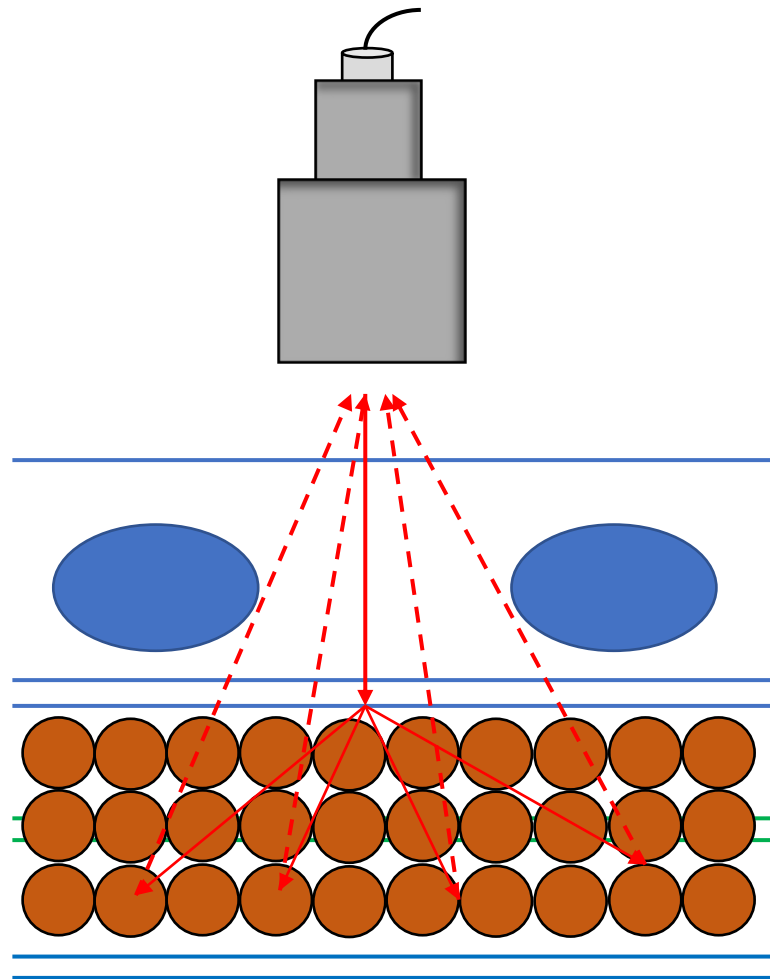


#### 4.1.2. *The 2025 guidelines*

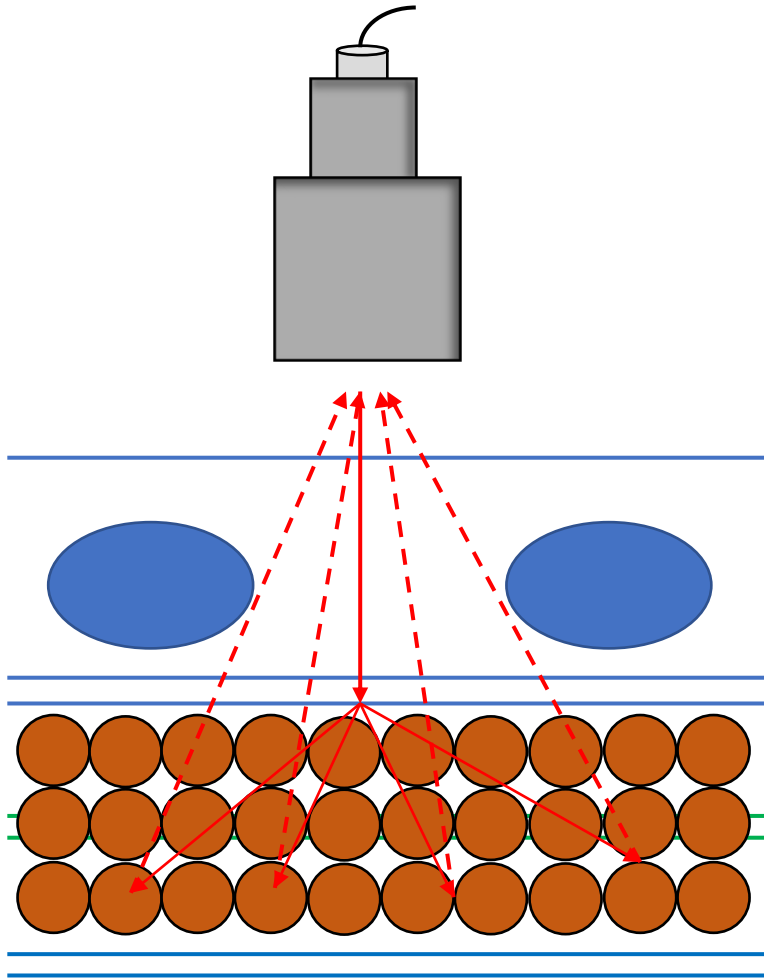
**In cases of suspected CAP (severe and non-severe) necessitating outpatient or hospital-based care**, thoracic ultrasound is a reliable tool for the diagnosis of pneumonia and can be proposed as a first-line method and as an alternative to chest X-ray, provided that the practitioner has received validated preliminary training.

It is particularly indicated for patients suffering from acute respiratory failure, as this condition hinders the acquisition high-quality chest X-ray (**Grade B-2**).

## Syndrome de consolidation alvéolaire



## Syndrome de consolidation alvéolaire



### PROFIL C

Poumon = perte majeure aération pulmonaire

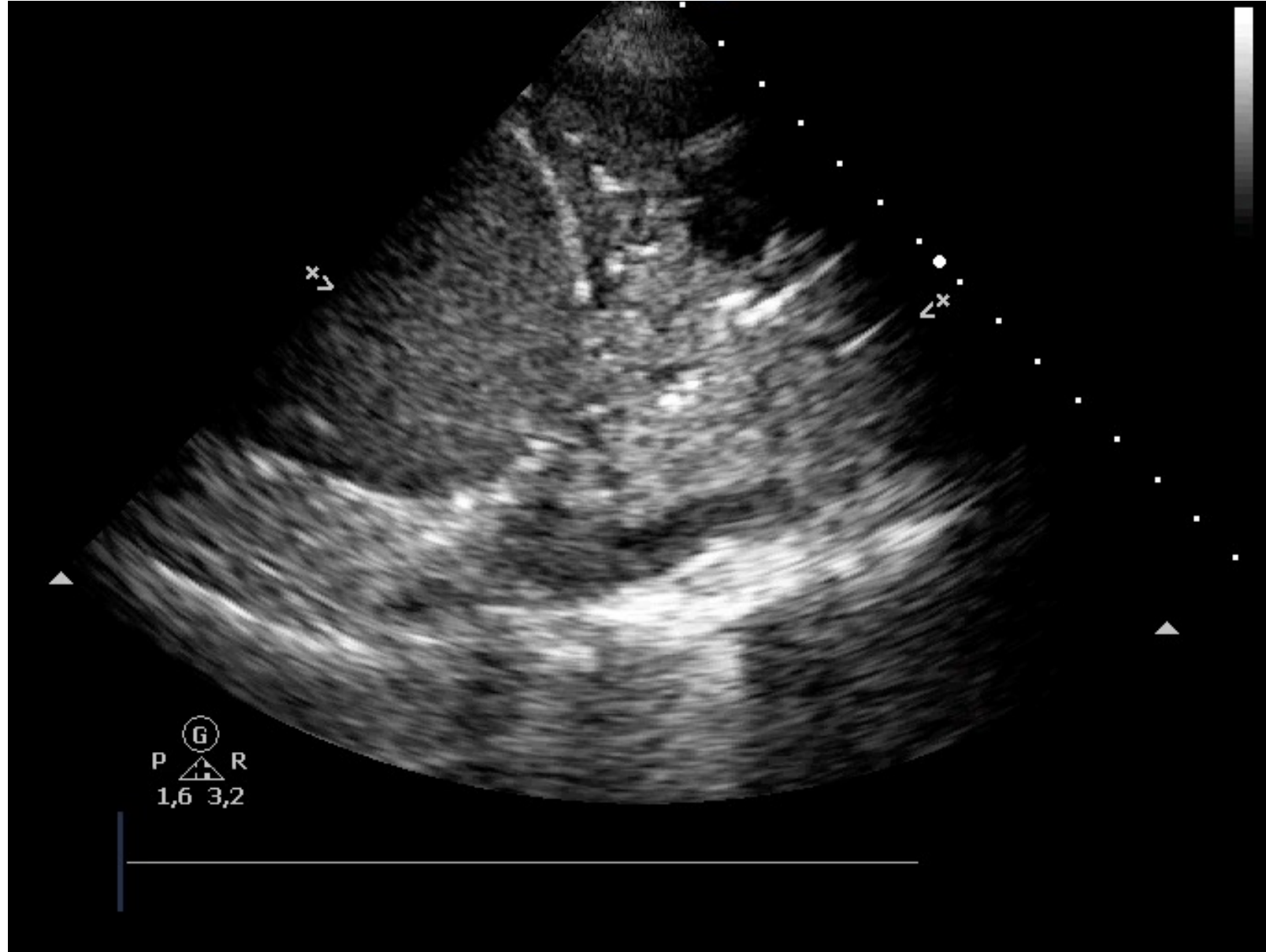
**Pneumonie**



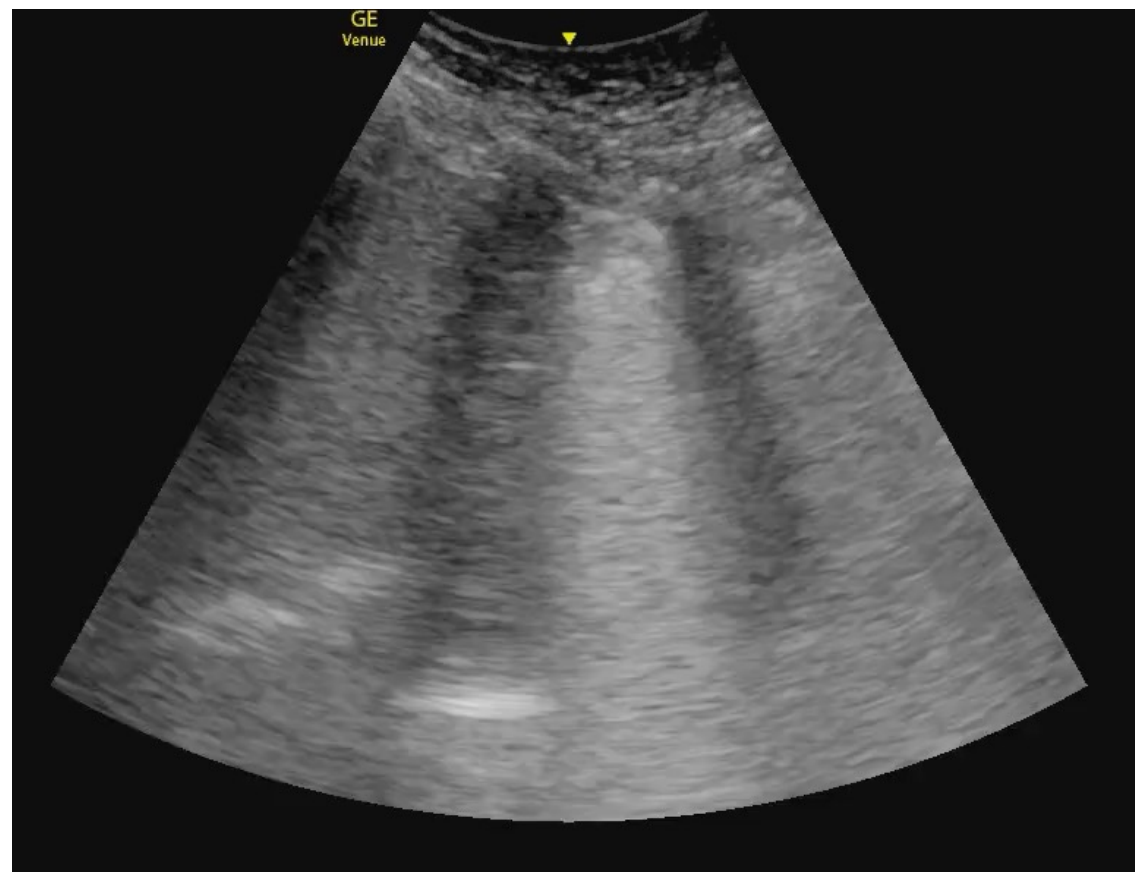
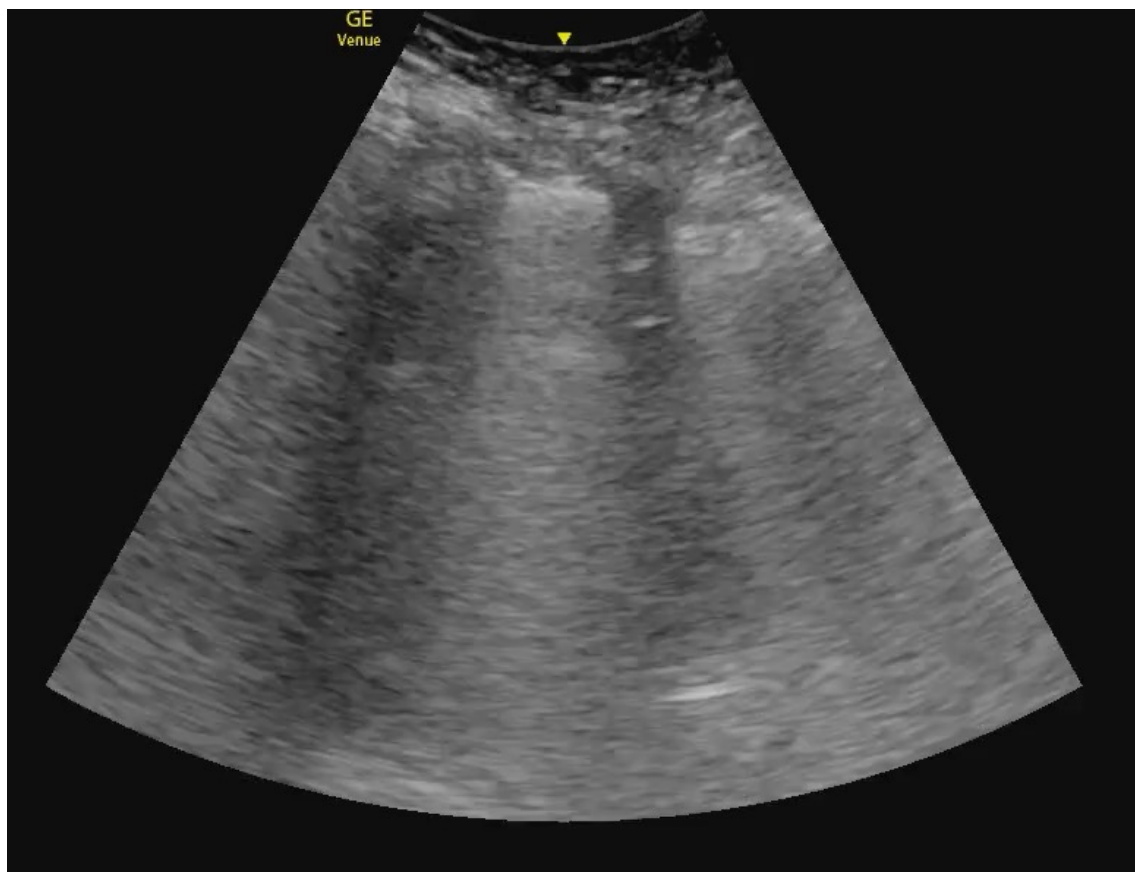
## Syndrome de consolidation alvéolaire = Profil C

- 1 syndrome, 2 formes
  - forme non-translobaire
  - forme translobaire

## Syndrome de consolidation alvéolaire



## Syndrome de consolidation alvéolaire



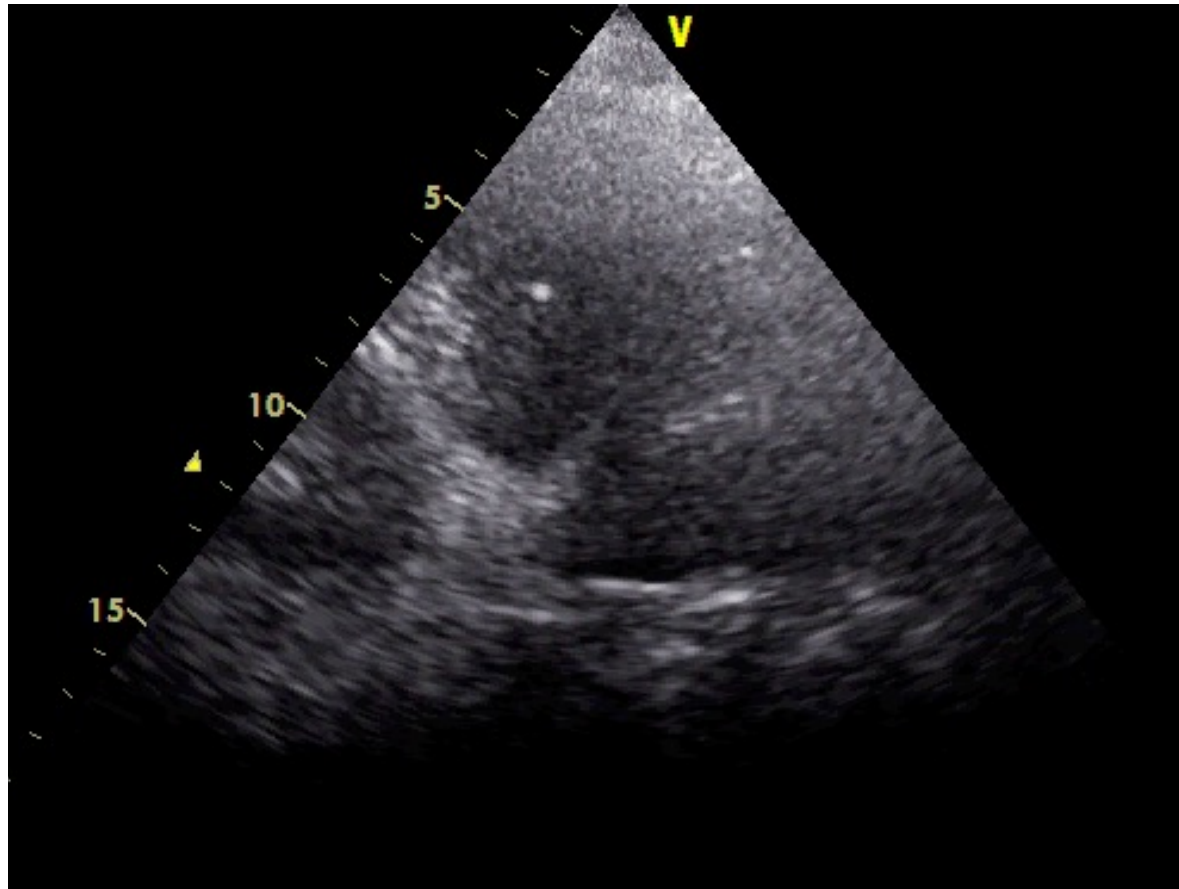
## Syndrome de consolidation alvéolaire = Profil C

