



# Congestion

## The key target in acute heart failure

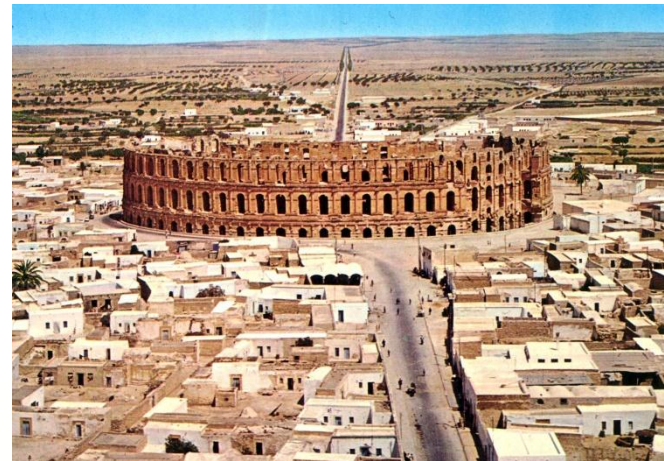
**Pr Semir Nouria**

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**Fattouma Bourguiba University Hospital**

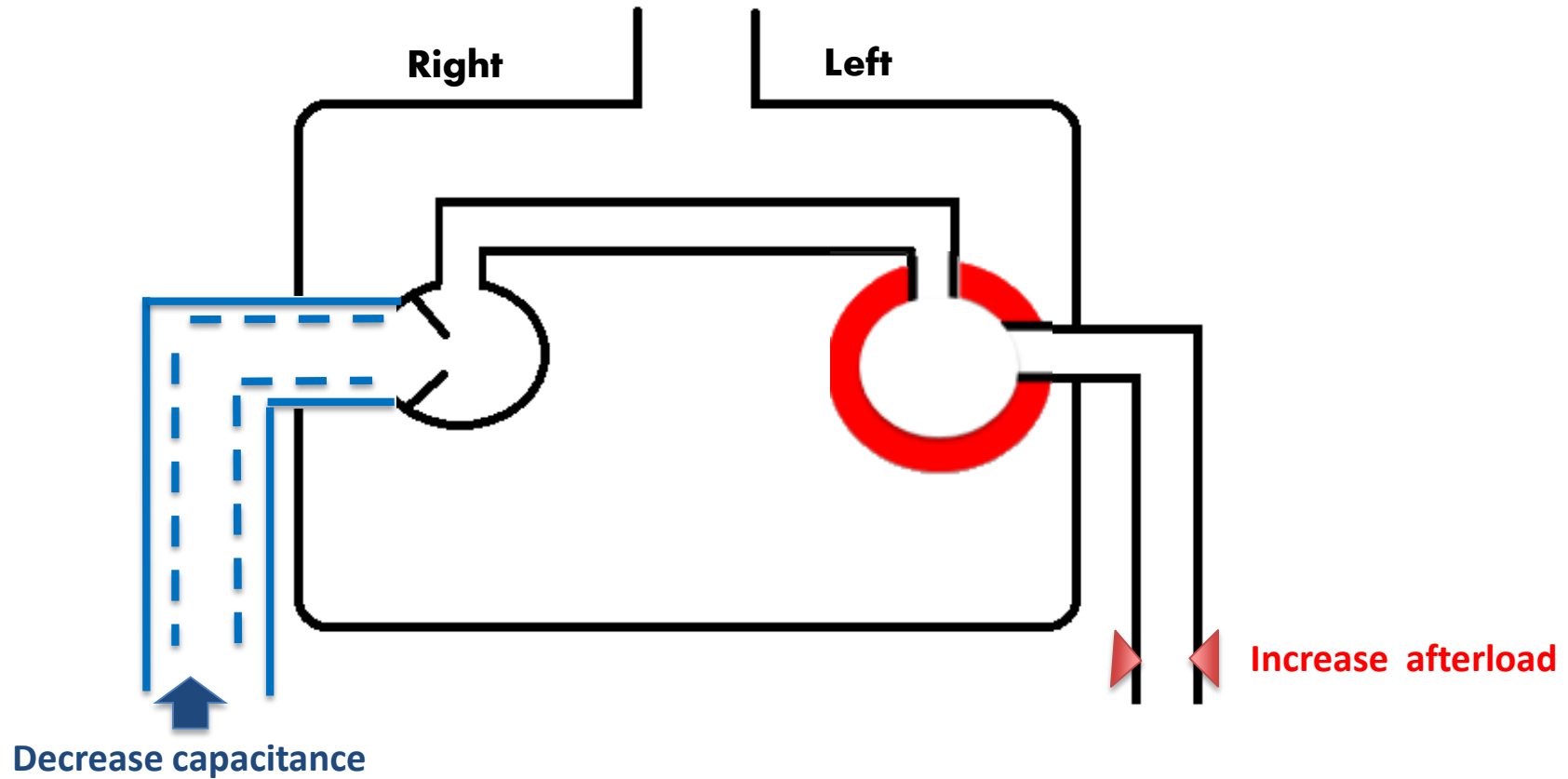
**Monastir Tunisia**



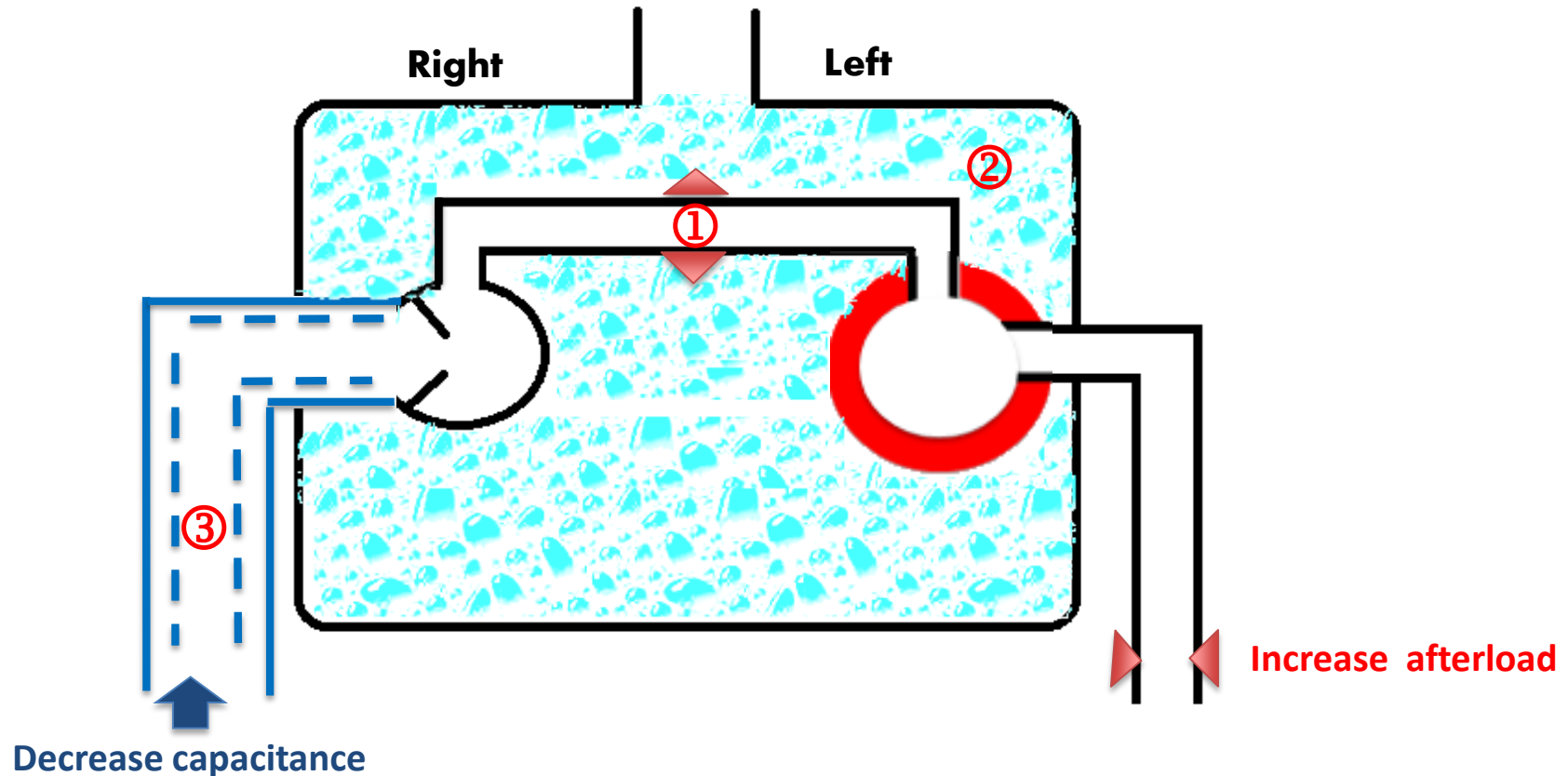




# CONGESTION MECHANISM



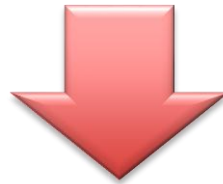
# CONGESTION MARKERS



- ① Pulmonary artery wedge pressure increase
- ② Pulmonary edema
- ③ Inferior Vena Cava dilatation

