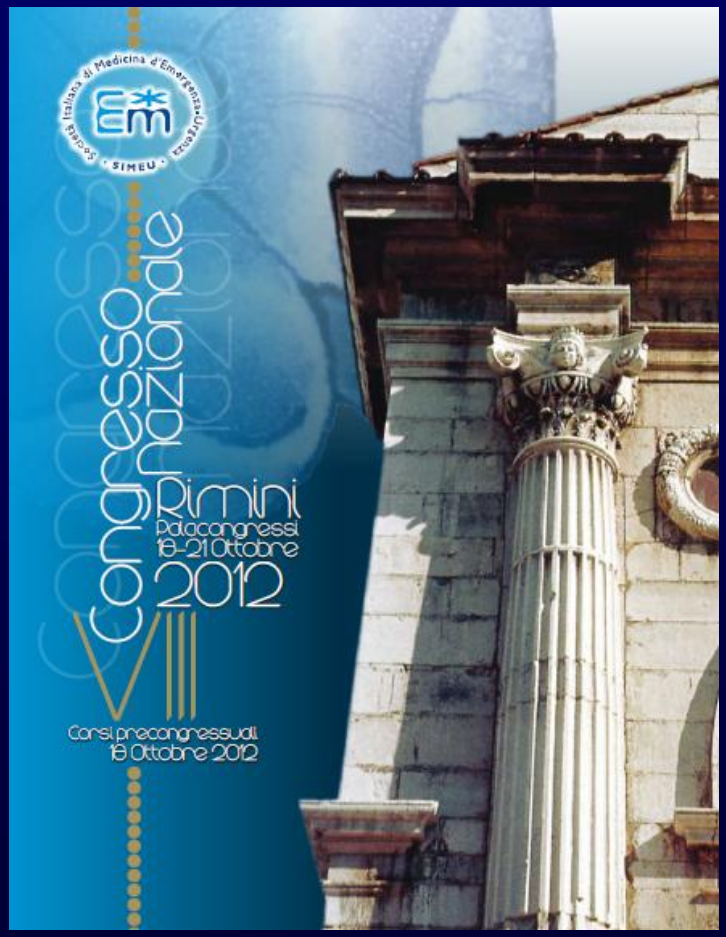


US HELP IN DIAGNOSIS AND MONITORING

ROBERTO COPETTI

DIRETTORE S.O.C.

PRONTO SOCCORSO-MEDICINA D'URGENZA

OSPEDALE DI LATISANA (UDINE)

CLINICAL EMERGENCY ULTRASOUND

LUNG : wet-dry, pnx, pneumonia, pleural effusion, ALI/ARDS, contusion, atelectasis, pulmonary embolism

HEART: systolic function, diastolic function, valvular disorders, pericardium, aorta