- 1 syndrome, 2 formes
  - forme non-translobaire
  - forme translobaire
  
- 1 syndrome, plusieurs pathologies
  - pneumopathie infectieuse
  - atélectasie
  - infarctus pulmonaire
  - néoplasie / métastase pulmonaire
  - contusion pulmonaire

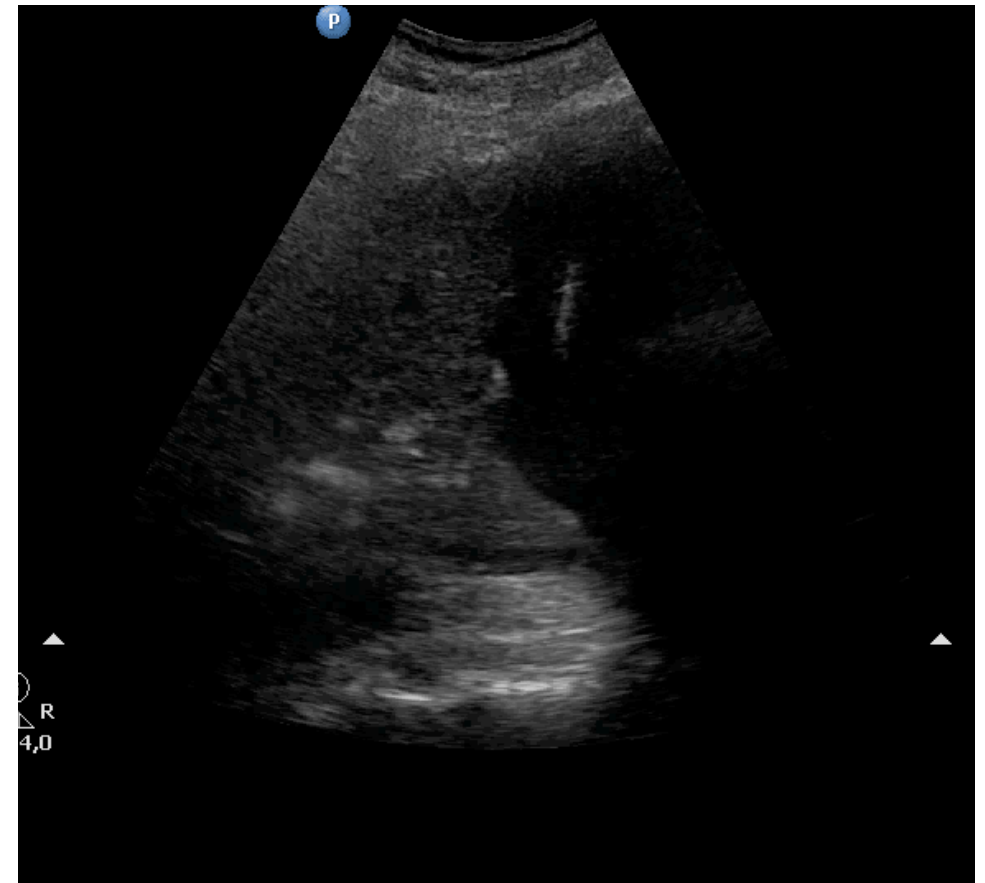
Clinique +++

## Syndrome de consolidation alvéolaire

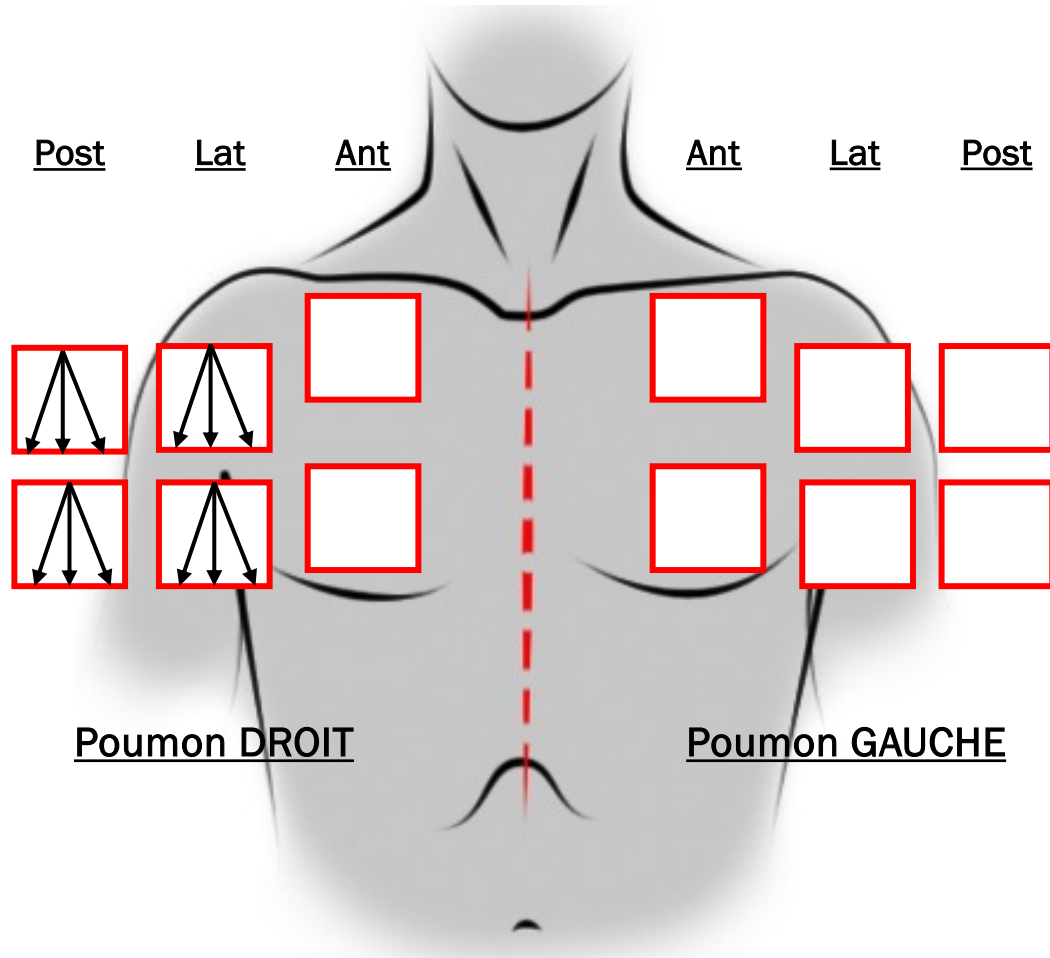
bronchogramme statique



bronchogramme dynamique



# Pneumopathie infectieuse

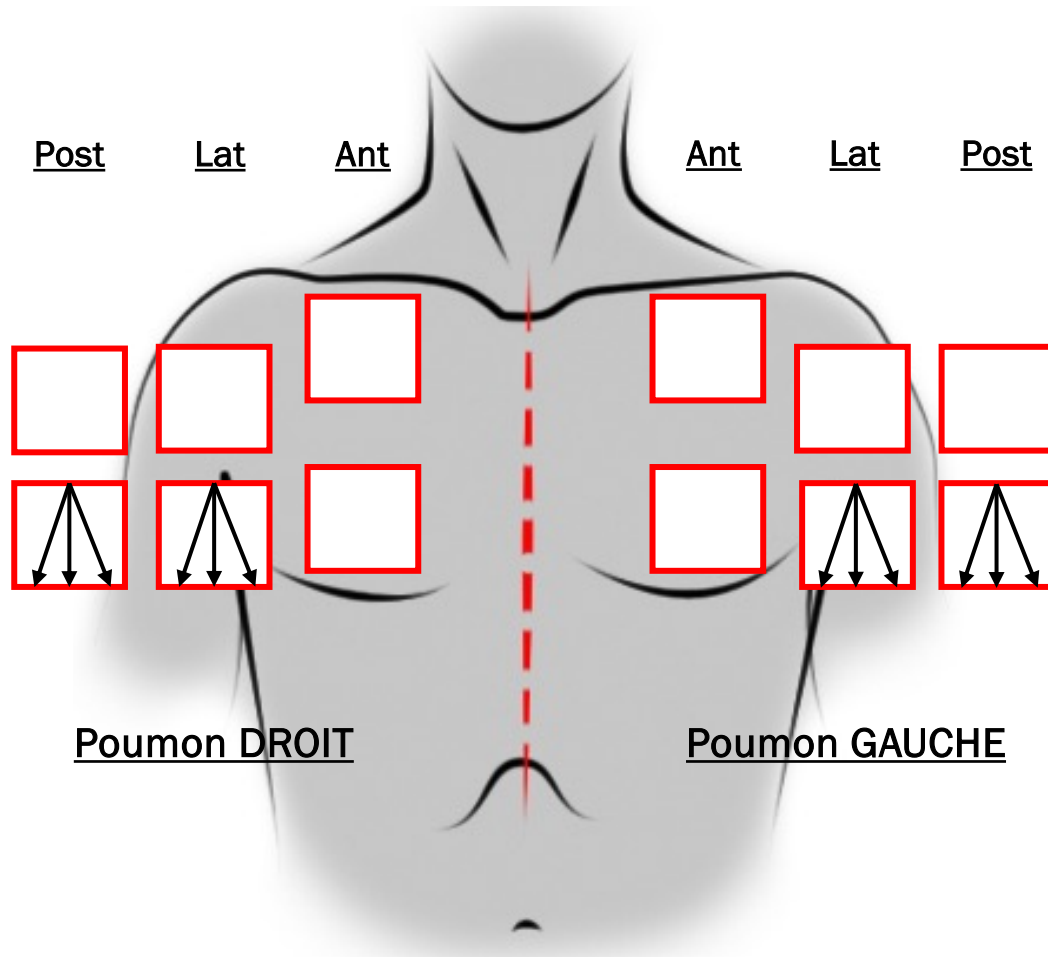


**PROFIL AB**

**Pneumonie**

# Pneumopathie infectieuse

## Syndrome interstitiel = Profil B



lignes B

**multiples** = au moins 3

**diffuses** = 2 coupes adjacentes

**bilatérales**

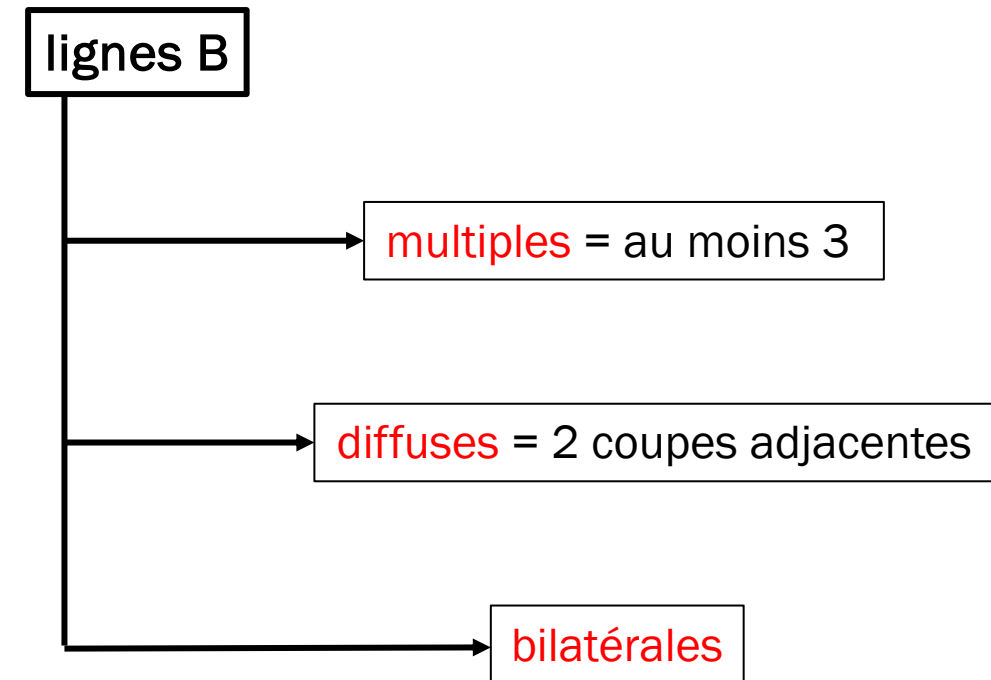
### B-D2-S4 (strong: level B)

- In the evaluation of interstitial syndrome, the following suggest a positive exam:
  - Two or more positive regions (see B-D2-S2) bilaterally.
  - The 28 rib space technique may semiquantify the interstitial syndrome: in each rib space, count the number of B-lines from zero to ten, or if confluent, assess the percentage of the rib space occupied by B-lines and divide it by ten.

### P-D5-S1 (strong: level B)

- The presence of multiple diffuse bilateral B-lines indicates interstitial syndrome. Causes of interstitial syndrome include the following conditions:
  - Pulmonary edema of various causes
  - **Interstitial pneumonia or pneumonitis**
  - Diffuse parenchymal lung disease (pulmonary fibrosis)

### Syndrôme interstitiel = Profil B





# Pneumopathie Infectieuse

EPP

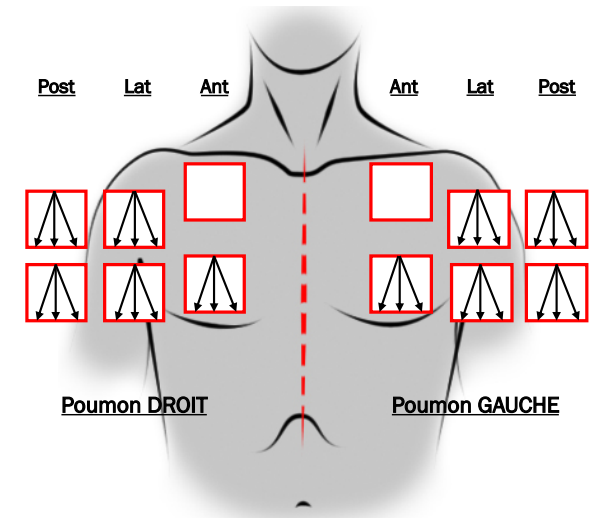
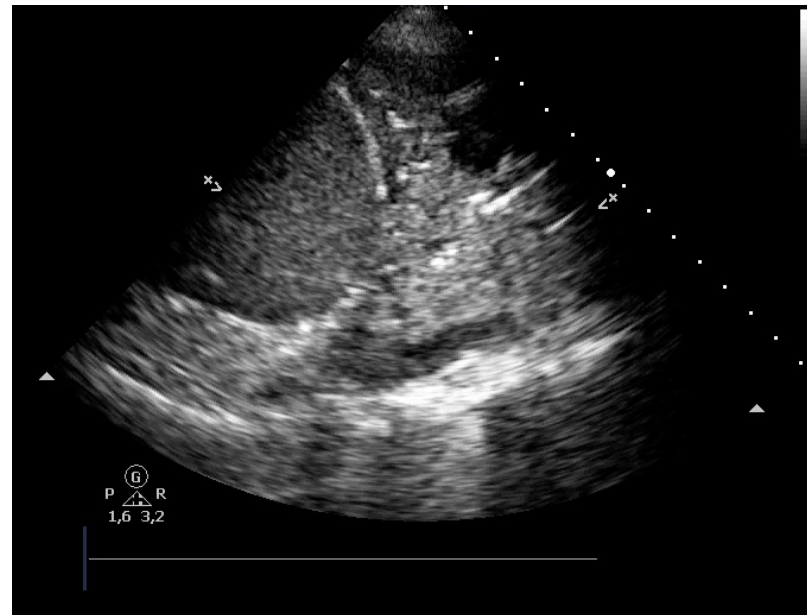
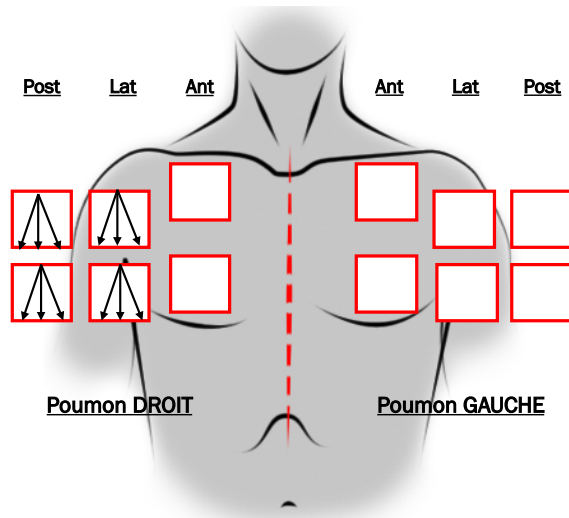
Profil B  
Unilatéral