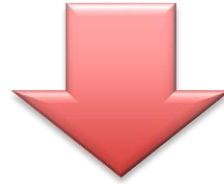
# RECOGNIZE CONGESTION

1. Pulmonary artery wedge pressure increase
2. Pulmonary edema
3. Inferior Vena Cava dilatation



**ULTRASONOGRAPHY**

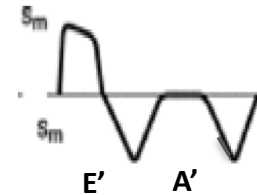
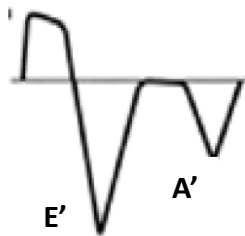
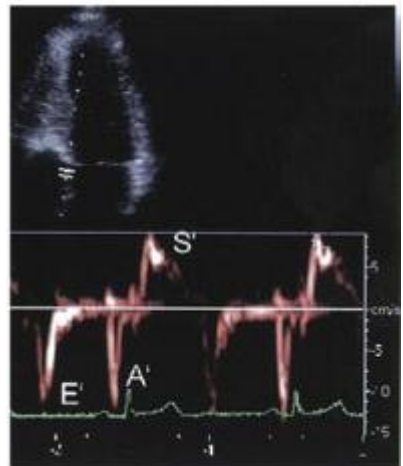
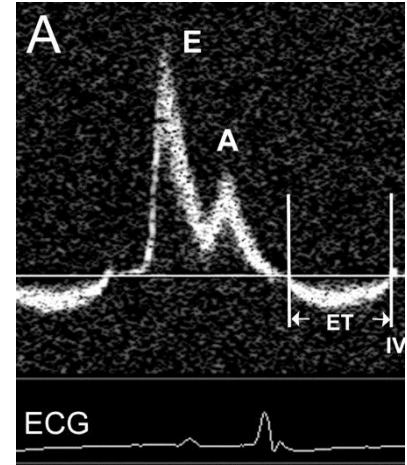
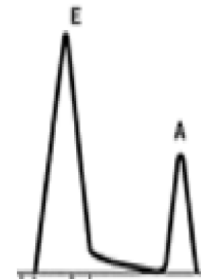
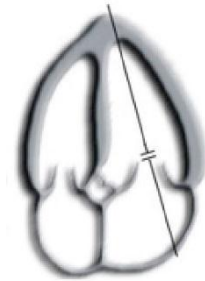
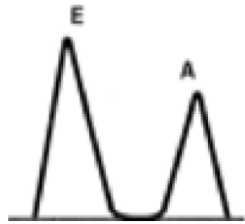
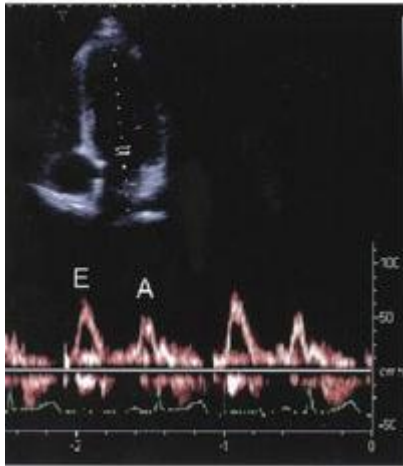
# RECOGNIZE CONGESTION