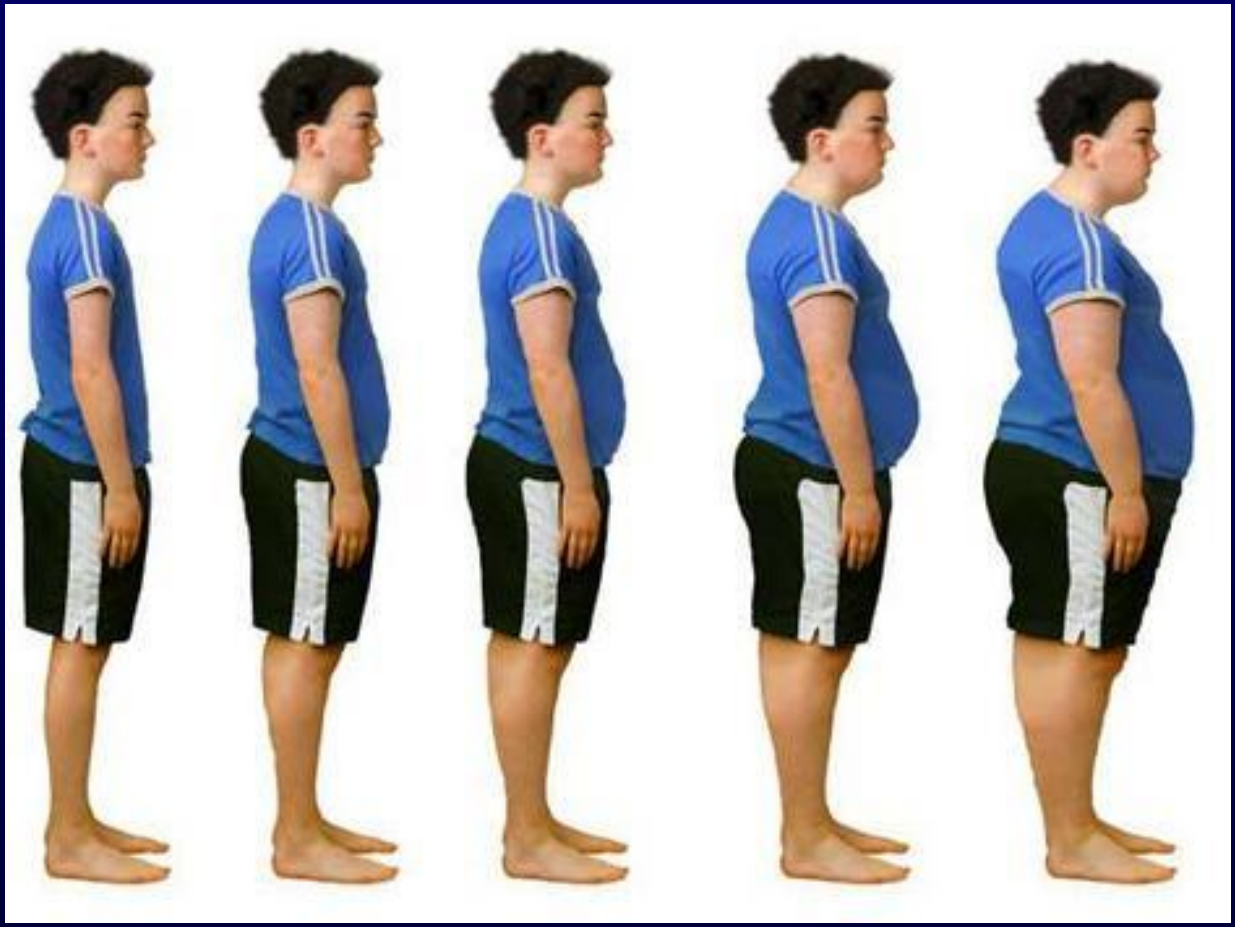
INFERIOR VENA CAVA: evaluation of volume status