Profil AB

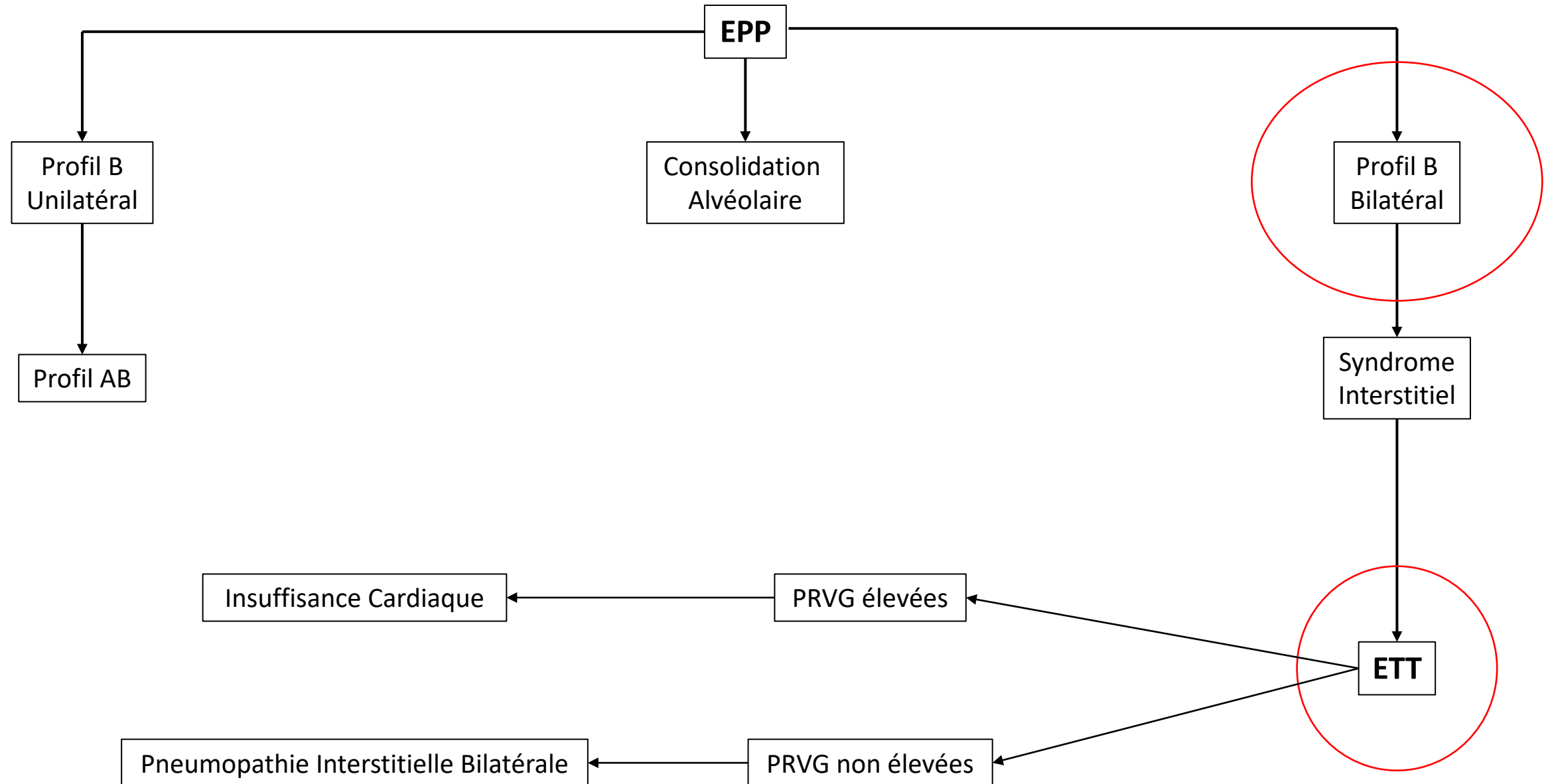
Consolidation  
Alvéolaire

Profil B  
Bilatéral

Syndrome  
Interstitiel



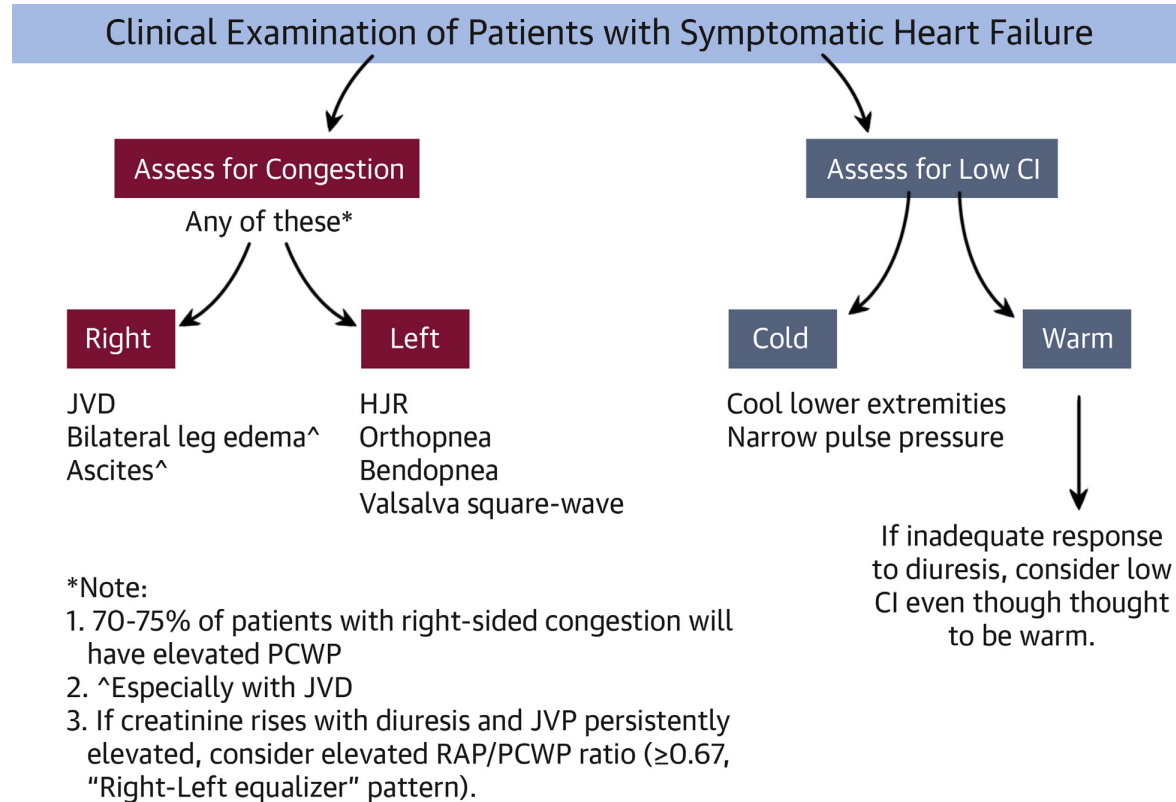
# Pneumopathie infectieuse



## Œdème cardiogénique



# Insuffisance cardiaque aiguë



**Bendopnea**

Clinical Finding	Sensitivity	Specificity	PPV	NPV
Rales $\geq 1/3$	15	89	69	38
Edema $\geq 2+$	41	66	67	40
Orthopnea $\geq 2$ pillows	86	25	66	51
JVP $\geq 12$ mm Hg	65	64	75	52
HJR	83	27	65	49

**33% d'erreurs diagnostic**

## Insuffisance cardiaque aiguë

	No. of Studies	No. of Patients	% AHF (95% CI)	Sensitivity, % (95%CI)	Specificity, % (95%CI)	LR+ (95% CI)	LR– (95% CI)
Electrocardiogram							
Ischemic changes <sup>15,51</sup>	2	1,138	35.5 (29.7–41.3)	34.0 (29.8–38.4)	84.2 (81.2–86.9)	2.9 (1.2–7.1)	0.78 (0.73–0.84)
T-wave inversion <sup>65</sup>	1	1,138	10.0 (7.5–13.0)	10.0 (7.5–13.0)	95.85 (92.3–98.1)	2.4 (1.2–4.8)	0.94 (0.90–0.98)
Atrial fibrillation <sup>19,20,36,58,60,65</sup>	5	1,338	20.5 (18.3–22.9)	20.5 (18.3–22.9)	89.9 (87.9–91.7)	2.2 (1.4–3.5)	0.88 (0.85–0.91)
ST-depression <sup>58,65</sup>	3	1,207	60.8 (57.8–63.8)	5.6 (3.9–7.7)	98.5 (94.2–98.1)	2.0 (1.0–3.8)	0.97 (0.95–1.00)
Normal sinus rhythm <sup>8,12,62</sup>	3	1,207	39.6 (36.9–42.4)	55.4 (50.9–60.0)	98.5 (94.2–98.1)	2.88 (1.26–6.57)	0.88 (0.85–0.91)
ST-elevation <sup>58</sup>	1	219	61.2 (54.6–67.4)	5.2 (2.1–10.5)	98.5 (94.2–98.1)	2.0 (1.0–3.8)	0.97 (0.95–1.00)
Chest radiograph							
Kerley B-lines <sup>36,72</sup>	2	814	46.8 (43.4–50.2)	9.2 (6.5–12.5)	98.8 (97.3–99.6)	6.5 (2.6–16.2)	0.88 (0.69–1.13)
Interstitial edema <sup>15,66,72</sup>	3	2,001	48.3 (46.2–50.5)	31.1 (28.2–34.2)	95.1 (93.6–96.3)	6.4 (3.4–12.2)	0.73 (0.68–0.78)
Cephalization <sup>8,57,64,66,72</sup>	5	1,338	54.0 (51.3–56.6)	44.7 (41.1–48.4)	94.6 (92.6–96.3)	5.6 (2.9–10.4)	0.53 (0.39–0.72)
Alveolar edema <sup>15,66,72</sup>	3	2,001	48.3 (46.2–50.5)	5.7 (4.7–6.9)	98.9 (98.4–99.3)	5.3 (3.3–8.5)	0.95 (0.94–0.97)
Pulmonary edema <sup>*7,8,12,14,16,18–21,23,36,54,57,58,64</sup>	15	4,393	46.6 (45.1–48.1)	56.9 (54.7–59.1)	89.2 (87.9–90.4)	4.8 (3.6–6.4)	0.48 (0.39–0.58)
Pleural effusion <sup>12,20,58,60,72</sup>	5	1,326	55.1 (52.4–57.8)	16.3 (13.7–19.2)	92.8 (90.4–94.7)	2.4 (1.6–3.6)	0.89 (0.80–0.99)
Enlarged cardiac silhouette <sup>8,12,15,18,20,21,54,58,60,64–66</sup>	12	3,515	51.7 (49.4–52.7)	74.7 (72.9–76.5)	61.7 (59.4–63.9)	2.3 (1.6–3.4)	0.43 (0.36–0.51)

➤ Mauvaise sensibilité

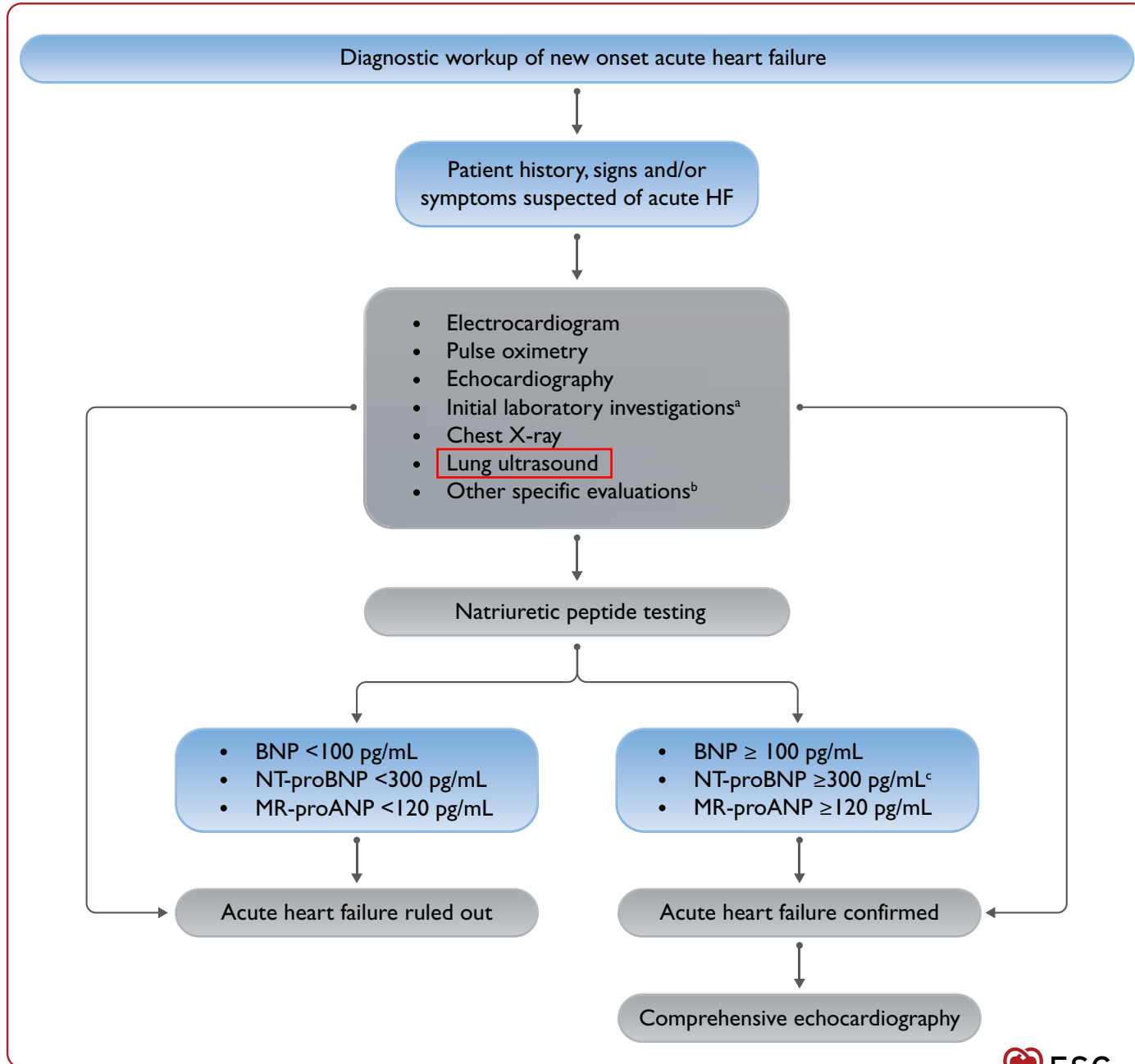
➤ Faisabilité aléatoire

Assay	Cutoff (pg/mL)	N	n	% AHF (95% CI)	Sensitivity % (95%CI)	Specificity % (95%CI)	LR+ (95% CI)	LR– (95% CI)
BNP								
Triage, Biosite	100 <sup>14,19,35,50,51,55,58,60,66,67,73–78,82,84,85</sup>	19	9,143	44.7 (43.7–45.8)	85.9 (84.2–87.6)	85.9 (84.2–87.6)	2.2 (1.8–2.7)	0.11 (0.07–0.16)
AxSym, Abbott	200 <sup>11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100</sup>	11	3,279	50.4 (48.7–52.1)	85.9 (84.2–87.6)	85.9 (84.2–87.6)	4.0 (2.4–6.4)	0.18 (0.12–0.27)
iSTAT, Abbott		8	3,915	46.7 (45.1–48.3)	67.7 (65.5–69.9)	89.8 (88.5–91.1)	3.0 (2.0–4.4)	0.34 (0.26–0.45)
NT-proBNP		4	684	52.3 (48.6–56.1)	93.3 (90.2–95.7)	53.1 (47.5–58.6)	1.8 (1.2–2.4)	0.15 (0.08–0.29)
Elecsys, Roche diagnostic	300 <sup>7,20,46,64,73,75,77,81,83,87</sup>	10	3,498	45.0 (43.4–46.7)	90.4 (88.9–91.8)	38.2 (36.0–40.4)	1.8 (1.4–2.2)	0.09 (0.03–0.34)
Dimension, Dade Behring	1,000 <sup>7,46,62,73,75,77,81,83</sup>	8	2,988	44.8 (43.0–46.6)	84.8 (82.8–86.7)	65.5 (63.2–67.8)	2.7 (1.9–3.9)	0.20 (0.12–0.33)
	1,550 <sup>10,46,61,75,77,79–81,83</sup>	9	3,043	37.3 (35.6–39.0)	75.5 (73.4–77.9)	72.9 (70.6–75.0)	3.1 (2.3–4.3)	0.32 (0.20–0.51)
	300 <sup>70</sup>	1	401	30.4 (26.0–35.2)	95.9 (90.7–98.6)	48.0 (42.0–54.1)	1.9 (1.6–2.1)	0.09 (0.04–0.20)