## ULTRASONOGRAPHY

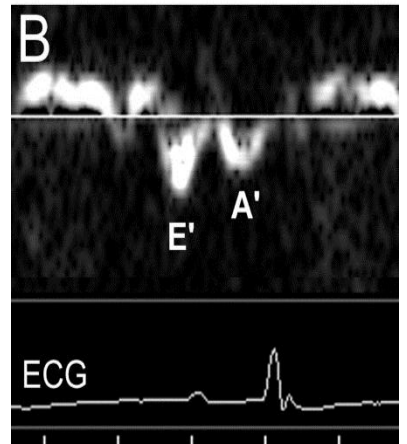
- 1. Pulmonary artery wedge pressure increase**
- 2. Pulmonary edema**
- 3. Inferior Vena Cava dilatation**

# E/E'



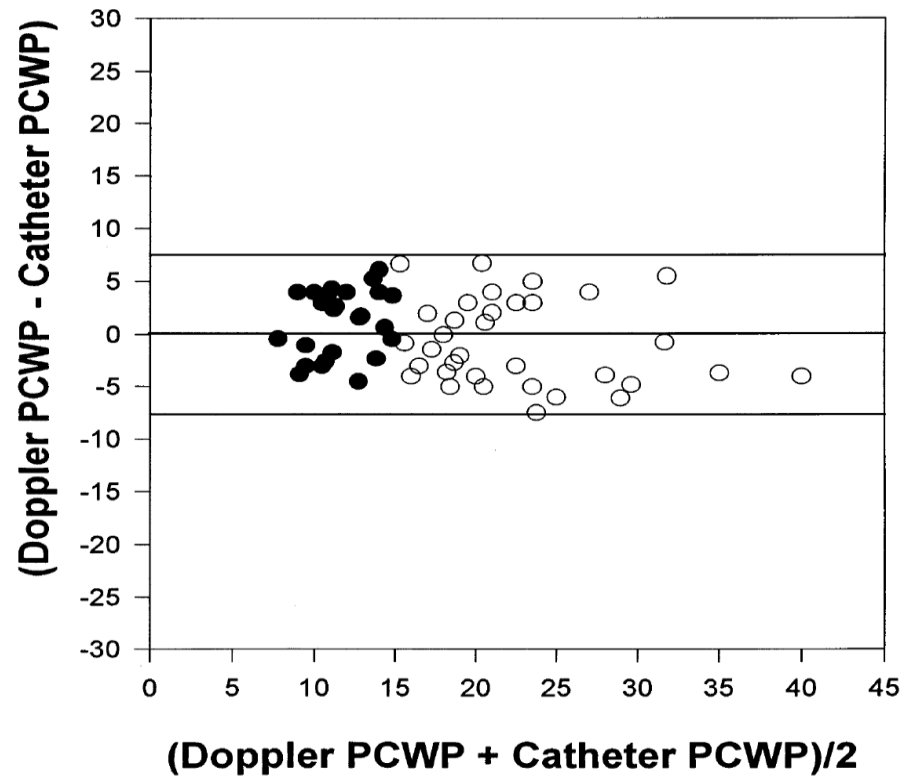
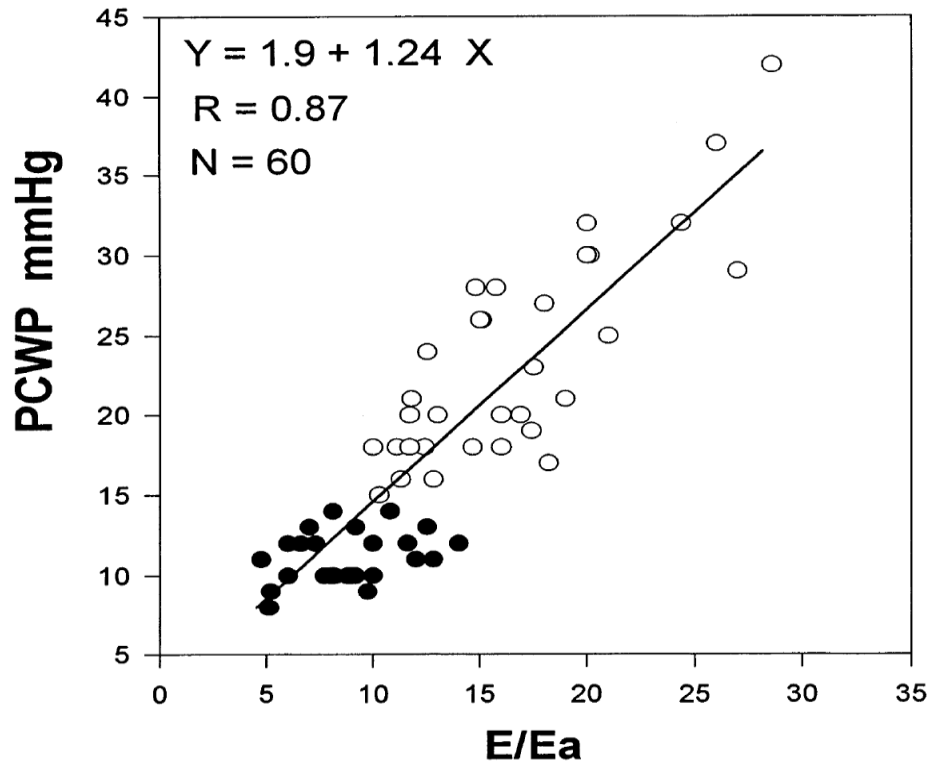
Normal