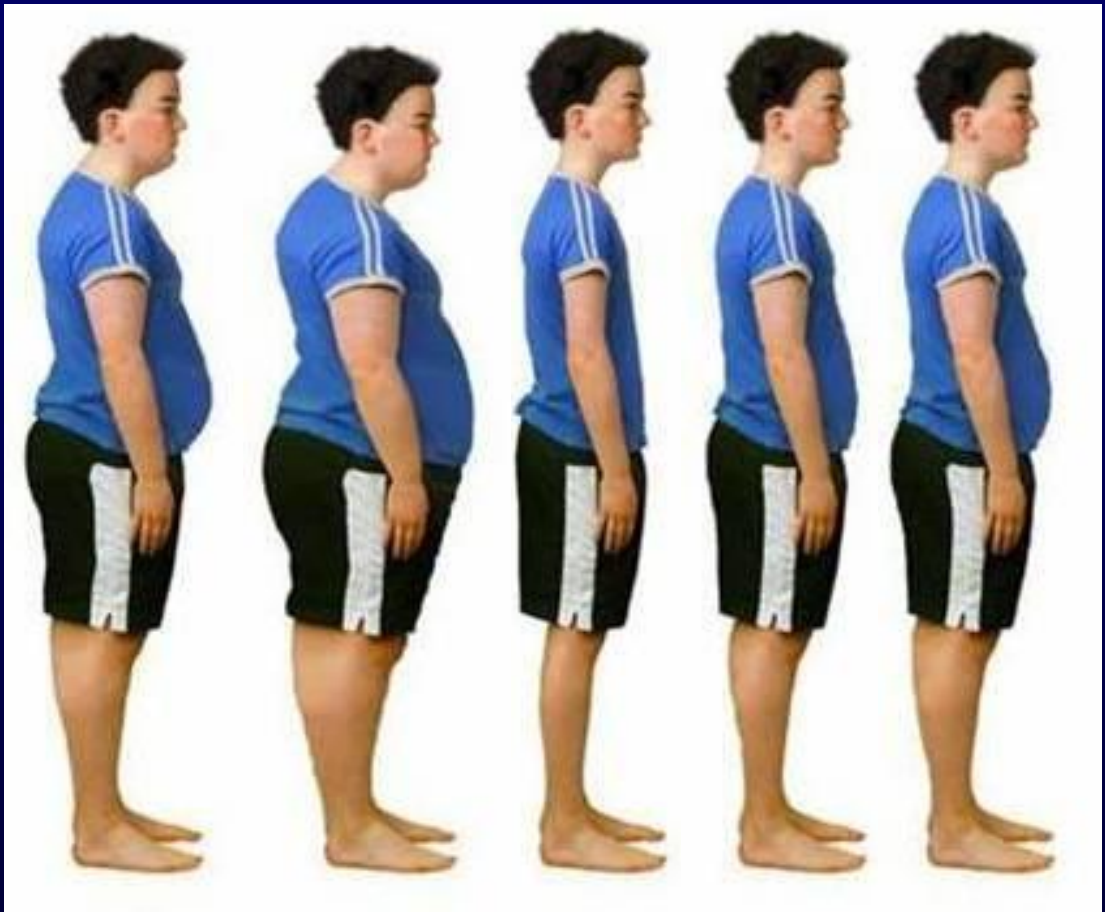
ABDOMEN: free fluid, AAA, etc..