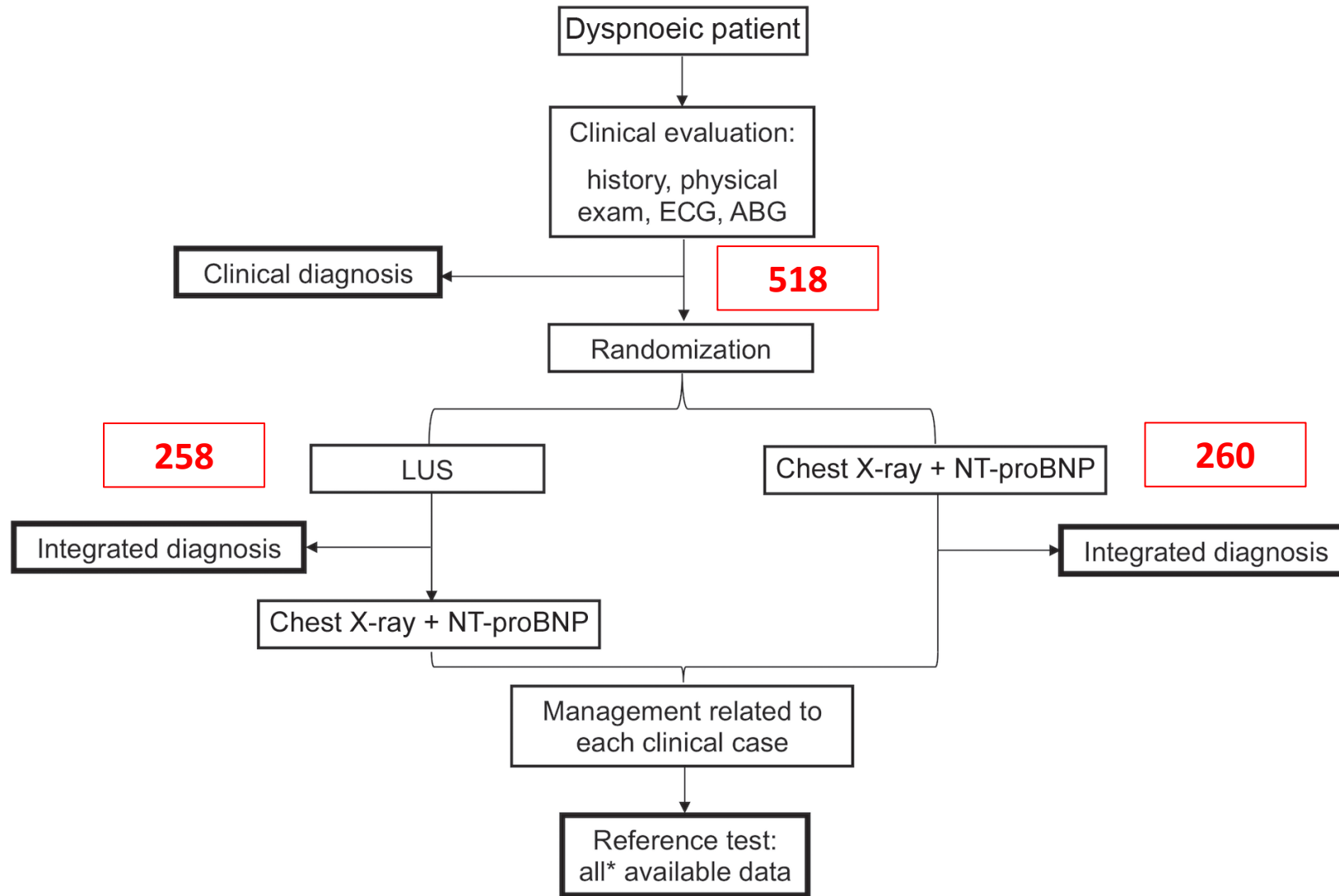
➤ Zone grise

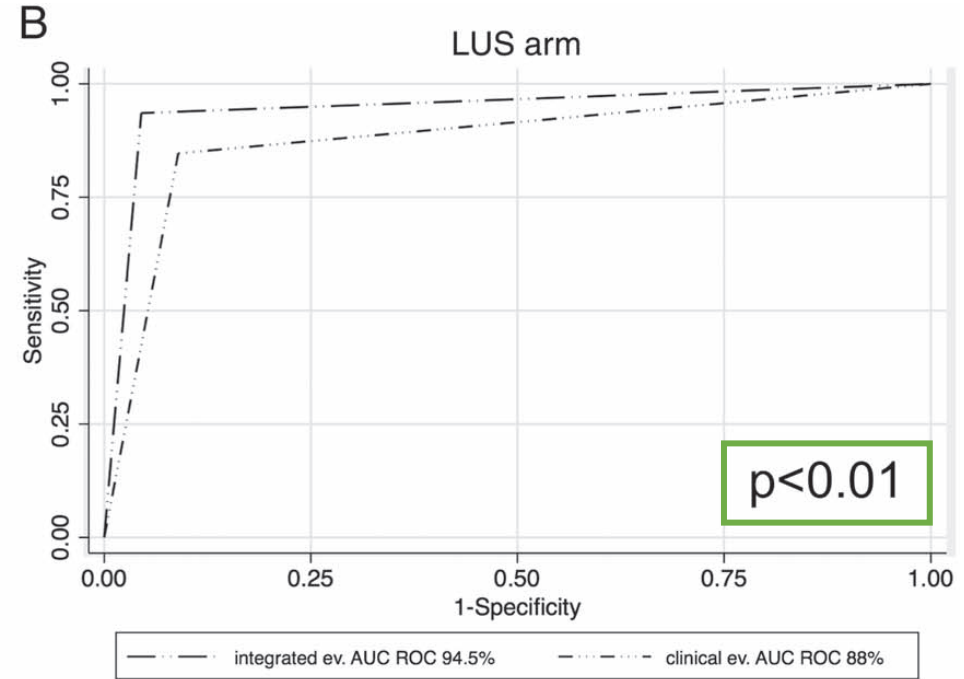
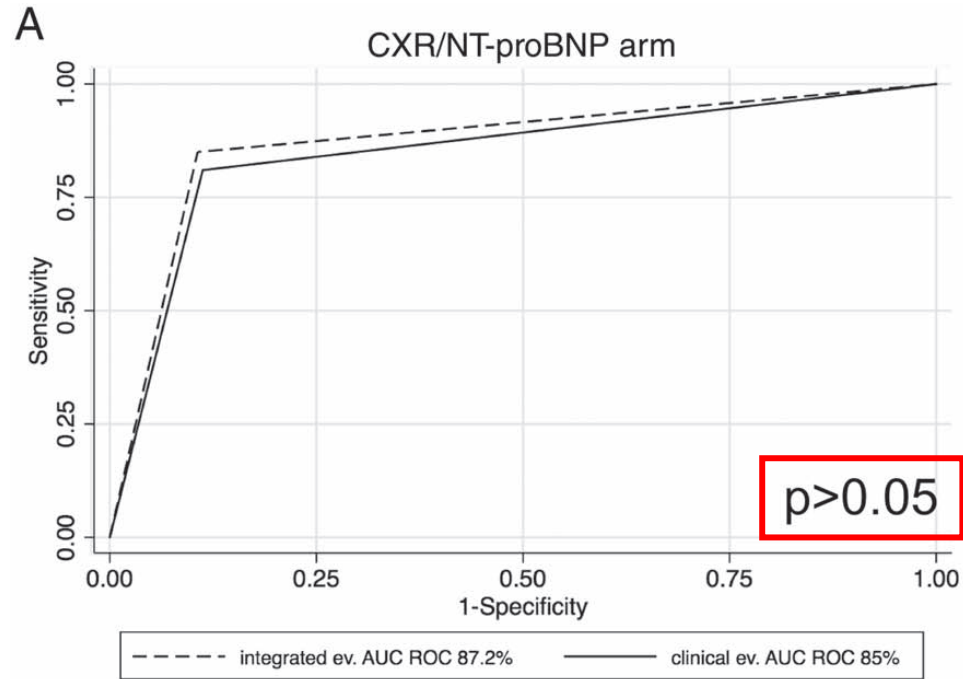
➤ Mauvaise spécificité

# Insuffisance cardiaque aiguë



# Echographie Pleuro-Pulmonaire



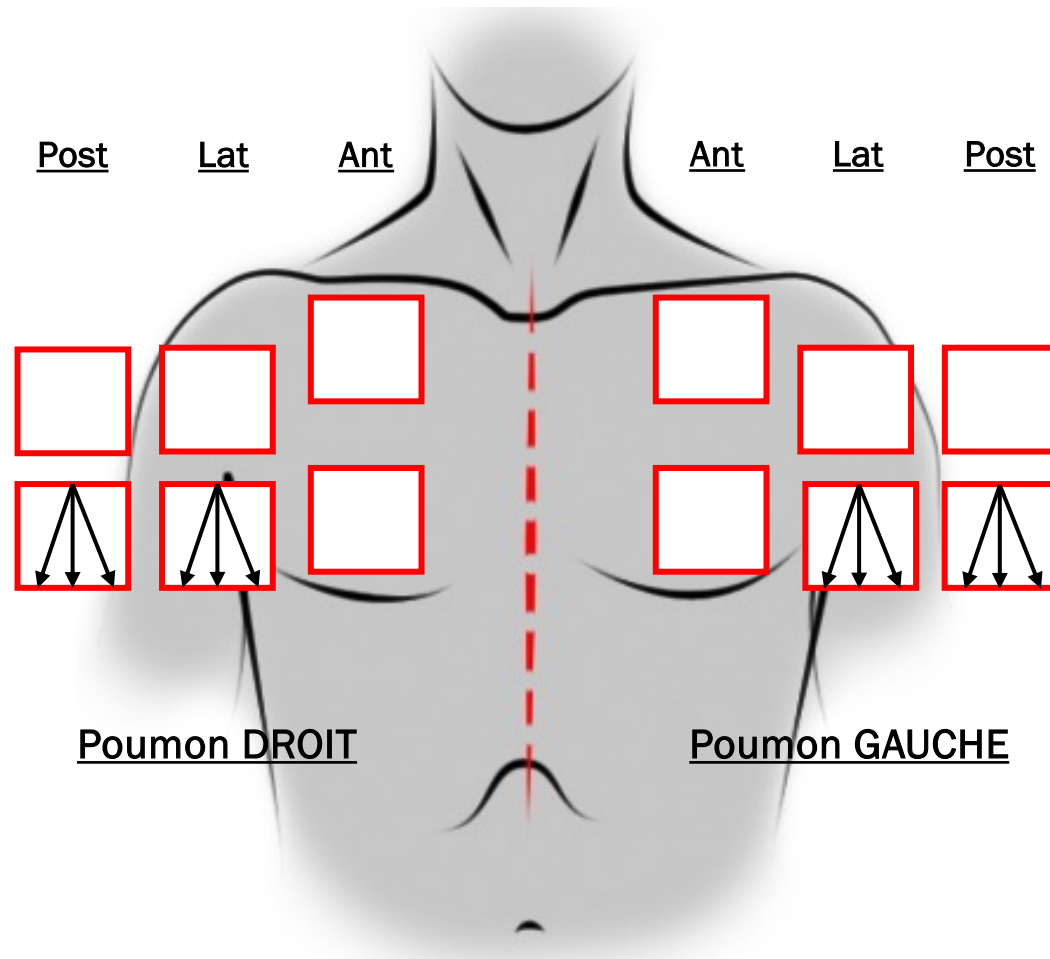


RxT / NT-proBNP = 104,5 min

LUS = 5 min

Gain de temps = **95%**

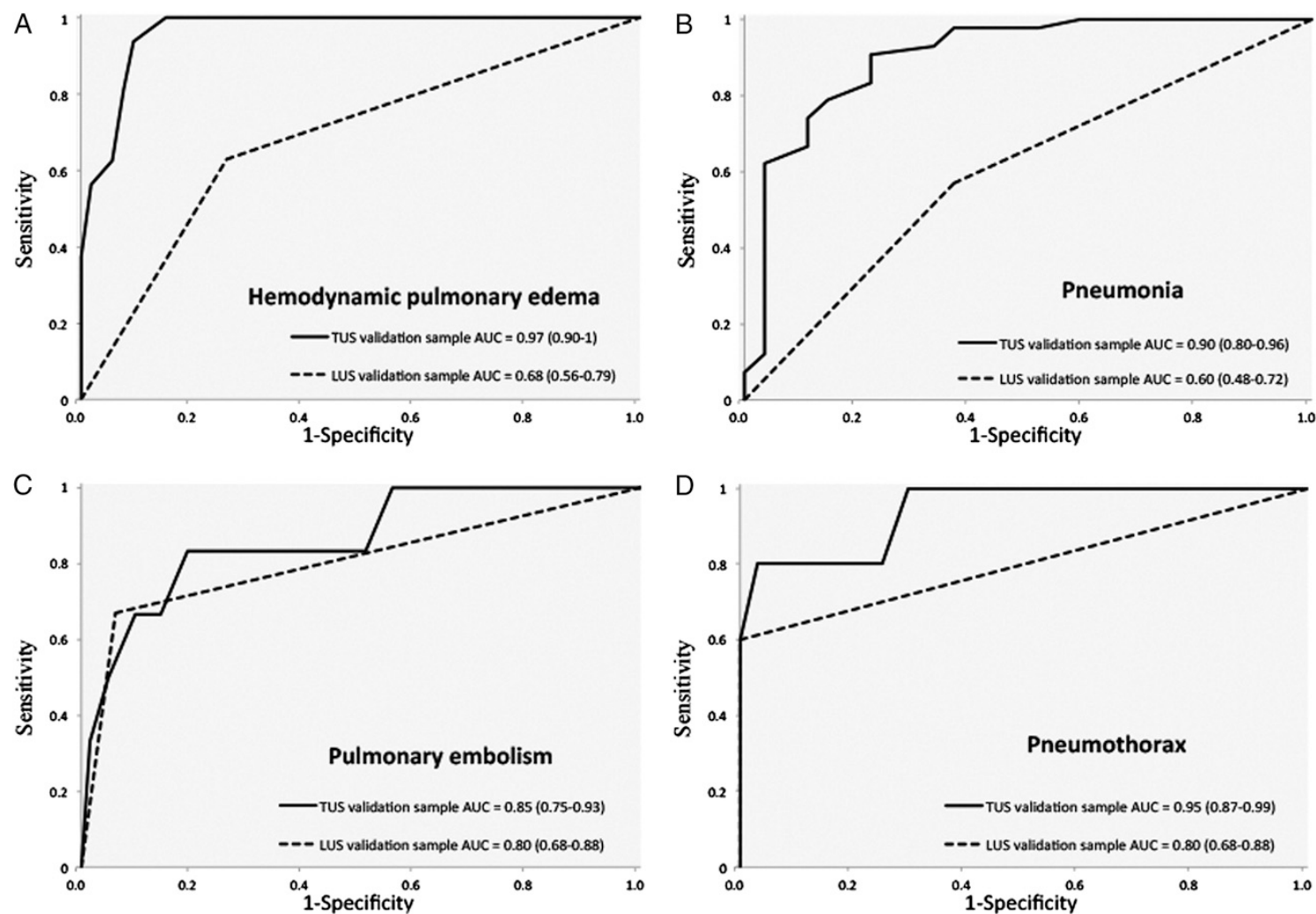




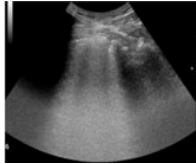
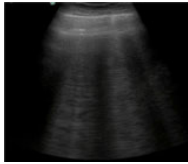

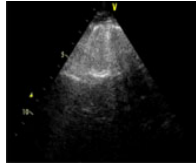

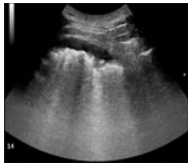

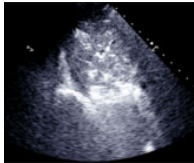
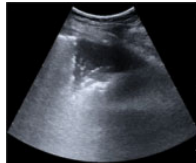

## Syndrome interstitiel

- ☒ Œdème Cardiogénique
- ☐ Œdème Lésionnel = SDRA
- ☐ Pneumopathie Interstitielle Bilatérale
- ☐ Fibrose Pulmonaire chronique

# Echographie Thoracique



# Syndrome interstitiel

	COVID-19 pneumonia	Cardiogenic pulmonary oedema	ARDS	Bacterial pneumonia	Chronic interstitial lung disease (pulmonary fibrosis)
<b>B-lines</b>	Patchy, non-gravity related distribution Separated and more often coalescent Very defined spared areas Light beam	Homogeneous, gravity-related distribution Usually separated or coalescent in more severe cases No spared areas	Patchy, non-gravity-related distribution Separated and more often coalescent Spared areas	Visible in the case of focal interstitial syndrome	Usually more prevalent at lung bases Usually separated B-lines or coalescent in more severe cases Usually no spared areas
<b>Pleural line</b>	Often irregular and 'fragmented'	Usually thin and regular	Irregular and 'fragmented'	Not visible in the spot of consolidation	Always very irregular in moderate/severe cases
					
<b>Consolidations</b>	Usually small peripheral consolidations Larger consolidations in more advanced phases or with superimposed bacterial pneumonia. Large pleural effusion rare	Usually not present unless compressive atelectasis with large pleural effusion	Frequent small peripheral consolidations and larger consolidations	Usually large, hypoechoic or tissue-like	Rarely present and usually small in acute phases (i.e. alveolitis)
<b>Pleural effusion</b>	Trivial localized pleural effusion in the context of more deaerated areas	Frequent, variable size Transudate, not complex appearance Usually bilateral (often larger on the right side)	Usually not large	Usually not large	Rare, unless in very advanced cases or acute phases Usually not large
					



European Society  
of Cardiology

European Heart Journal (2021) **42**, 3599–3726

doi:10.1093/eurheartj/ehab368

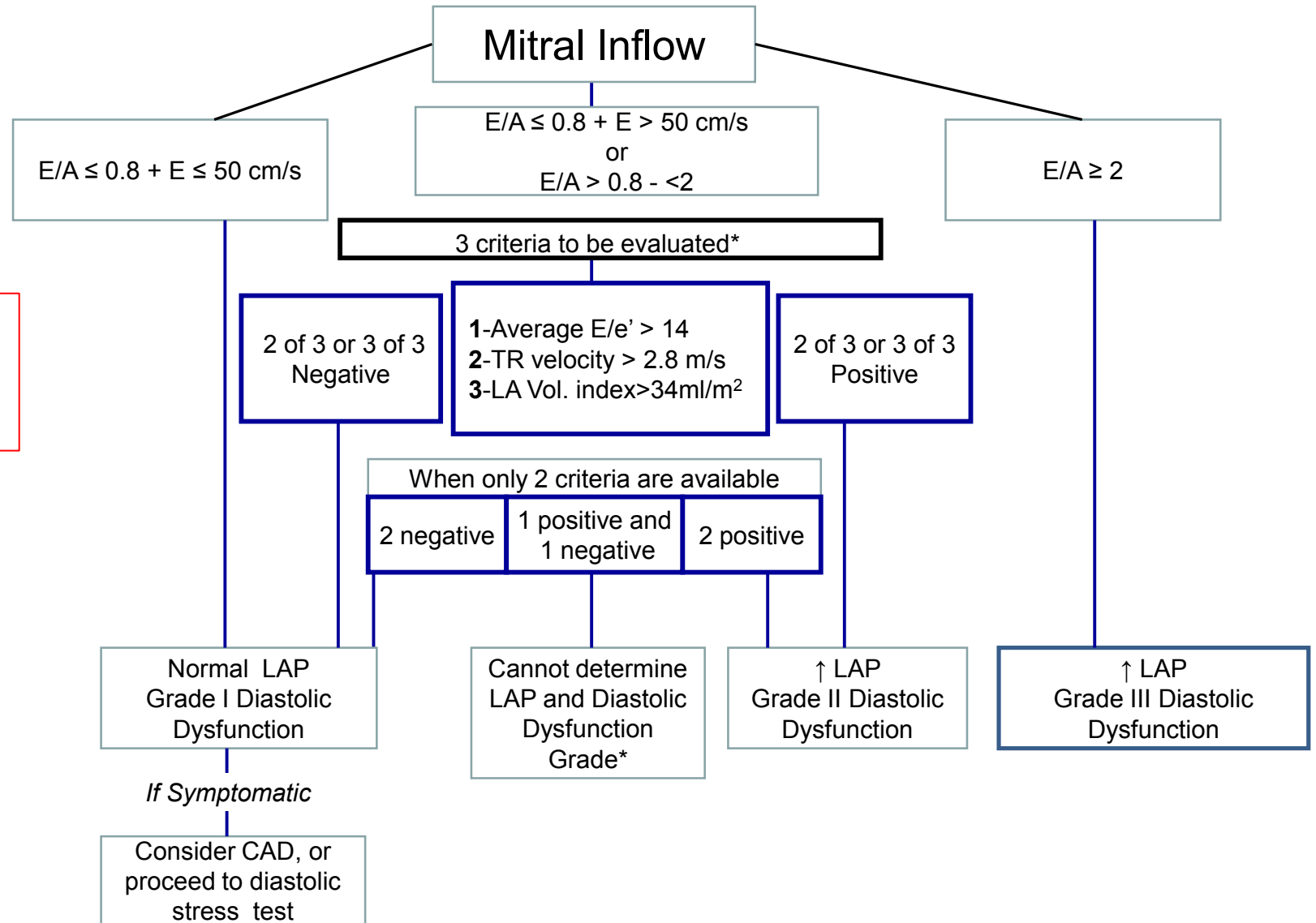
**ESC GUIDELINES**

# 2021 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure

HF is not a single pathological diagnosis, but a clinical syndrome consisting of cardinal symptoms (e.g. breathlessness, ankle swelling and fatigue) that may be accompanied by signs (e.g. elevated jugular venous pressure, pulmonary crackles and peripheral oedema). It is due to a structural and/or functional abnormality of the heart that results in **elevated intracardiac pressures** and/or inadequate cardiac output at rest and/or during exercise.