PAWP increase





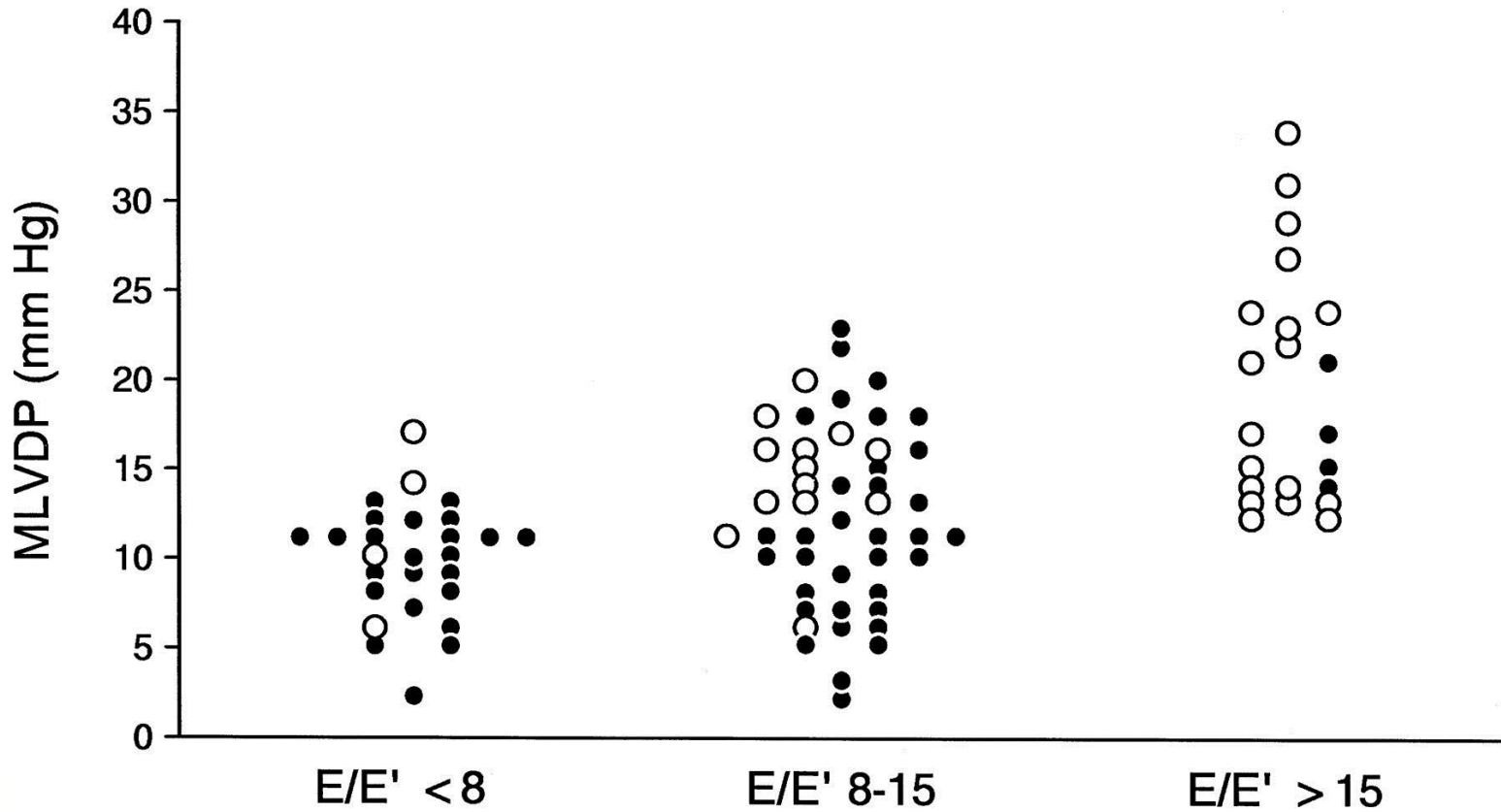
# E/E' and PAWP



# Septal E/E'

○ patients with EF <50%

● patients with EF >50%



# E/E' Limits

- **Situations where the use of E/e' may be unreliable**
  - Tachycardia
  - Mitral regurgitation or replacement
  - LBBB

→ Surrogate indices

- **PFV**
- **LA Ø**
- **LV Ø**

- **Hemodynamic and pulmonary congestion discrepancy**

# INTRODUCTION

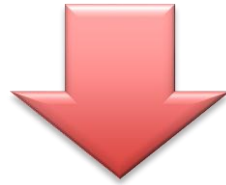
## Types of congestion in AHF

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Hemodynamic	Pulmonary
Early (proximal)	Intermediate (distal)
Increased LV filling pressures	Increased lung water
Pulmonary circulation	Alveolar-capillary membrane

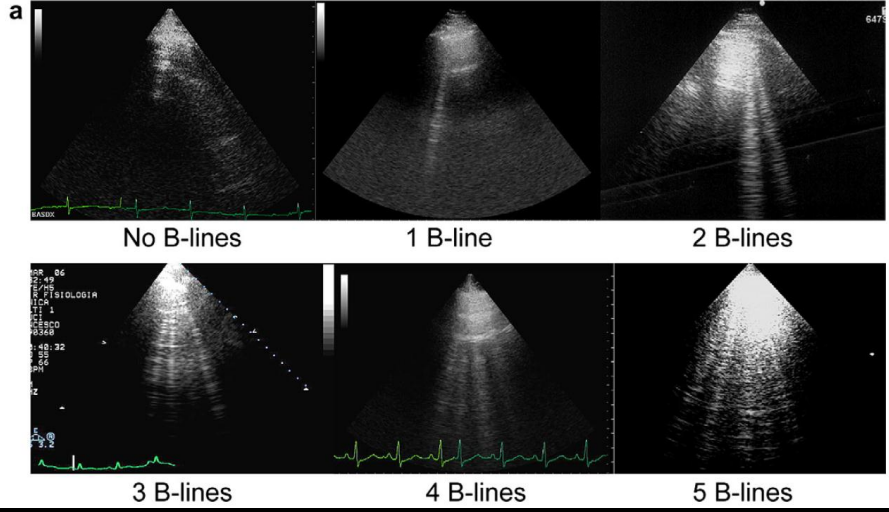
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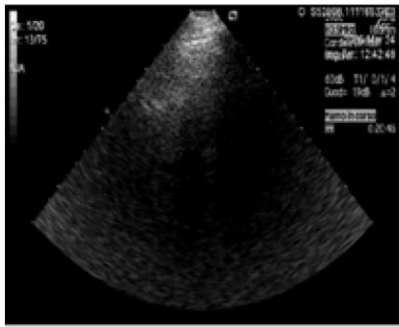
# RECOGNIZE CONGESTION



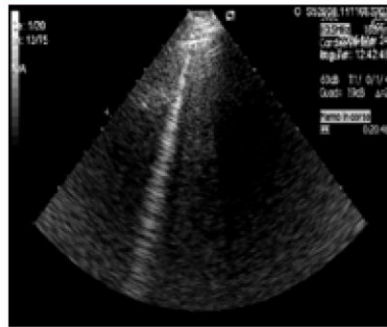
## ULTRASONOGRAPHY

1. Pulmonary artery wedge pressure increase
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Normal Lung



Mild degree of ULC



Moderate degree of ULC



Severe degree of ULC

	Mid-axillary	Anterior axillary	Mid-clavicular	Para-sternal	Inter-costal space	Para-sternal	Mid-clavicular	Anterior axillary	Mid-axillary	
right side					2					left side
					3					
					4					
					5					