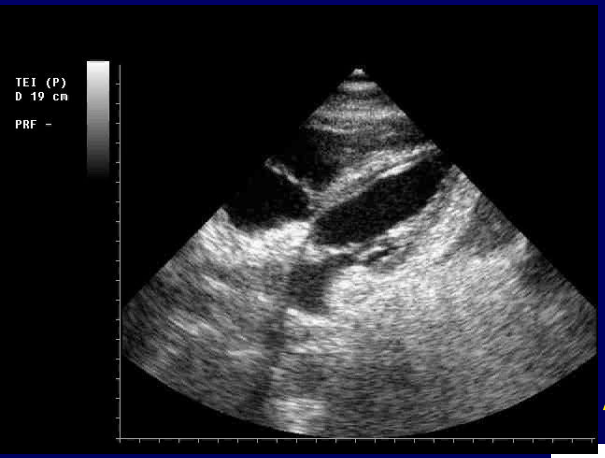
LEGS: DVT

FLUID AND DRUG THERAPHY MANAGEMENT
ULTRASOUND GUIDED PROCEDURES

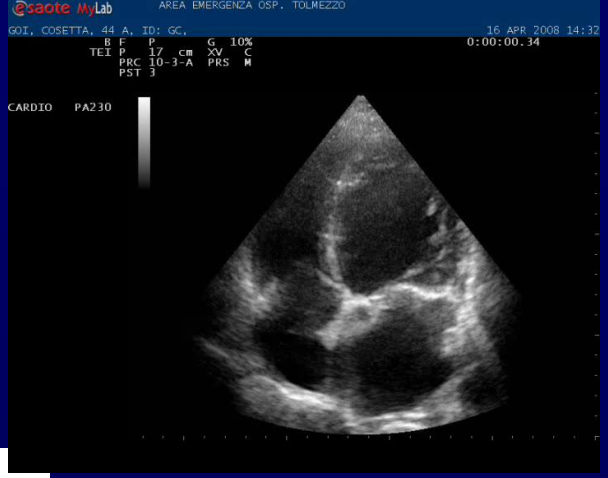
REMARKABLE DIFFERENCES FROM NORMALITY





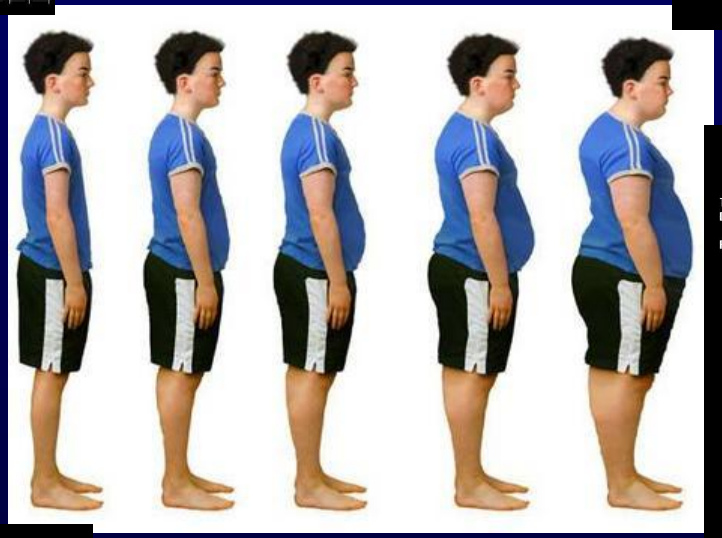

TEI (P)
D 19 cm
PRF -

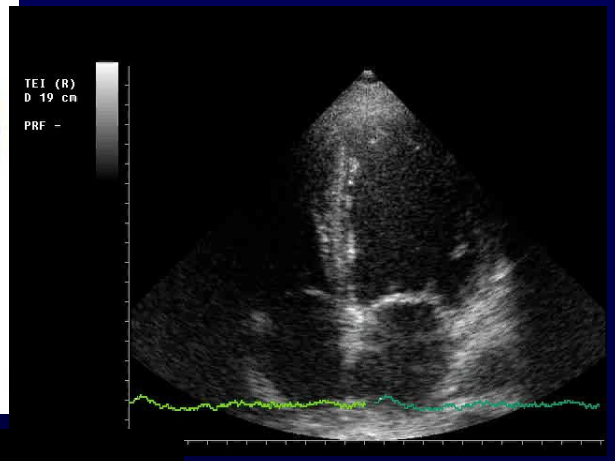