# Pressions de remplissage du VG

**B**



FeVG altérée

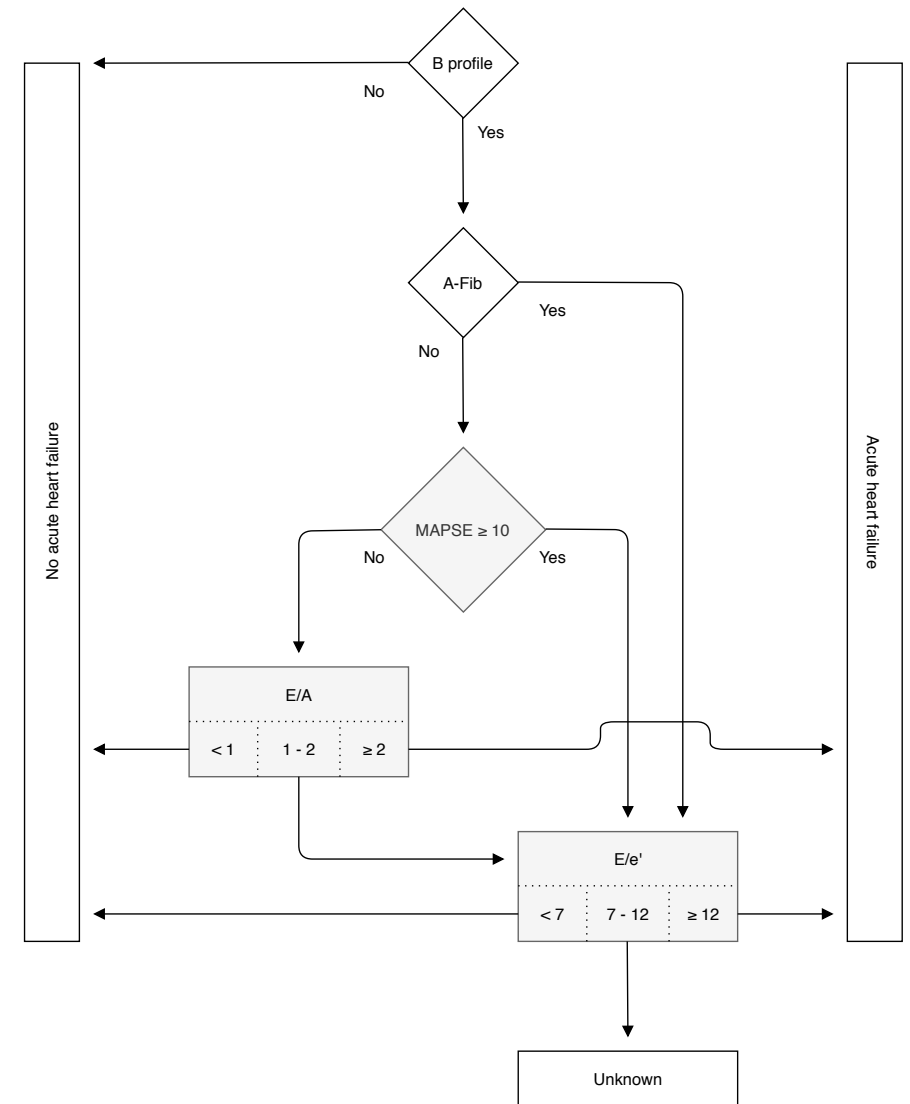
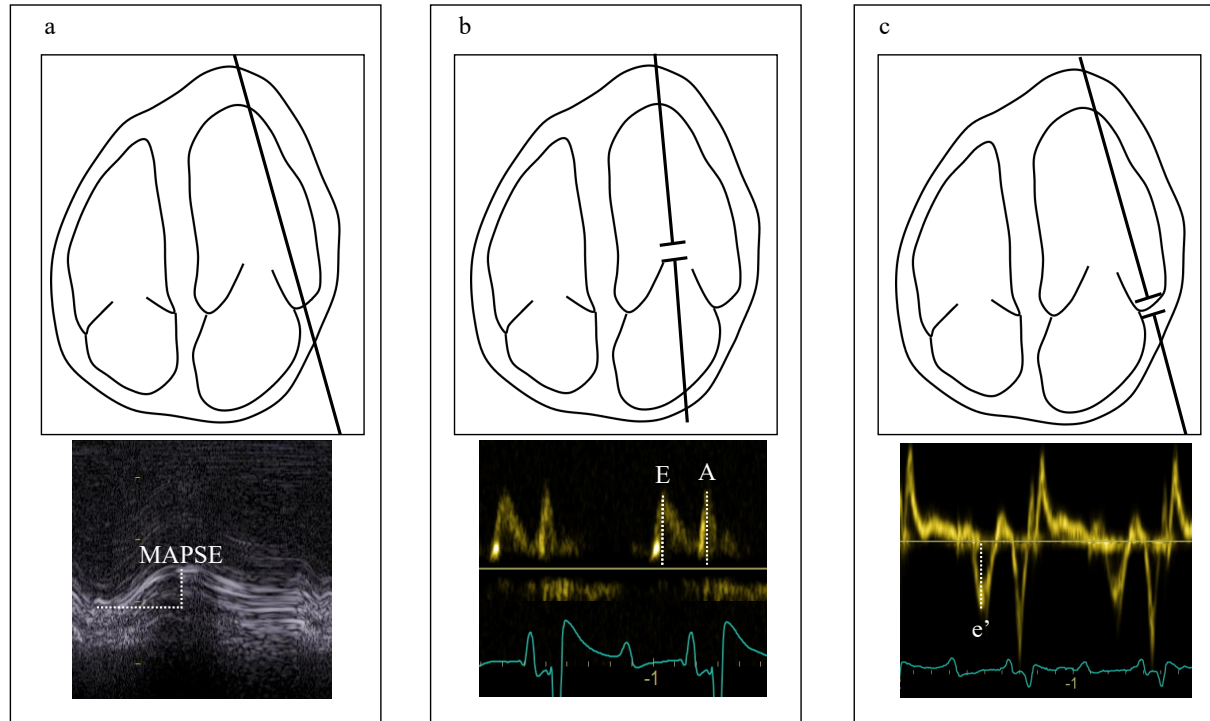
ou

FeVG normale + maladie cardiaque

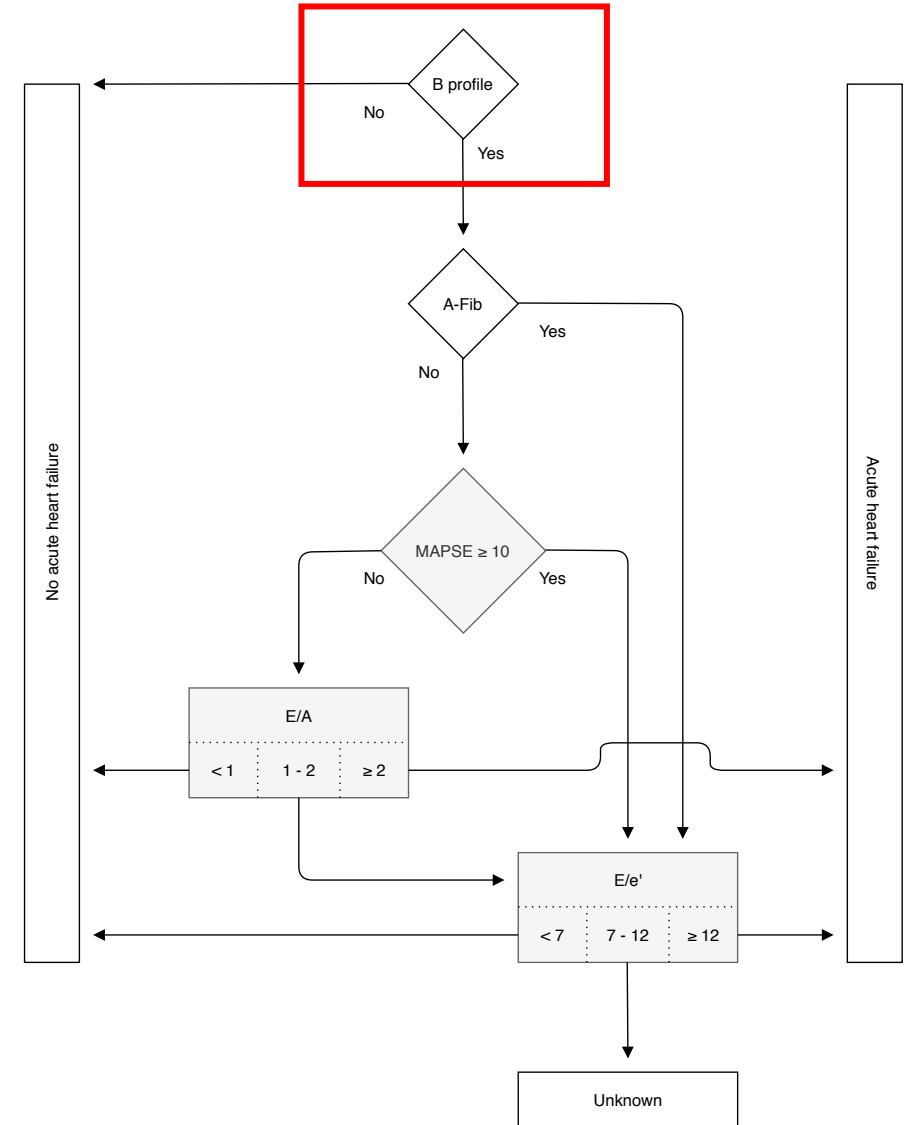
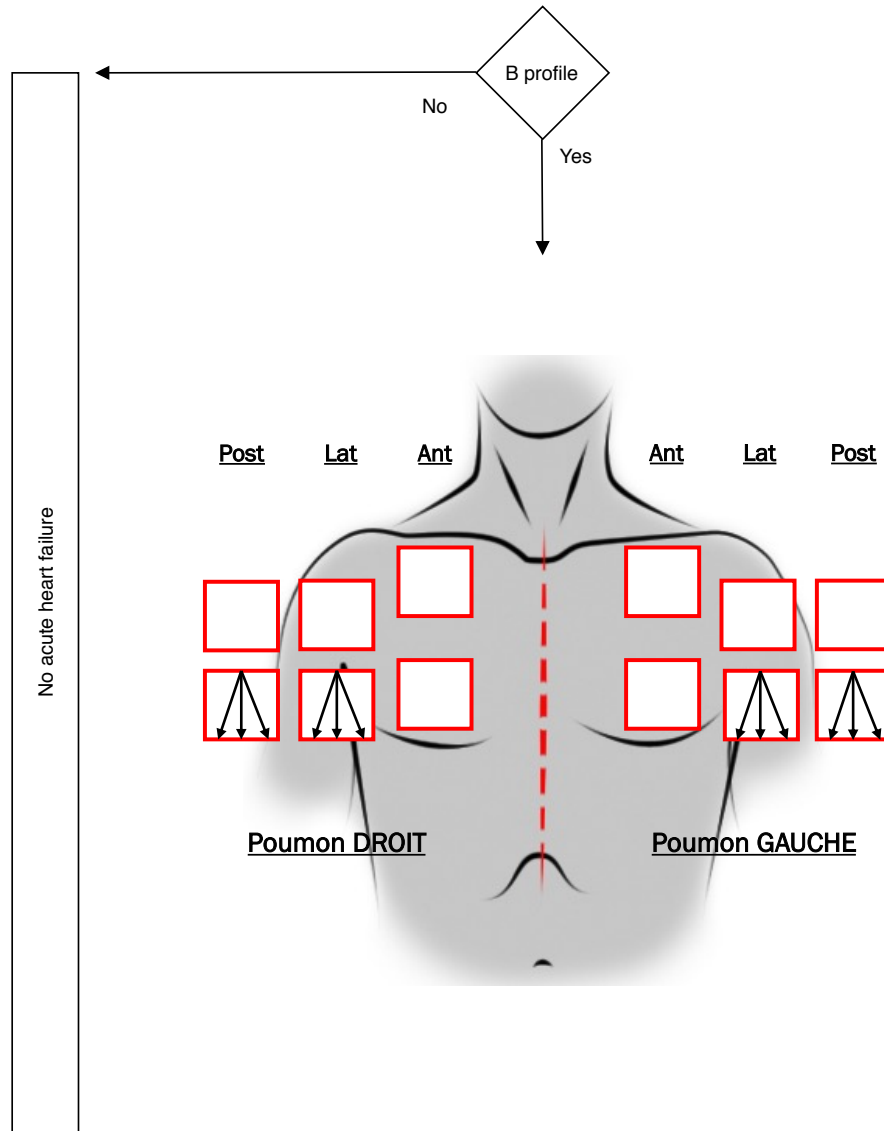
Exclusions :

- ACFA
- Maladie mitrale
- Assistance VG
- BBG
- EEV

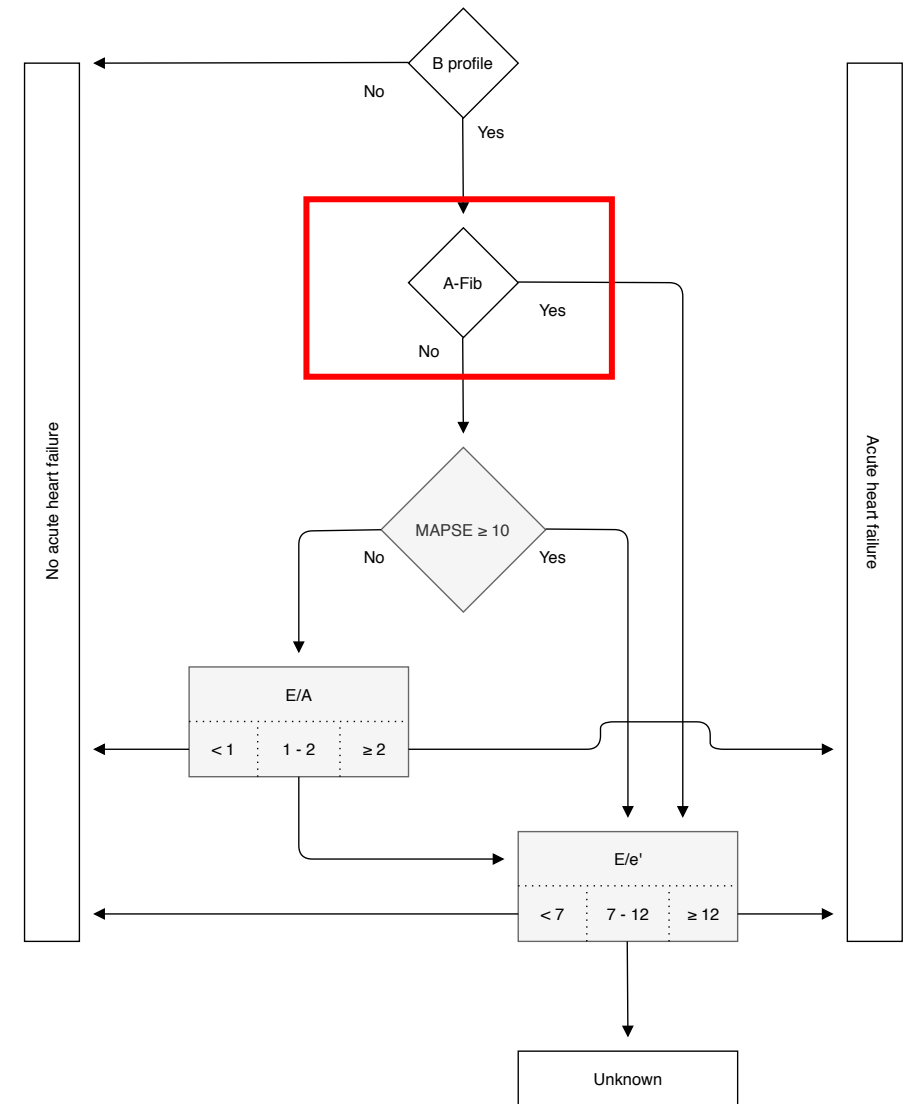
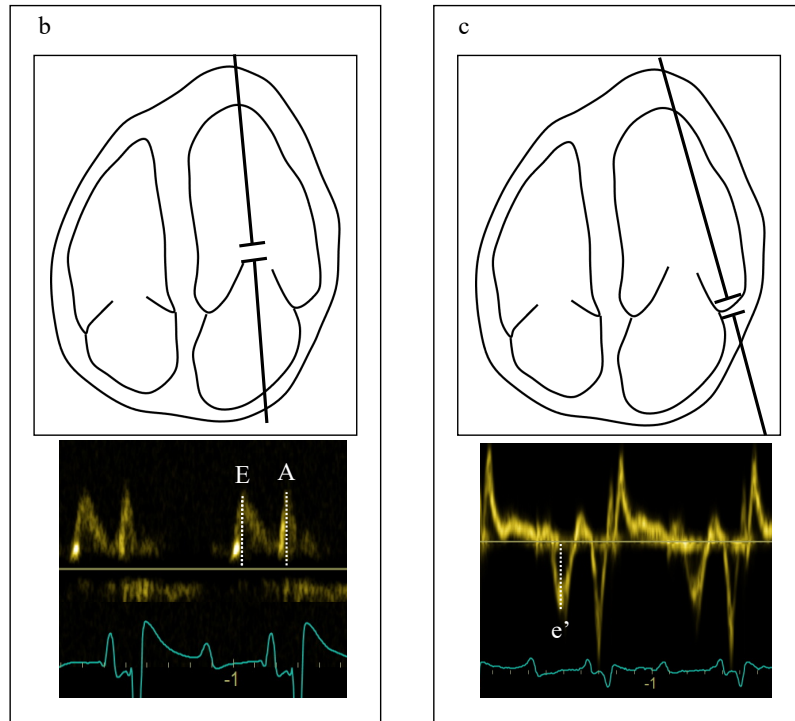
# Insuffisance cardiaque aiguë et Echographie Clinique



# Insuffisance cardiaque aiguë et Echographie Clinique

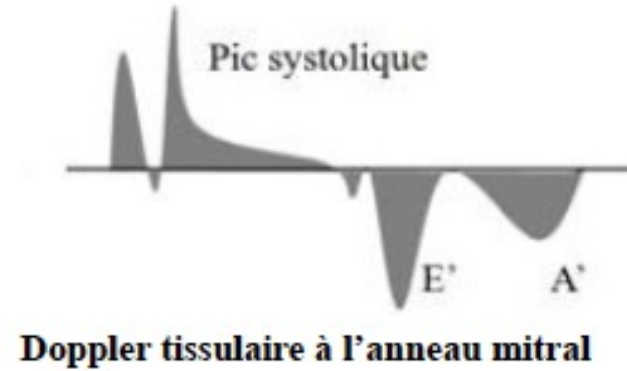
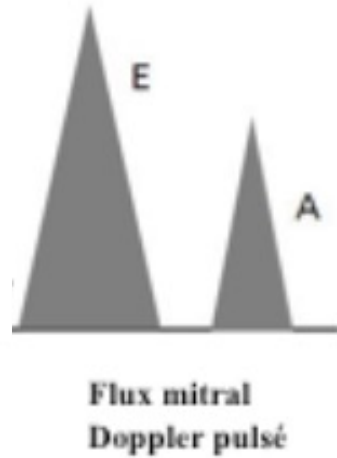