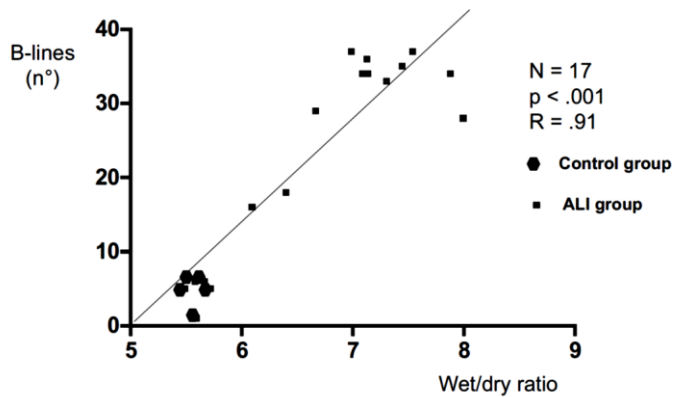
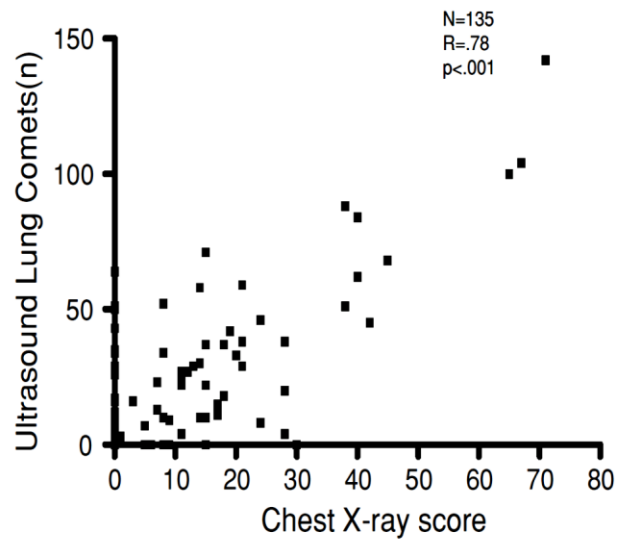
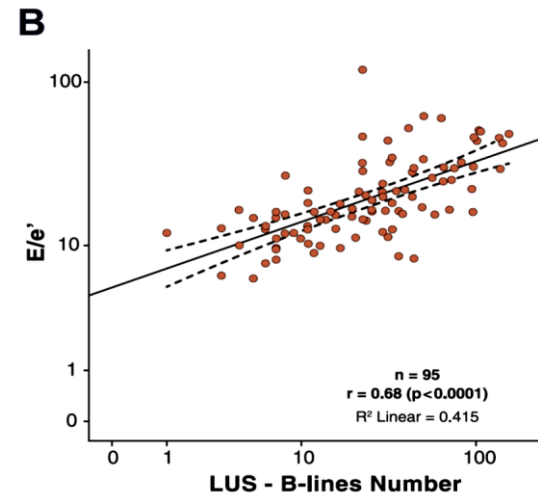
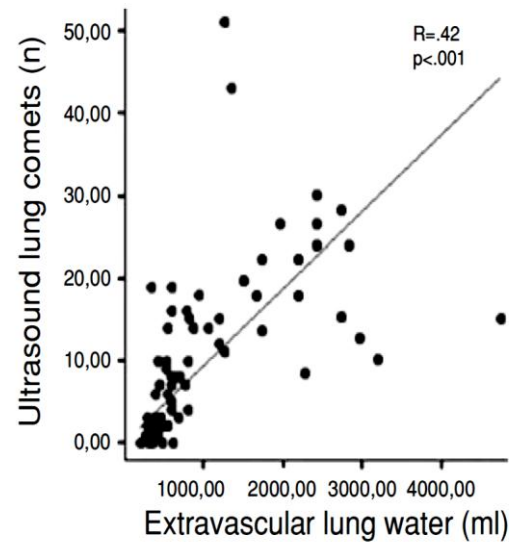


Fig. 4. The correlation between gravimetry values (x-axis) and lung ultrasound findings (y-axis) in the 17 pigs.

Jambrik ZN *Ultrasound Med. & Biol.* 2010



Picano E . *Heart Fail Rev* 2010



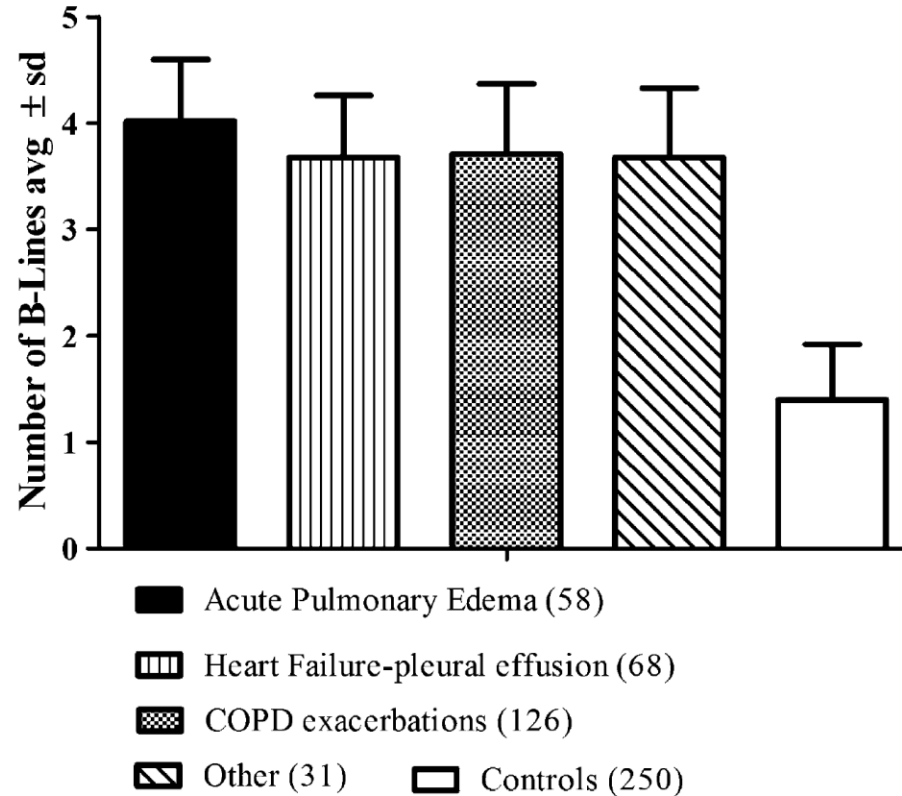
Miglioranza MH *J Am Coll Cardiol Imag* 2013