1


esaote MyLab
AREA EMERGENZA OSP. TOLMEZZO
GOI, COSETTA, 44 A, ID: GC,
16 APR 2008 14:32
0:00:00.34
CARDIO PA230

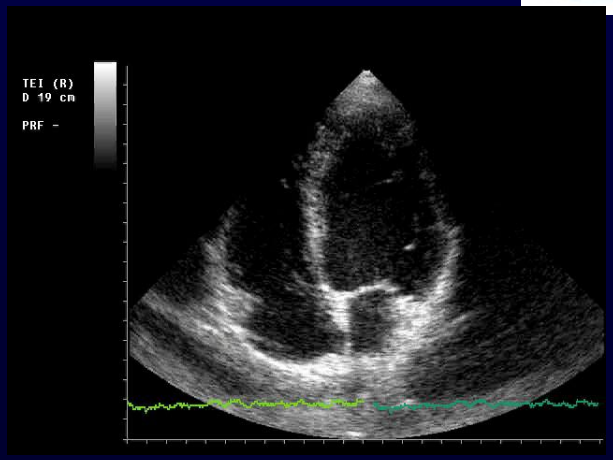
2

A B C D E

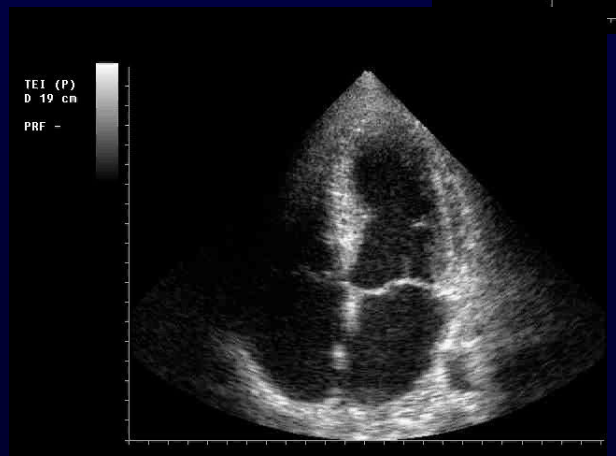



TEI (R)
D 19 cm
PRF -

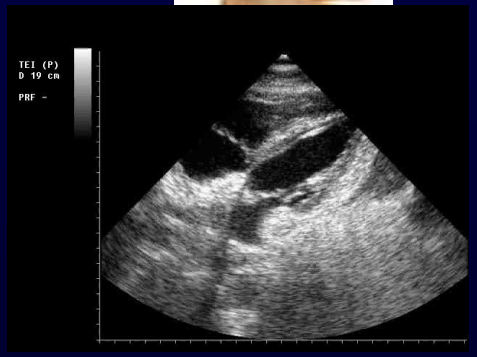
3

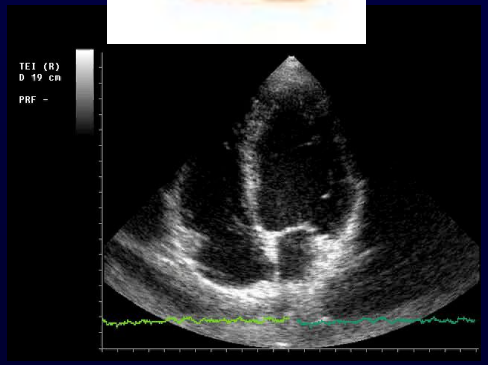