# Insuffisance cardiaque aiguë et Echographie Clinique





## Insuffisance cardiaque aiguë et Echographie Clinique



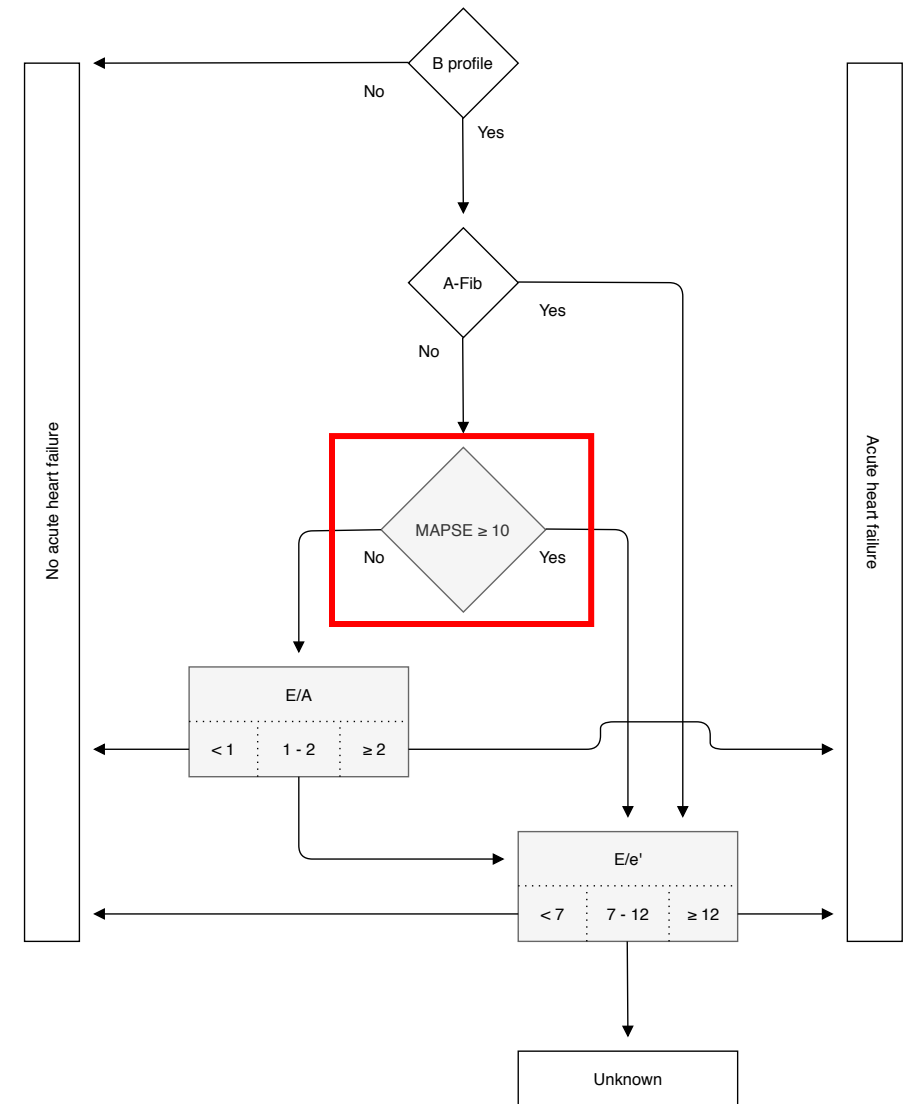
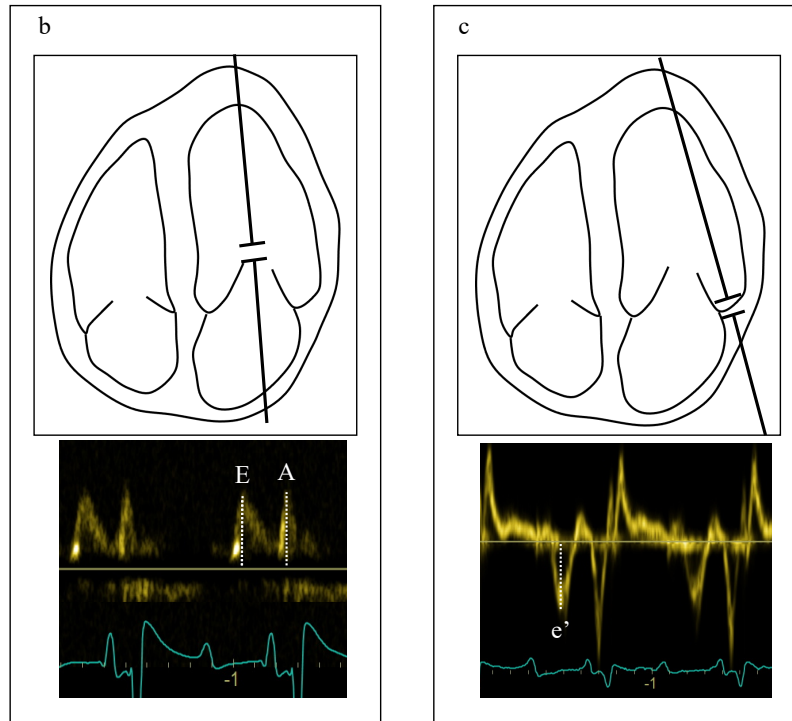
1) ACFA → E/E'

2) FeVG normale → E/E'

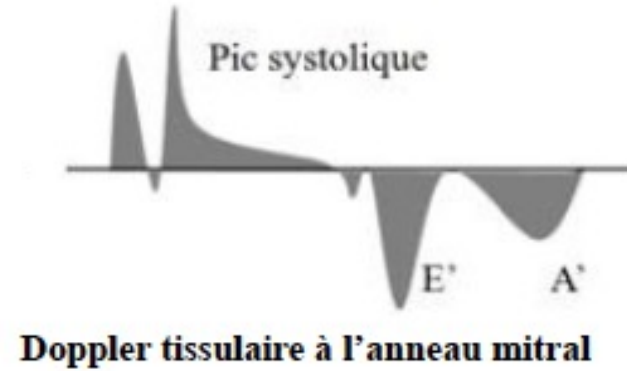
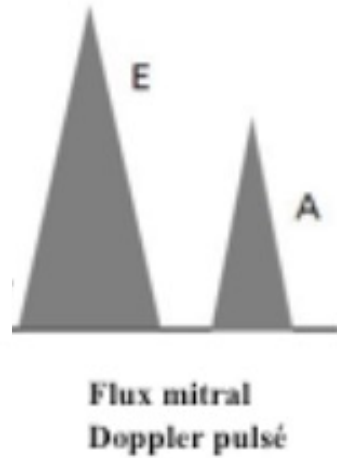
*3 situations cliniques*

3) FeVG altérée → E/A → E/A = 1 - 2 → E/E'

# Insuffisance cardiaque aiguë et Echographie Clinique



## Insuffisance cardiaque aiguë et Echographie Clinique



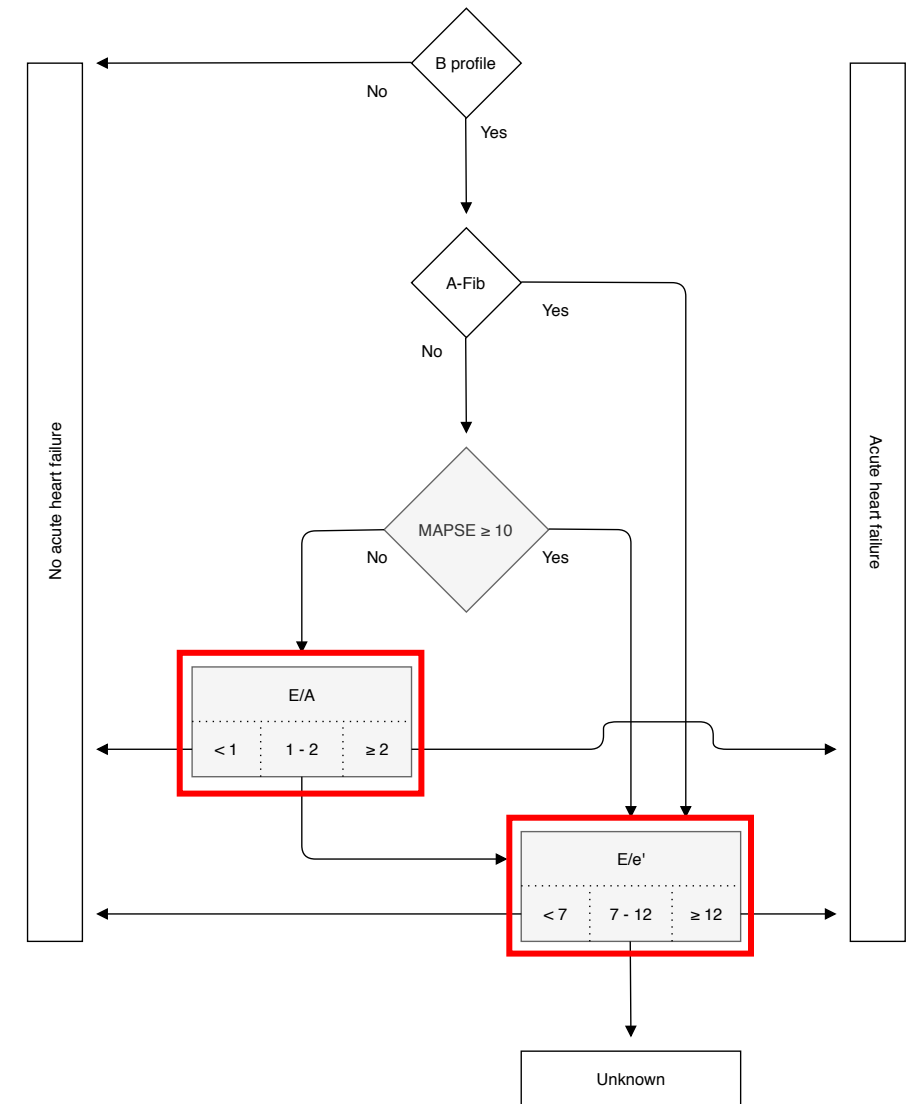
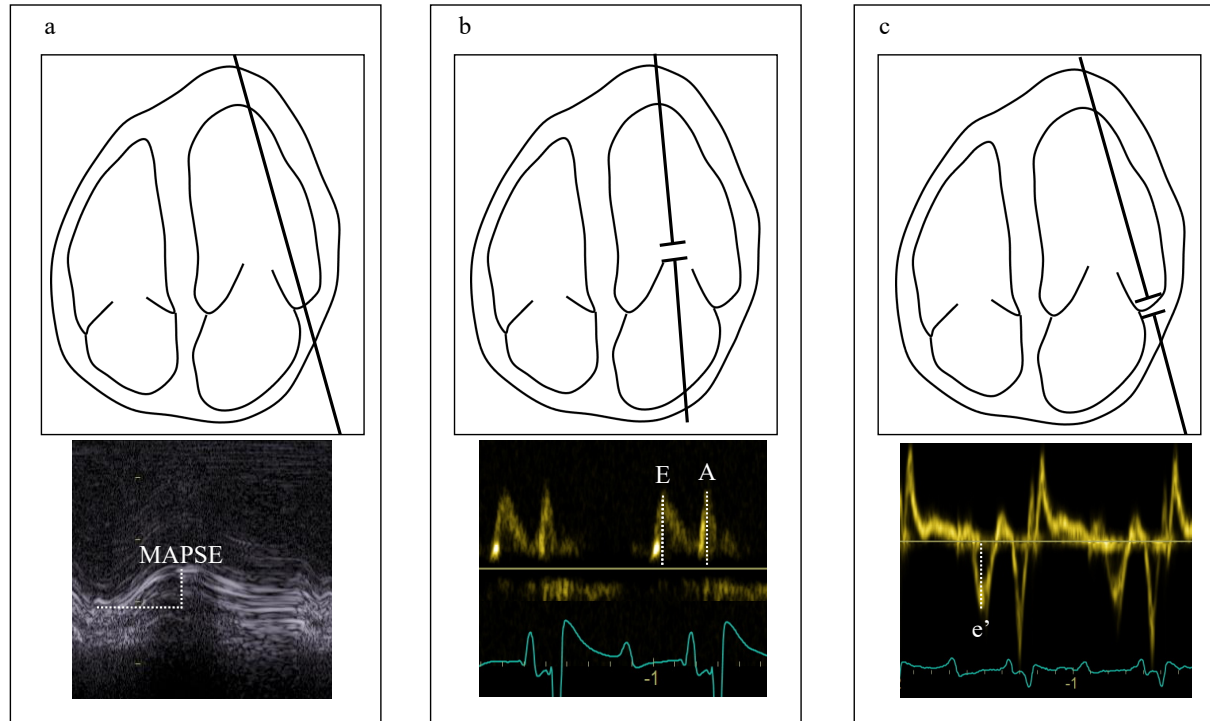
1) ACFA →  $E/E'$

2) FeVG normale →  $E/E'$

*3 situations cliniques*

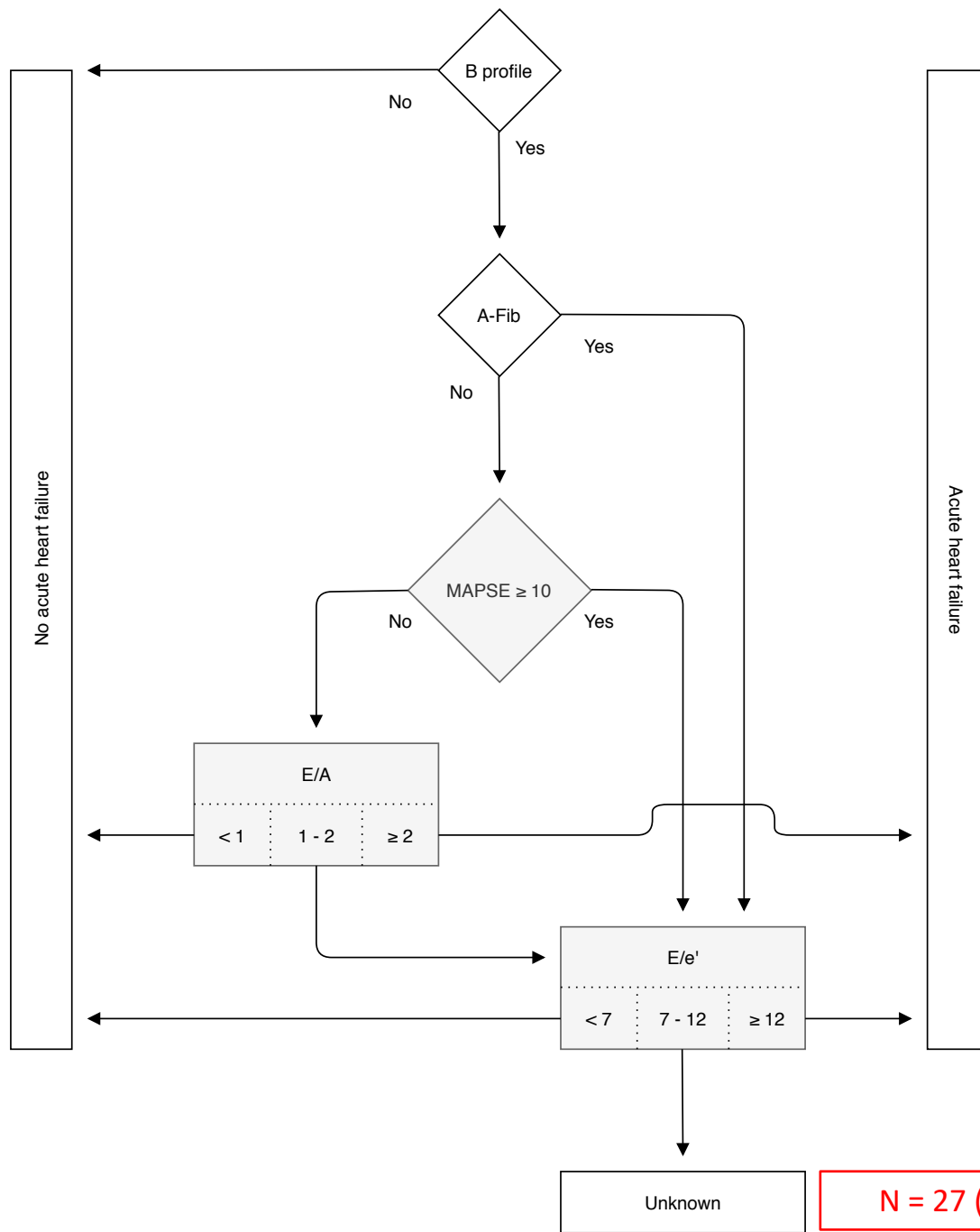
3) FeVG altérée →  $E/A$  →  $E/A = 1 - 2$  →  $E/E'$

# Insuffisance cardiaque aiguë et Echographie Clinique



## Insuffisance cardiaque aiguë et Echographie Clinique

	AUC [95% CI]	Se [95% CI]	Sp [95% CI]	PPV [95% CI]	NPV [95% CI]	PLR [95% CI]	NLR [95% CI]	Non- classified patients N (%)
B-profile	0.70 [0.64; 0.77]	100% [0.92; NaN]	41% [28%; 54%]	53% [39%; NaN]	100% [86%; 100%]	1.7 [1.4; 2.1]	0.00 [0.00; NaN]	0 (0%)
MAPSE < 10	0.64 [0.55; 0.73]	38% [23%; 55%]	89% [77%; 97%]	74% [53%; 85%]	65% [47%; 86%]	3.6 [1.4; 9.0]	0.70 [0.53; 0.91]	0 (0%)
E/A	0.82 [0.67; 0.97]	70% [35%; 93%]	94% [79%; 99%]	78% [47%; 95%]	91% [69%; 99%]	10.9 [2.7; 44.0]	0.32 [0.12; 0.83]	62 (60%)
E/e'	0.96 [0.92; 1.00]	100% [85%; NaN]	92% [79%; 98%]	88% [70%; NaN]	100% [90%; 100%]	12.7 [4.3; 37.5]	0.00 [0.00; NaN]	78 (76%)
Algorithm	0.94 [0.88; 1.00]	96% [78%; 100%]	93% [82%; 98%]	85% [67%; 100%]	98% [88%; 100%]	12.7 [4.9; 32.7]	0.05 [0.01; 0.32]	27 (26%)



**Faisabilité = 74%**

**AUC = 0.94** (0.88 - 1.00)

Se = 96% (78% - 100%)

Sp = 93% (82% - 98%)

VPP = 85% (67% - 100%)

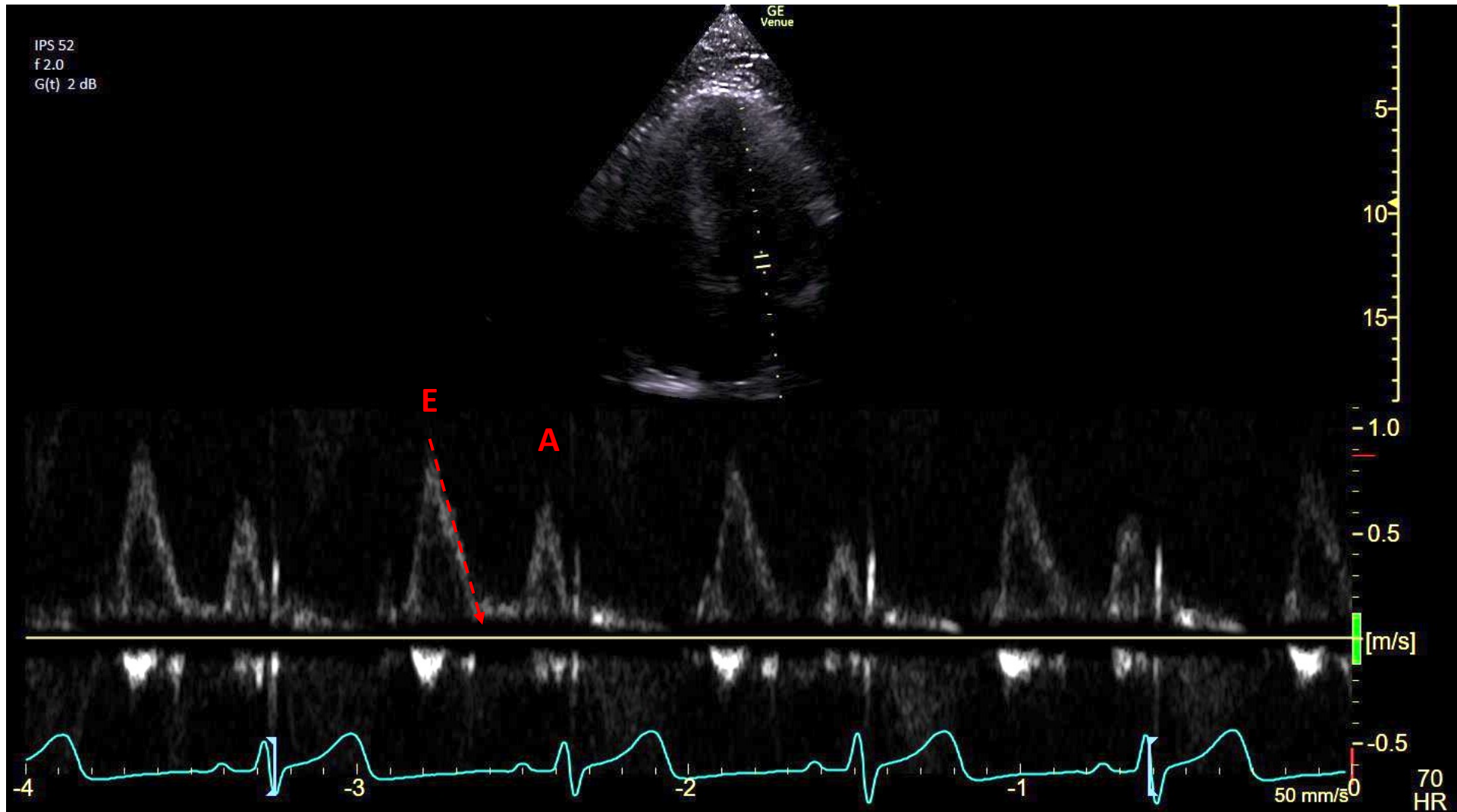
VPN = 98% (88% - 100%)