# LIMITS OF LUNG ULTRASOUND

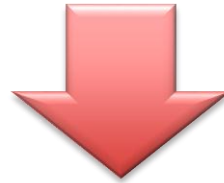
- ❑ **Sensitive but not specific**
  - ✓ **ARDS**
  - ✓ **Pulmonary fibrosis...**
- ❑ **Methodological biases**
  - ✓ **Position of the patient**
  - ✓ **Equipment (probe type...)**

# LIMITS OF LUNG ULTRASOUND



*Figure 1.* Comparison of number of ultrasound B-lines in patients with dyspnea according to the diagnosis (analysis of variance,  $P < 0.007$ ) and also including normal controls (analysis of variance,  $P > 0.0001$ ).

# RECOGNIZE CONGESTION

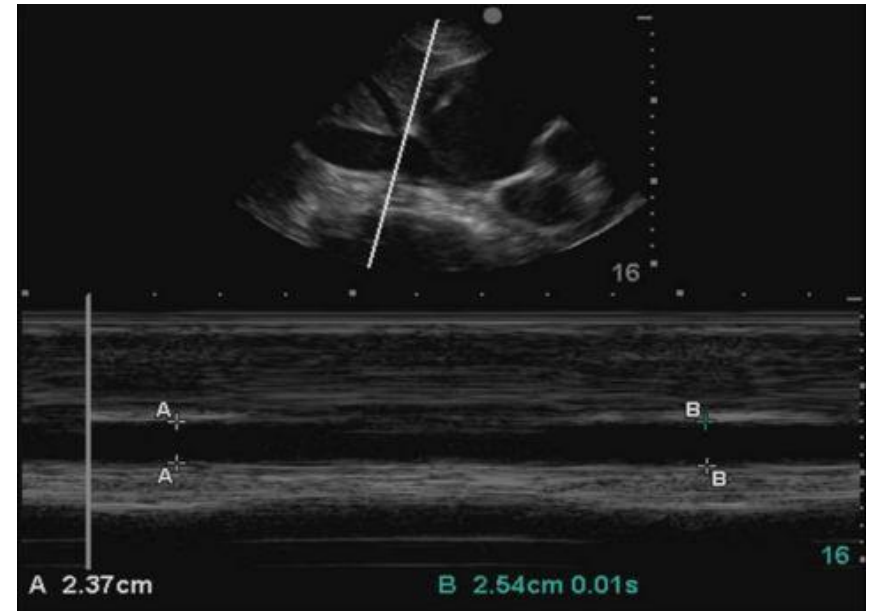
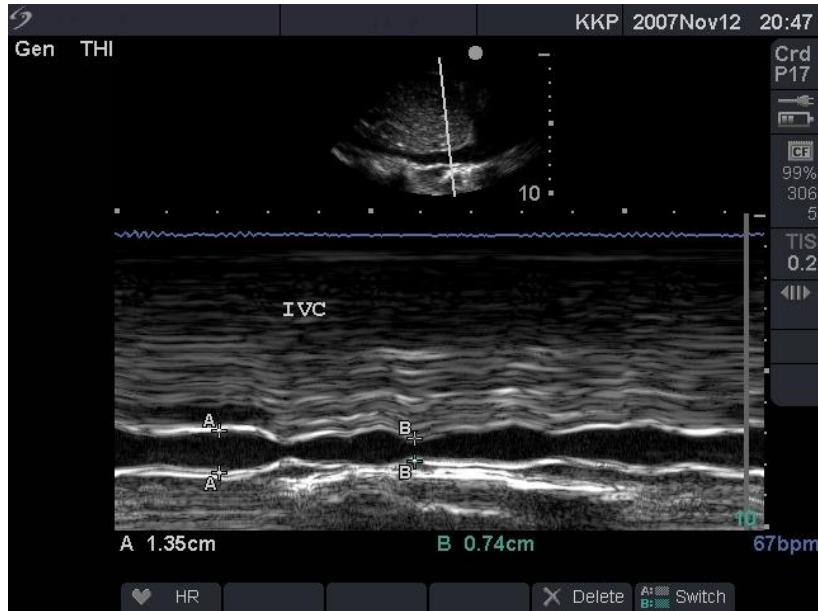