TEI (R)
D 19 cm
PRF -

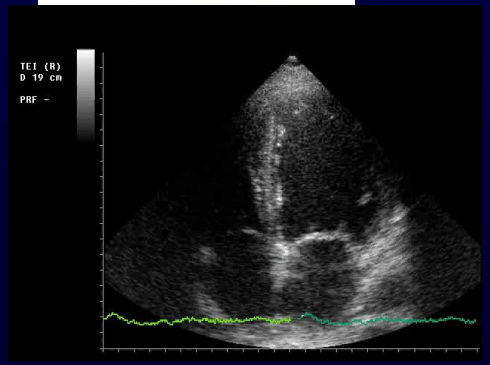
5


TEI (P)
D 19 cm
PRF -

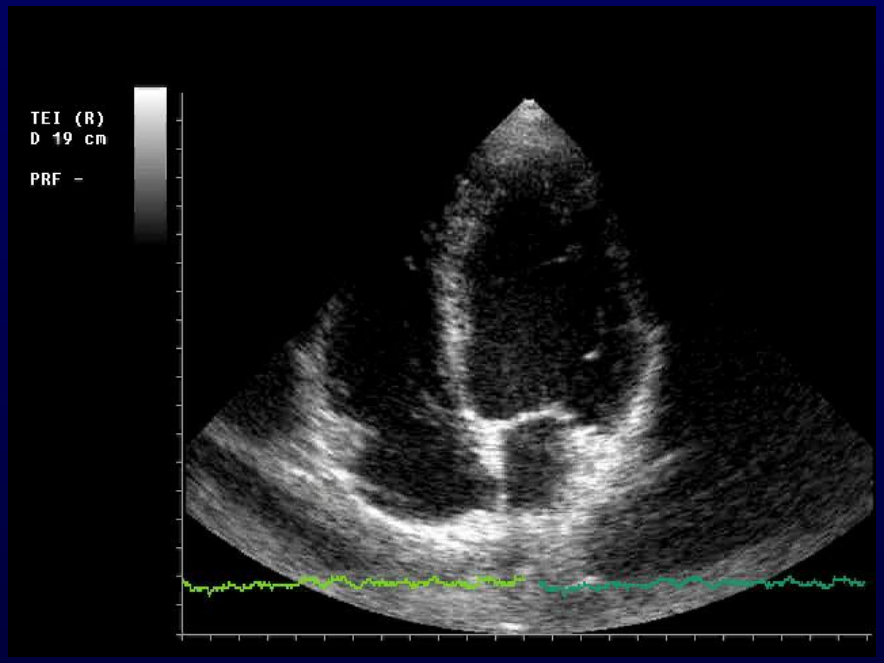
4


TEI (P)
D 19 cm
PRF -


TEI (R)
D 19 cm
PRF -

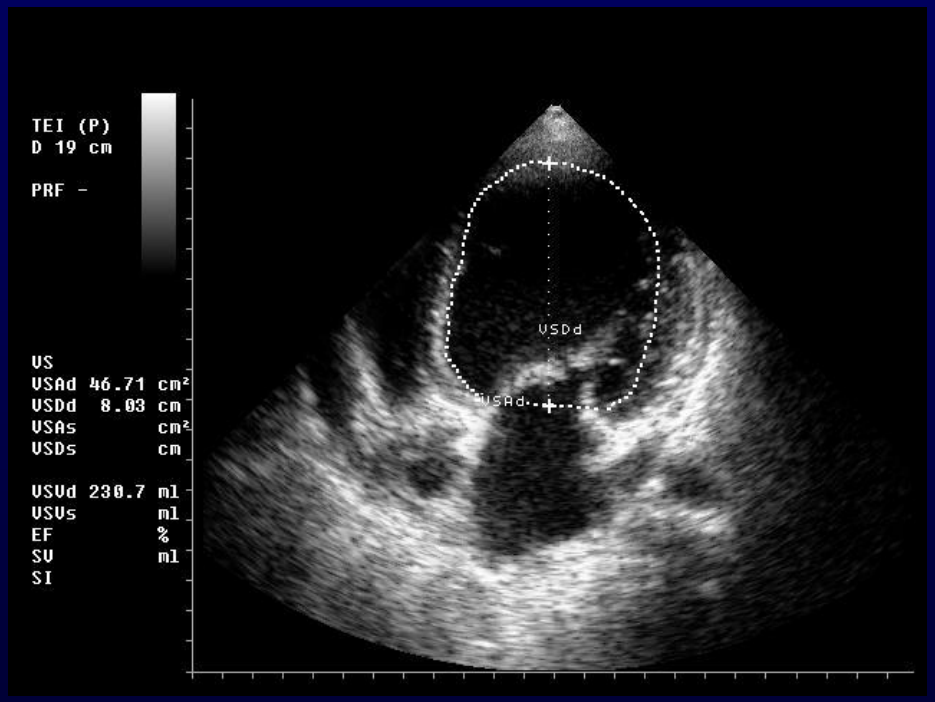

TEI (R)
D 19 cm
PRF -

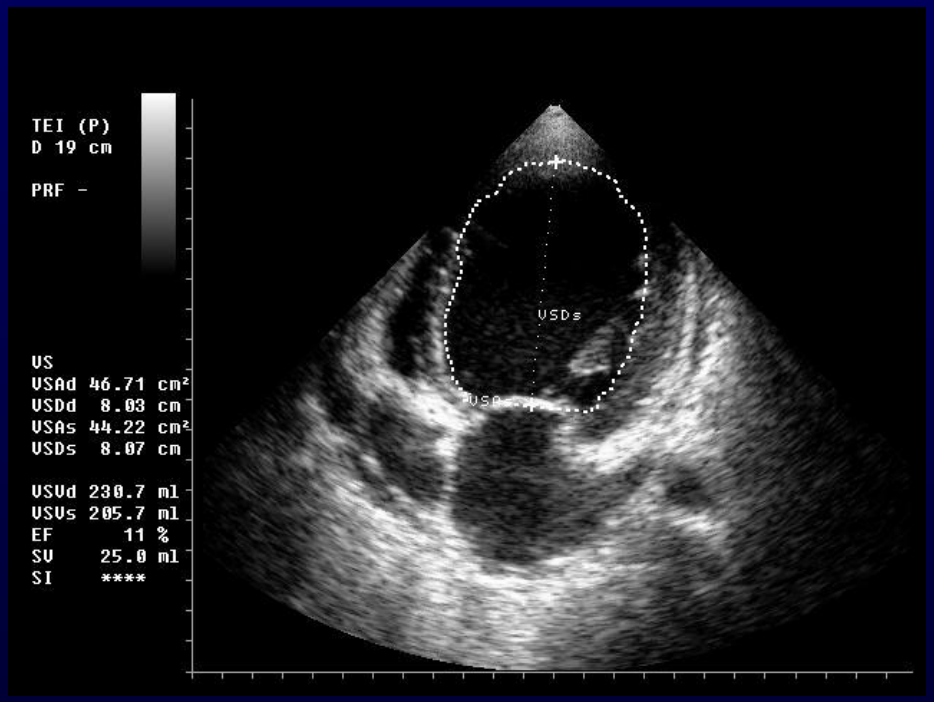
?