LR + = 12.7 (4.9 – 32.7)

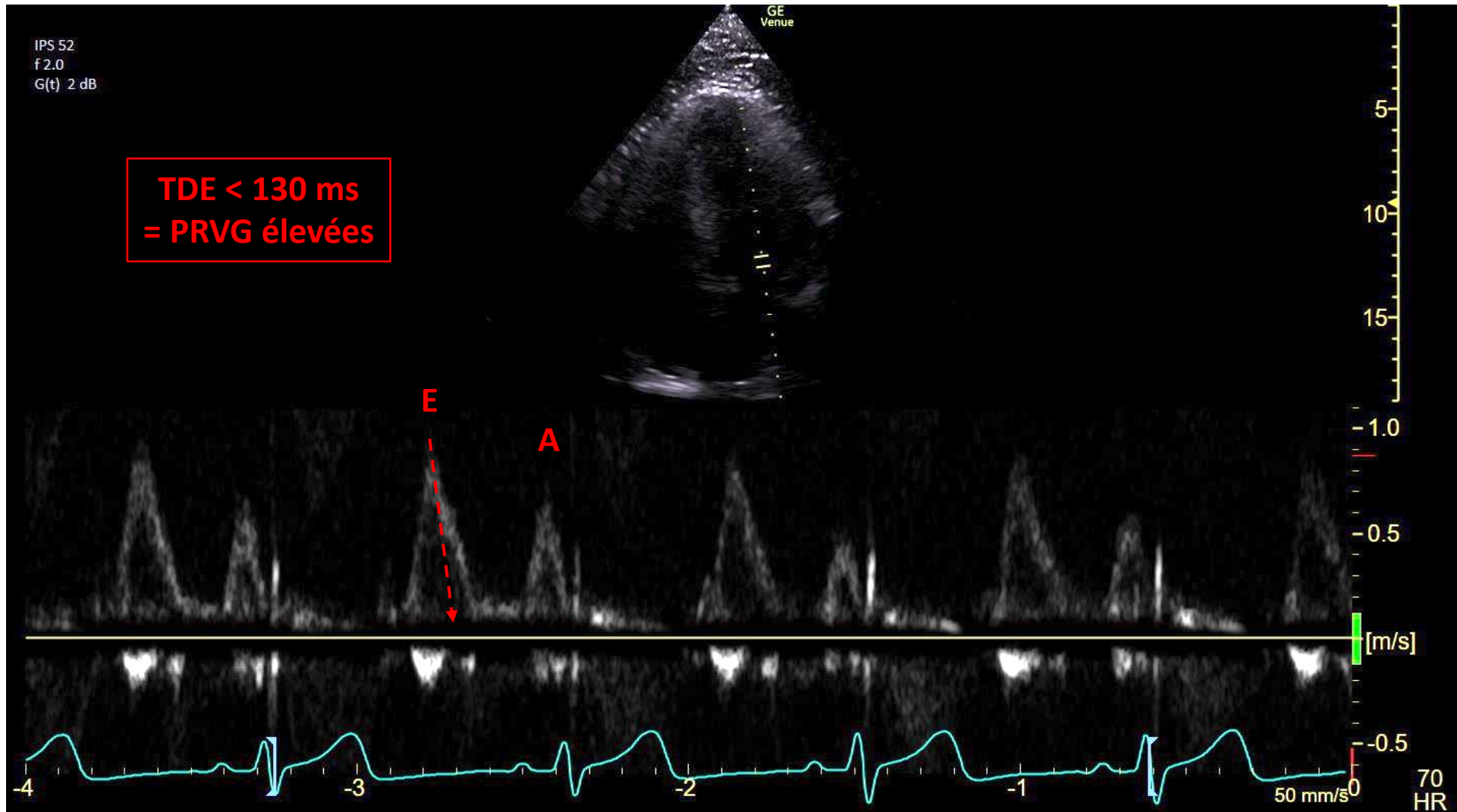
LR - = 0.05 (0.01 – 0.32)

- Nombre de patients limité
- Biais de sélection
- Variabilité inter et intra-individuelle
- Algorithme échographique

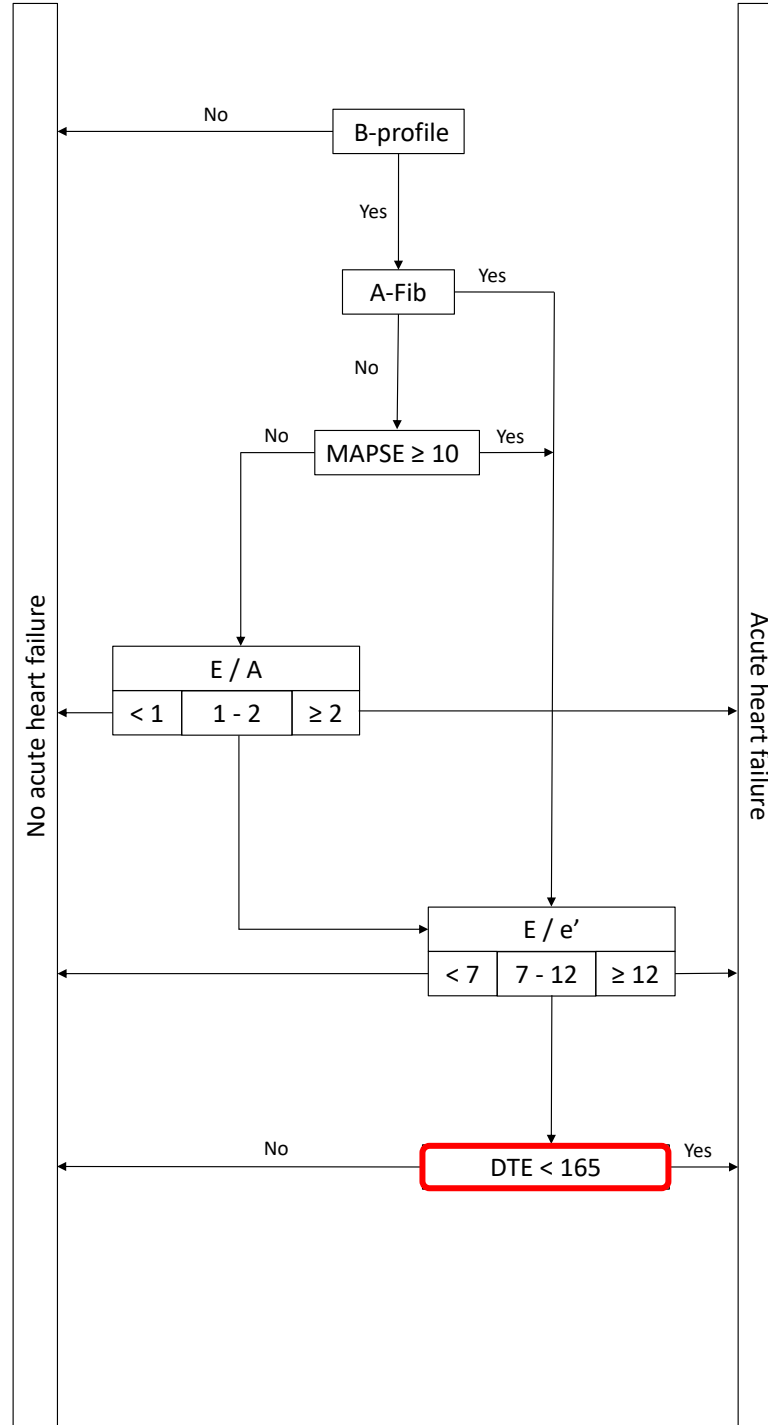
## Insuffisance cardiaque aiguë et Echographie Clinique



## Insuffisance cardiaque aiguë et Echographie Clinique





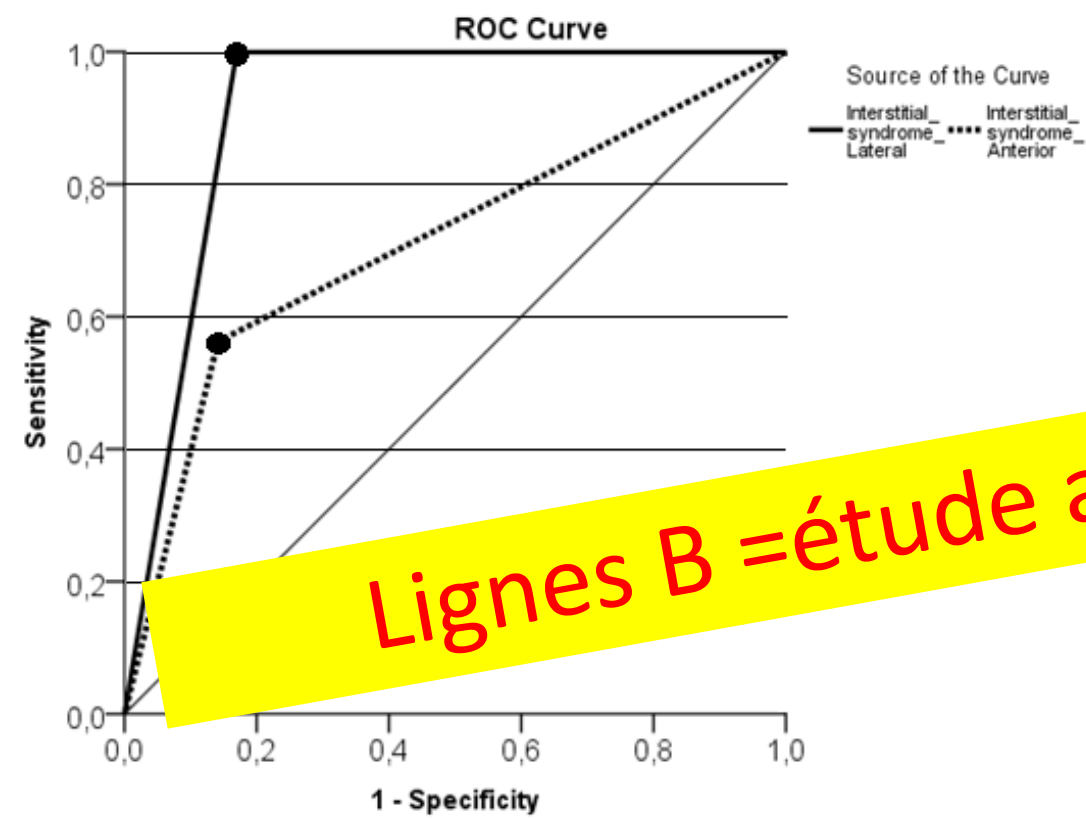


Insuffisance cardiaque aiguë et Echographie Clinique

	AUC (95% CI)	Se (95% CI)	Sp (95% CI)	PPV (95% CI)	NPV (95% CI)	PLR (95% CI)	NLR (95% CI)	Non- classified patients (%)	P value
Algorithm with DTE (165 ms)	0.91 (0.86-0.96)	87 (76-94)	95 (89-98)	92 (82-96)	93 (85-98)	18.1 (7.7-42.8)	0.14 (0.07-0.26)	0 (0)	
Algorithm without DTE	0.94 (0.90-0.99)	89 (75-96)	100 (96-100)	100 (91-100)	95 (88-100)	NC	0,11 (0.05-0.26)	33 (20)	0.35

## Echographie Pleuro-Pulmonaire





Lateral vs Antérieur

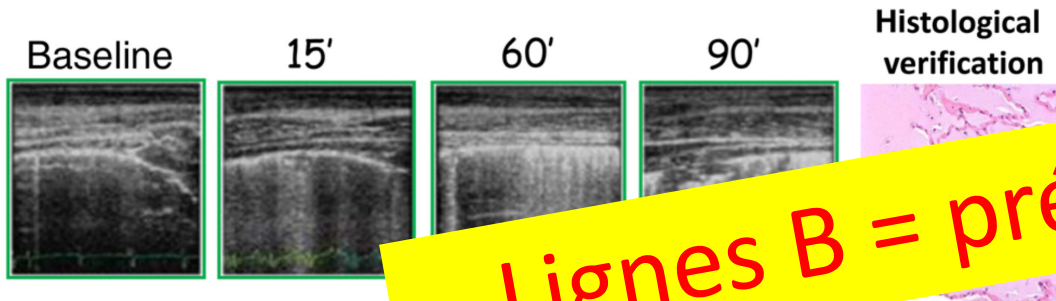
Lignes B = étude antérieure (et latérale)

- Anterior lung ultrasound can be safely used to identify acute heart failure in all dyspneic patients
- Anterior lung ultrasound can be safely used to identify acute heart failure in patients with severe/critical hypoxemia

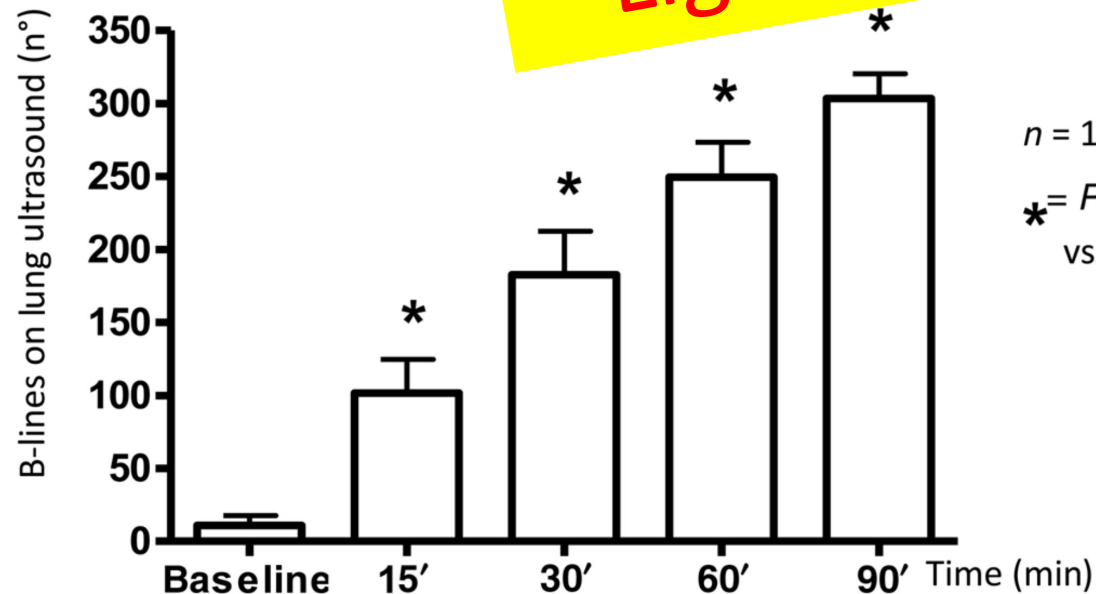
Test Result Variable(s)	AUC	Std. Error	Asymptotic 95% Confidence Interval		p
			Lower	Upper	
Lateral LUS positive	0.915	0.023	0.871	0.959	0.0001
Anterior LUS positive	0.710	0.043	0.626	0.795	



## ARDS and ALI have B-lines



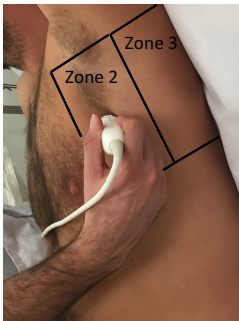
**Lignes B = précoce**



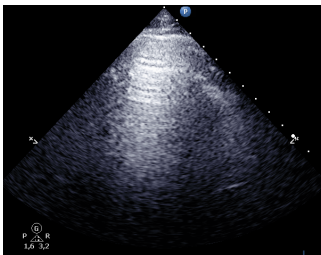
Lignes B vs score PAFi

- lignes B = 15 min
- PAFi = 90 min

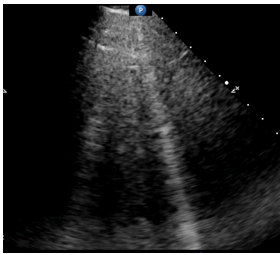
# Echographie Pleuro-Pulmonaire – Score MLUS



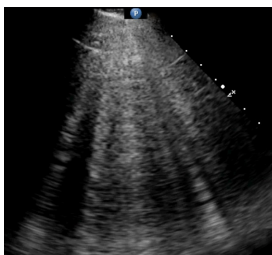
		RIGHT Lung	LEFT Lung
Anterior Chest Wall (zone 1)	UPPER		
	LOWER		
Lateral Wall (zone 2)	UPPER		
	LOWER		
Posterolateral Wall (zone 3)	UPPER		
	LOWER		
TOTAL		/ 36	