## ULTRASONOGRAPHY

1. Pulmonary artery wedge pressure increase
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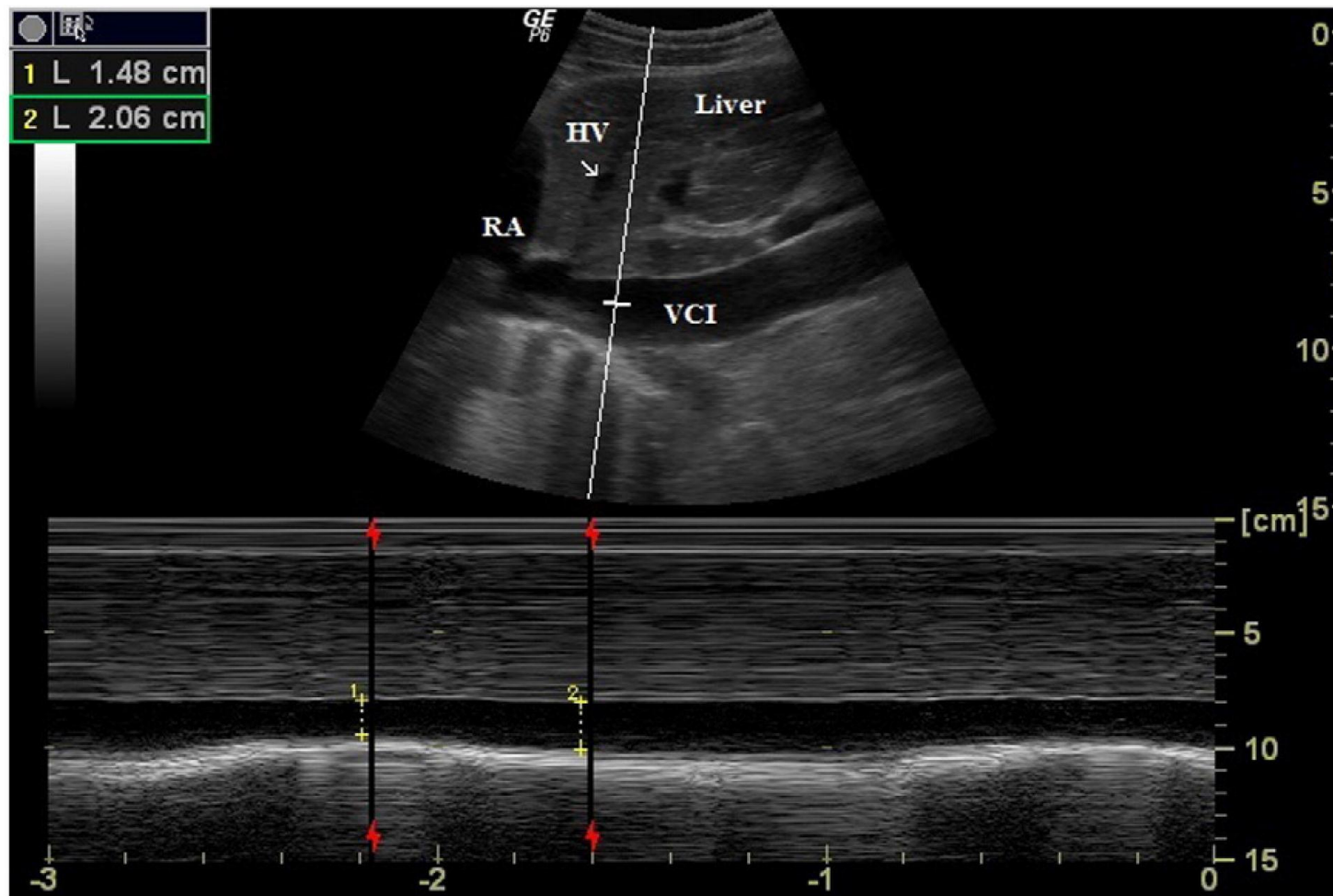
# IVC diameter and collapsibility



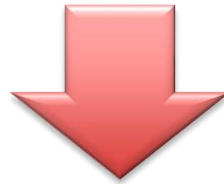
IVC size (cm)	Collapsing rate (%)	RAP (right atrium pressure)
<1.5 cm	100% collapsed	0-5 mmHg
1.5-2.5cm	>50% collapsed	5-10 mmHg
1.5-2.5cm	<50% collapsed	10-15 mmHg
>2.5cm	<50% collapsed	15-20 mmHg
>2.5cm	No change	>20 mmHg

IVC – inferior vena cava; RAP – right atrium pressure.

# IVC diameter and collapsibility Limits



# RECOGNIZE CONGESTION



## BIOMARKERS ?

# BIOMARKERS AND CONGESTION

Biomarkers of heart failure.

Myocardial insult	Neurohormonal activation	Remodeling
<b>Myocyte stretch</b> <ul style="list-style-type: none"><li>• NT-proBNP, BNP, MR-proANP</li></ul>	<b>Renin angiotensin system</b> <ul style="list-style-type: none"><li>• Renin, angiotensin II, aldosterone</li></ul>	<b>Inflammation</b> <ul style="list-style-type: none"><li>• C-reactive protein, tumor necrosis factor <math>\alpha</math>, Fas, interleukins, osteoprotegerin, adiponectin</li></ul>
<b>Myocardial Injury</b> <ul style="list-style-type: none"><li>• Troponin T, troponin I</li></ul>	<b>Sympathetic nervous system</b> <ul style="list-style-type: none"><li>• Norepinephrine, Chromogranin A</li></ul>	<b>Hypertrophy/Fibrosis</b> <ul style="list-style-type: none"><li>• Matrix metalloproteinases, collagen propeptides, galectin 3, soluble ST2</li></ul>
<b>Oxidative stress</b> <ul style="list-style-type: none"><li>• Myeloperoxidase, oxidized low-density lipoproteins, MR-proADM</li></ul>	<b>Arginine vasopressin system</b> <ul style="list-style-type: none"><li>• Arginine vasopressin</li></ul>	<b>Apoptosis</b> <ul style="list-style-type: none"><li>• GDF-15</li></ul>

BNP = B-type natriuretic peptide, GDF-15 = growth differentiation factor-15, MR-proADM = mid-regional pro adrenomedullin, MR-proANP = mid-regional pro atrial natriuretic peptide, NT-proBNP = N-terminal pro B-type natriuretic peptide.

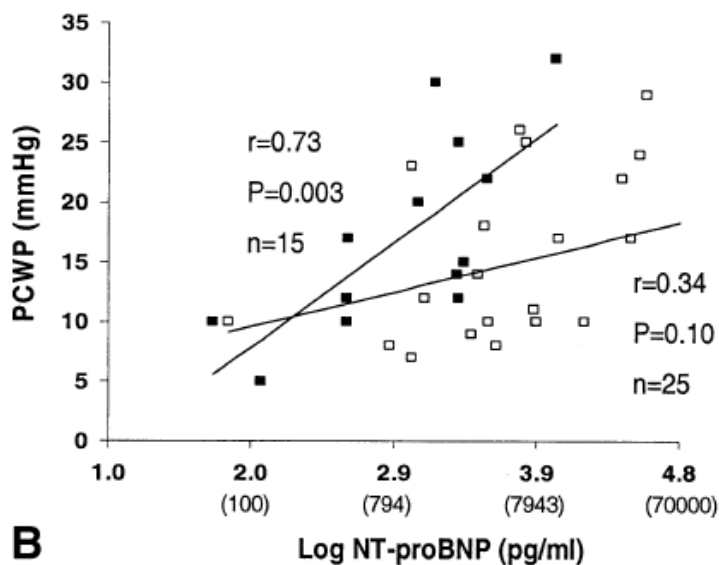
Gaggin HK Biochimica Biophysica Acta 2013