TEI (R)
D 19 cm
PRF -


TEI (P)
D 17 cm
PRF -

EJECTION FRACTION





“EYEBALL”

Deep Impact of Ultrasound in the Intensive Care Unit: The "ICU-sound" Protocol.

Manno E. et al. Anesthesiology. 2012 Oct;117(4):801-9.

Ultrasonography confirmed the admitting diagnosis in 58.4% of patients and modified it in 25.6%

Evaluation of Transesophageal Echocardiography as a Diagnostic and Therapeutic Aid in a Critical Care Setting*

Jan I. Poelaert, MD, FCCP; Jan Trouerbach, MD; Marc De Buyzere, BSc; Jan Everaert, RN; and Francis A. Colardyn, MD

(Chest 1995; 107:774-79)

Objectives: To assess the impact of transesophageal echocardiography (TEE) on therapeutic management in relation to pulmonary artery catheterization (PAC) in the ICU.

Design: Retrospective analysis of 108 consecutive TEE video and related patient files during a 7-month period.

Setting: A 33-bed medical and surgical ICU.

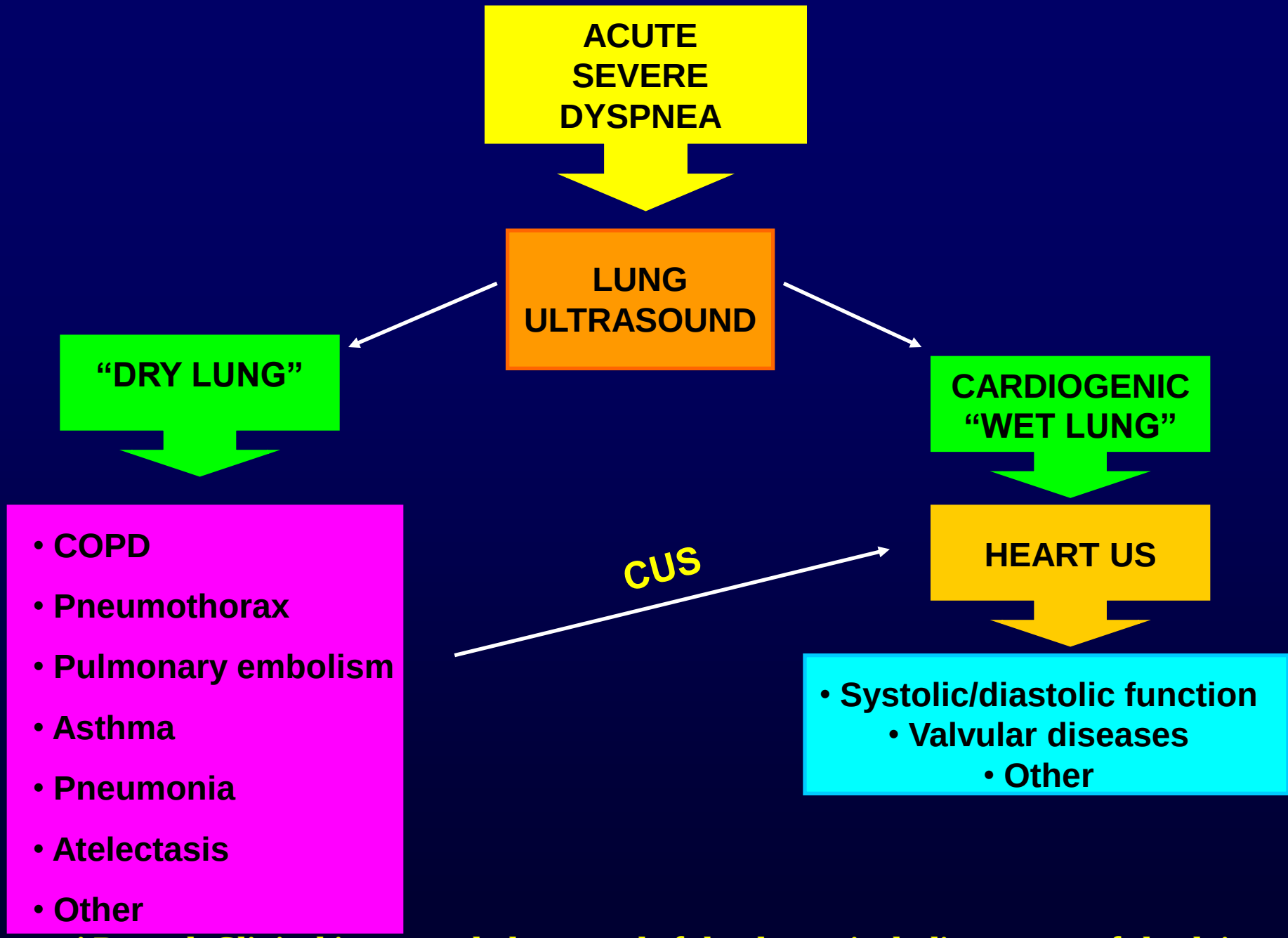
Methods: All critically ill patients with or without PAC in whom a TEE was performed, excluding postoperative cardiac surgical patients. Patients were divided in a cardiac and a septic group depending on the primary disease on admission to the ICU. The impact of TEE in relation to PAC on ICU management was evaluated in whether therapy changes were performed strictly on the basis of the TEE findings.