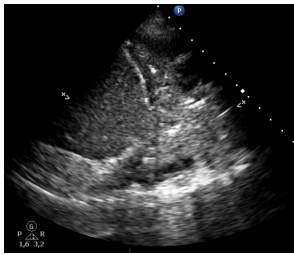
normal aeration



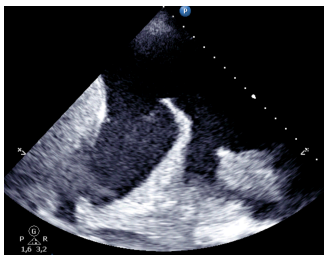
moderate damage



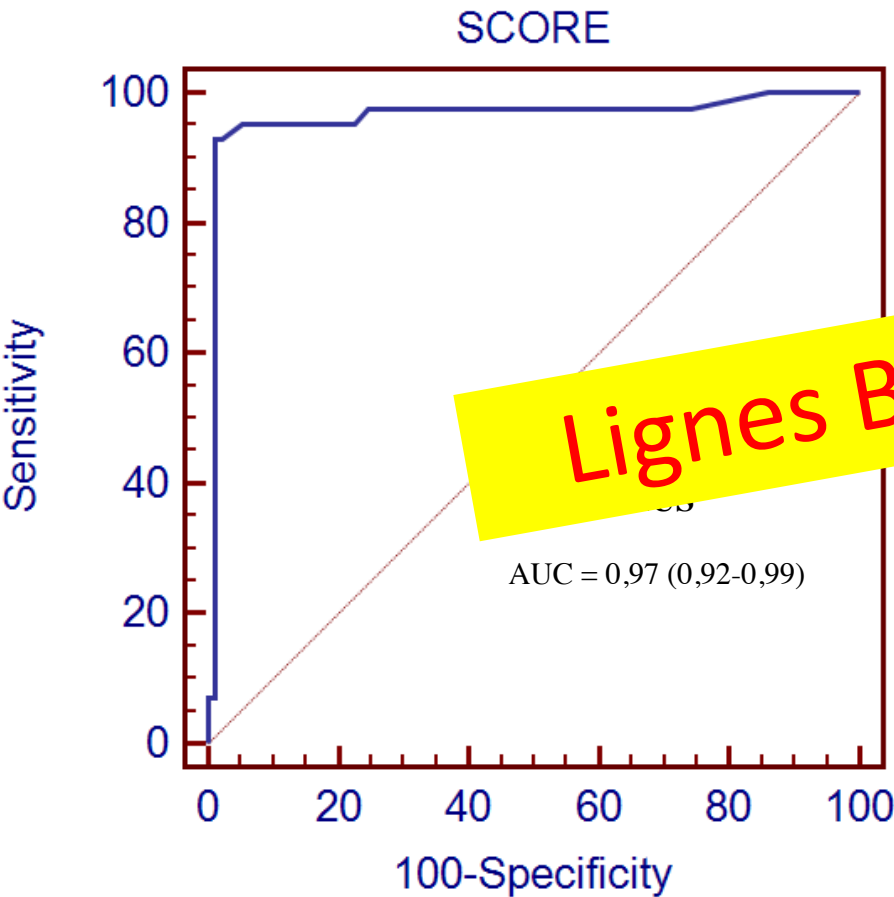
serious damage



pulmonary  
consolidation



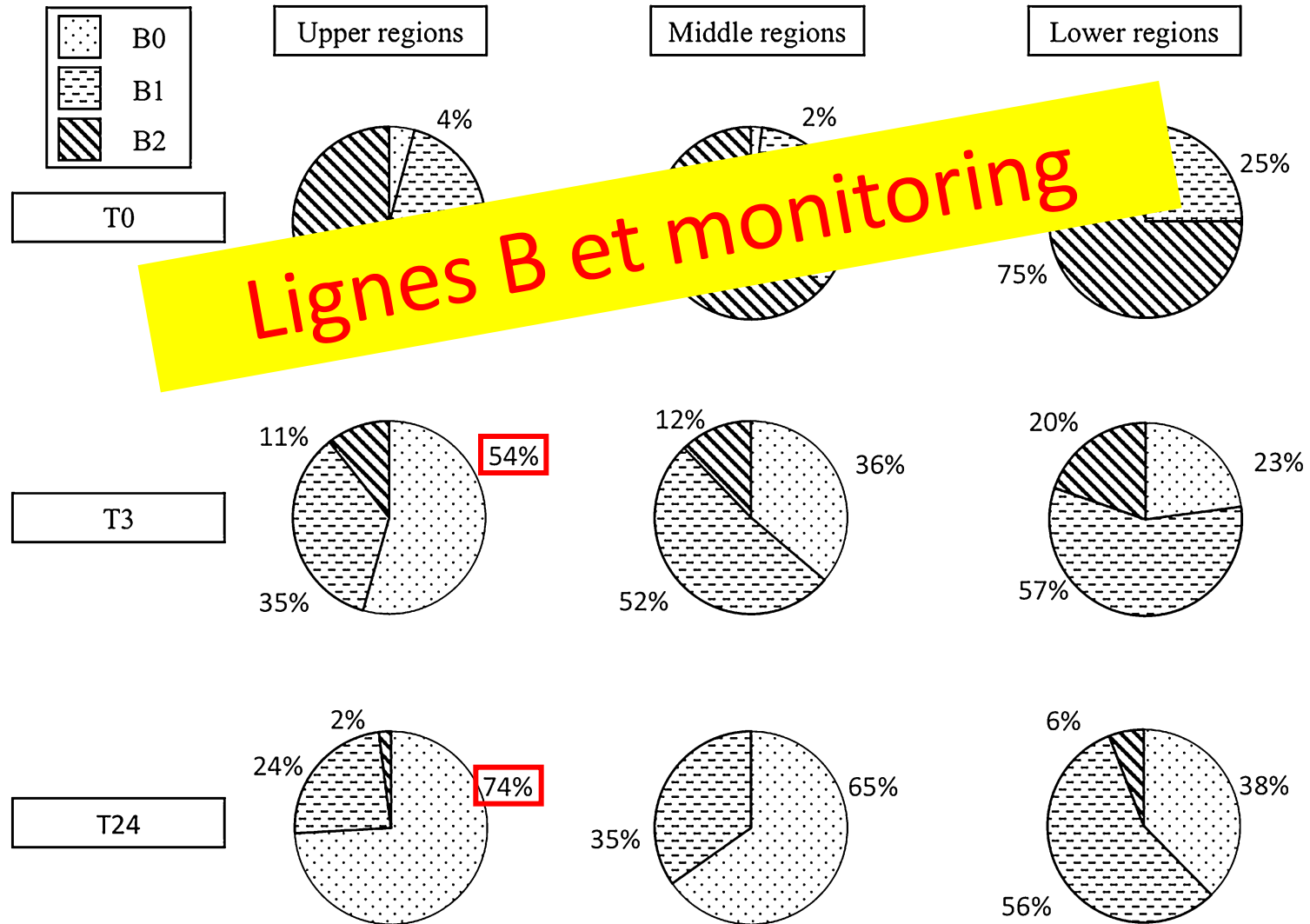
pleural effusion



Lignes B +++ = signe de gravité

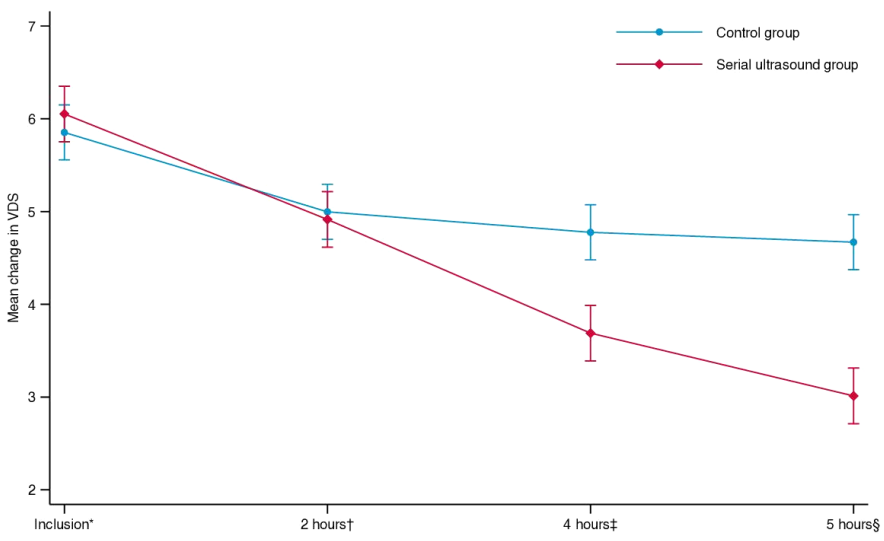
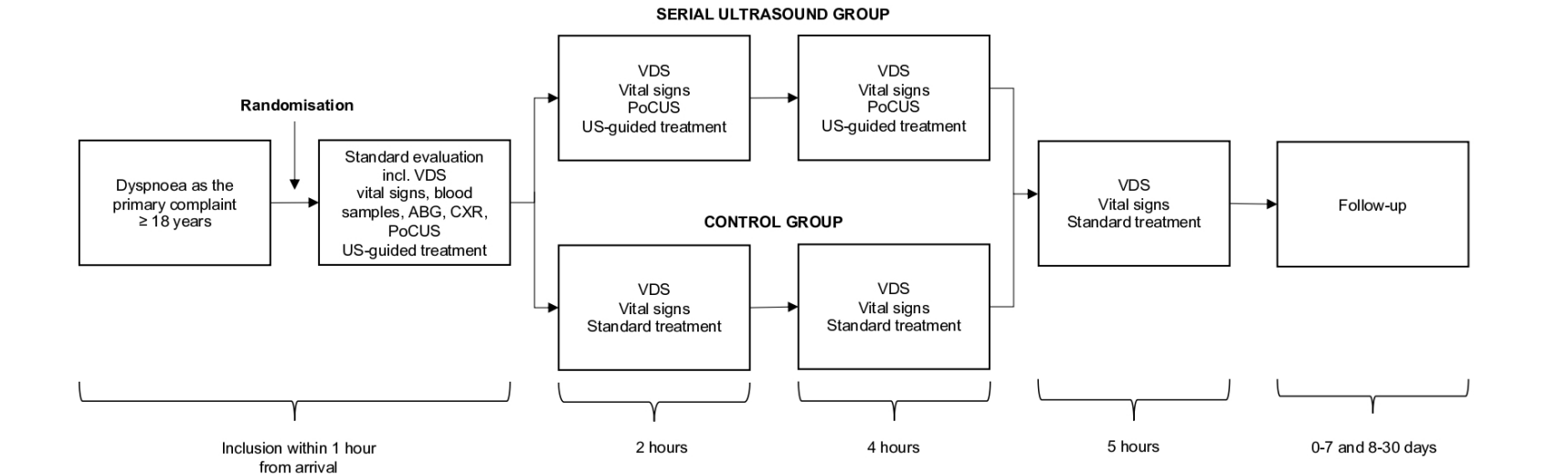
	analysis	
		p value
	0,09 (0-21,53)	0,38
Failure rate	1,3 (0,86-1,97)	0,21
Boston score	1,33 (0,56-3,15)	0,52
MLUS > 17	454,89 (9,86-20984)	0,002
Lactate	1,67 (0,47-5,97)	0,43

# Echographie Pleuro-Pulmonaire – Monitoring





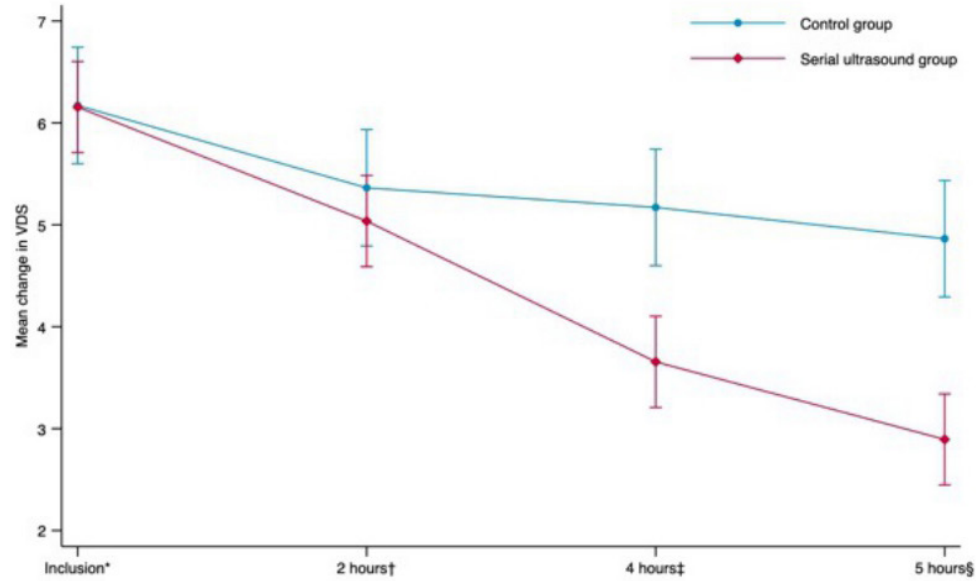
# Echographie Pleuro-Pulmonaire – Monitoring



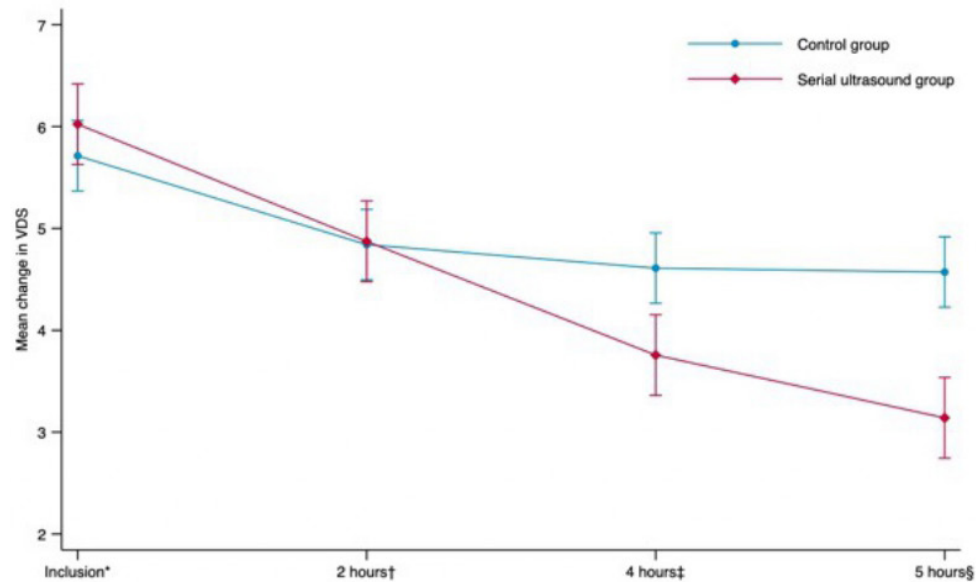
**Differences between groups and within groups at different time points**

Between groups	
Serial ultrasound versus control group at inclusion	VDS difference (95% CI) 0.20 (-0.23 to 0.63)
Serial ultrasound versus control group +2 hours	-0.08 (-0.51 to 0.35)
Serial ultrasound versus control group +4 hours	-1.09 (-1.51 to -0.66)
Serial ultrasound versus control group +5 hours	-1.66 (-2.09 to -1.23)
Within the control group	
Control group at +2 hours versus control group <1 hour	-0.86 (-1.16 to -0.55)
Control group at +4 hours versus control group at +2 hours	-0.22 (-0.53 to 0.09)
Control group at +5 hours versus control group at +4 hours	-0.11 (-0.41 to 0.20)
Within the serial ultrasound group	
Serial ultrasound group at +2 hours versus serial ultrasound group <1 hours	-1.14 (-1.45 to -0.83)
Serial ultrasound group at +4 hours versus serial ultrasound group at +2 hours	-1.23 (-1.54 to -0.91)
Serial ultrasound group at +5 hours versus serial ultrasound group at +4 hours	-0.68 (-0.99 to -0.37)

## Echographie Pleuro-Pulmonaire – Monitoring



OAP



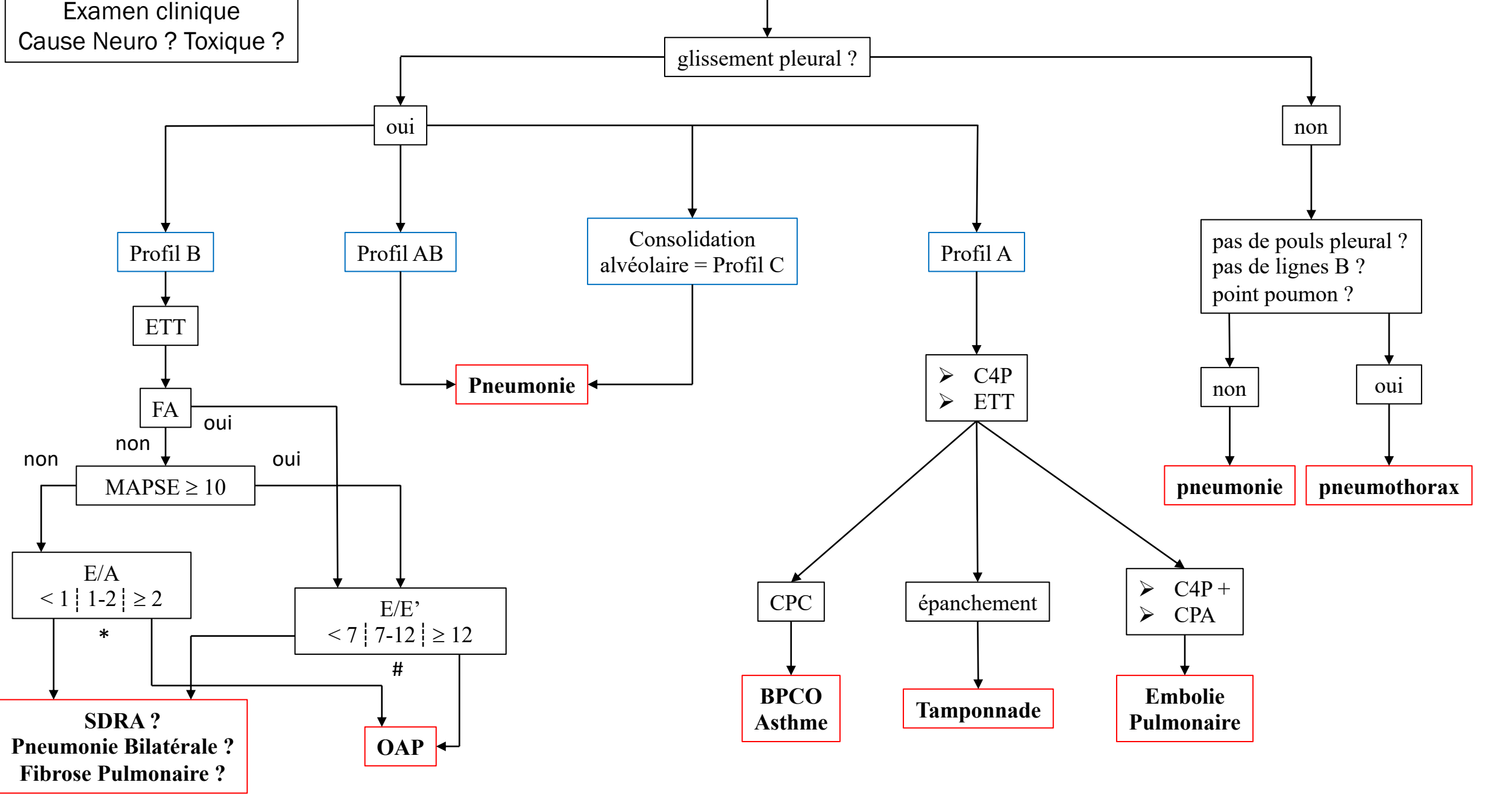
Autres

## Echographie Pleuro-Pulmonaire – Monitoring

	Serial ultrasound group (n=102)		Control group (n=104)		Risk difference (95% CI)	P value
Length of hospital stay, days	4	(1–7)	3	(0–6)	3.9 (–9.8 to 17.5)	0.58
Readmissions						
0–7 days	15	(14.7)	10	(9.6)	5.1 (–3.8 to 14.0)	0.26
8–30 days	15	(14.7)	7	(6.7)	8.0 (–0.4 to 16.4)	0.06
In-hospital mortality	4	(3.9)	4	(3.8)	0.1 (–5.2 to 5.4)	0.98
Mortality						
0–7 days	2	(2.0)	3	(2.9)	–0.9 (–5.1 to 3.3)	0.67
8–30 days	2	(2.0)	2	(1.9)	0.0 (–3.7 to 3.8)	0.98
No. of correct final ED diagnoses	64	(62.7)	59	(56.7)	6.0 (–7.4 to 19.4)	0.38
Data are n (%) or median (IQR).						

Anamnèse ++  
Examen clinique  
Cause Neuro ? Toxique ?

**DETRESSE RESPIRATOIRE AIGUE**



**08h45 – 09h00 : Accueil des participants**

09h00 – 09h30 : Concept des pressions de remplissage du ventricule gauche

09h30 – 10h30 : Le Ventricule Droit

**10h30 – 11h00 : Pause**

11h00 – 12h00 : Ateliers pratiques

**12h00 – 13h00 : Pause repas**

13h00 – 14h00 : Détresse respiratoire

14h00 – 15h00 : Etat de choc

15h00 – 16h00 : Ateliers pratiques

16h00 – 17h00 : Quizz interactif