#heartfailure2015

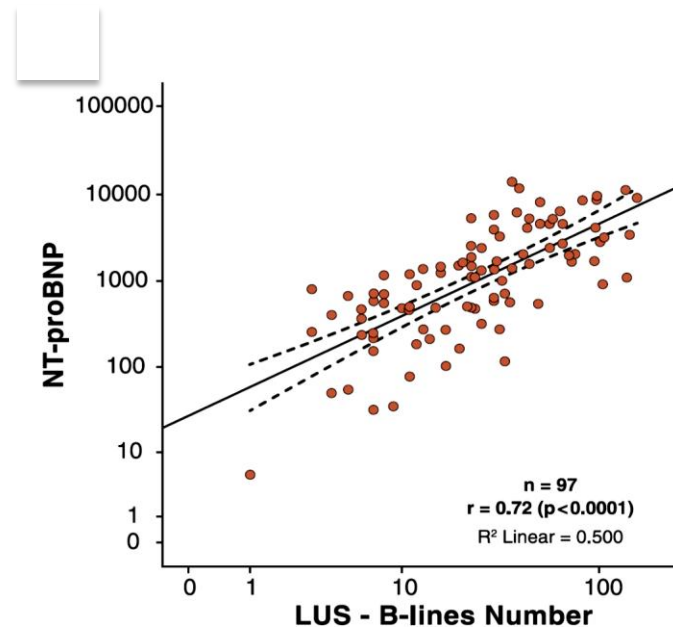
[www.escardio.org/HFA](http://www.escardio.org/HFA)

# BIOMARKERS AND CONGESTION



**B**

Forfia PR J Am Coll Card 2005



Miglioranza MH J Am Coll Cardiol Imag 2013



# BIOMARKERS AND CONGESTION

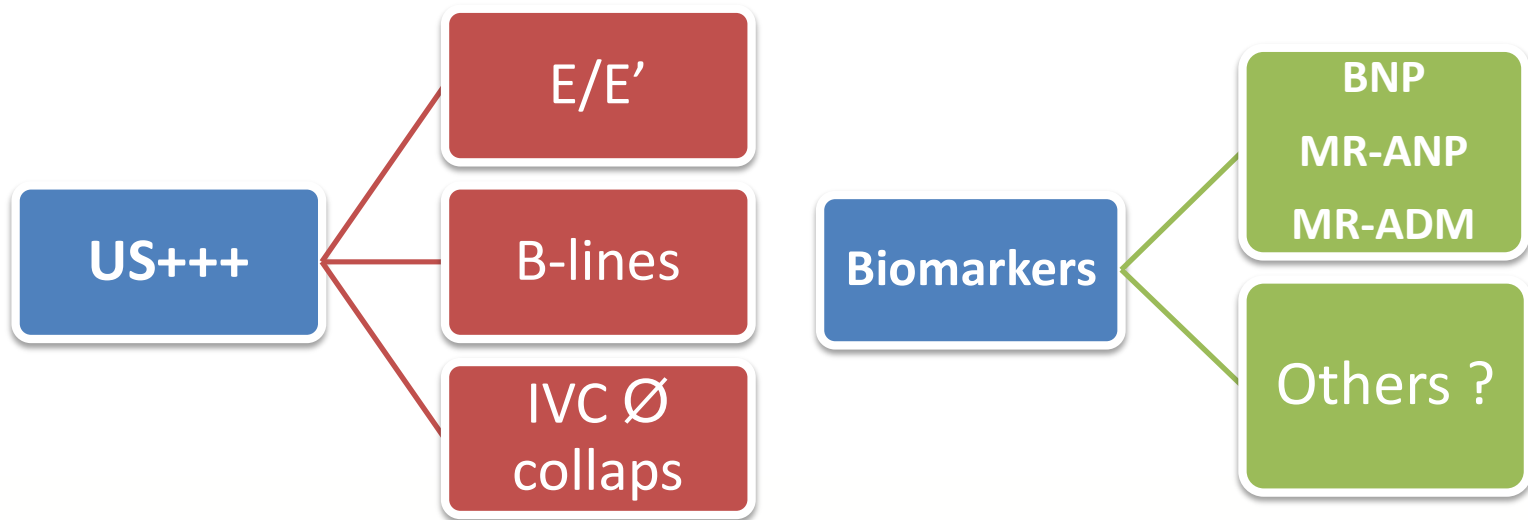
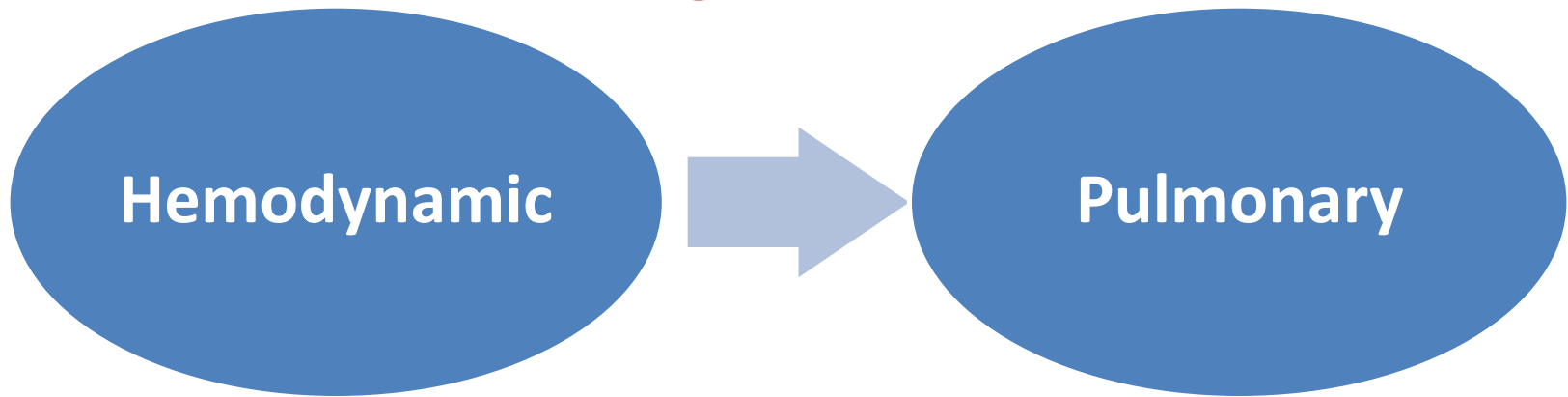
- ❑ **Mid-region pro-atrial natriuretic peptide (MR-proANP)**
- ❑ **Mid-regional adrenomedullin (MR-proADM)**



**as BNP are elevated in fluid overloaded patients who have elevated filling pressures**

# CONCLUSION

## Congestion





**Thank you**

**Greetings  
From Tunisia**