Main results: Of 64% of patients with a PAC, 44% underwent therapy changes after TEE: 41% in the cardiac and 54% in the septic subgroup. In 41% of patients without a PAC, TEE led to a change in therapy.

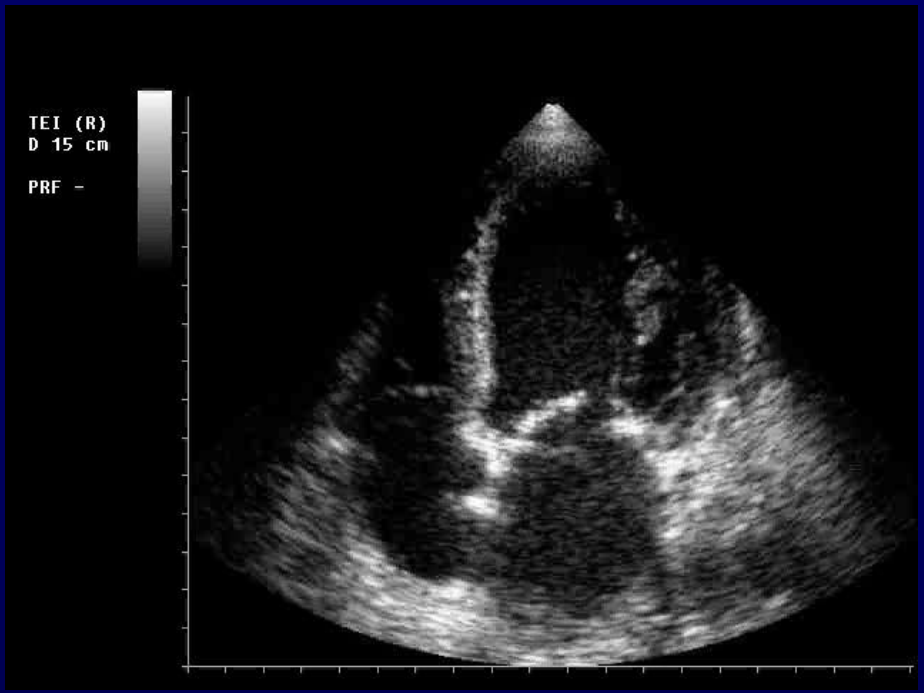
Conclusions: TEE results in altered therapeutic management in at least one third of our (noncardiac surgery) ICU patient population independent of the presence of a PAC. *(Chest 1995; 107:774-79)*

PAC=pulmonary artery catheter(ization); TEE=transesophageal echocardiography; TTE=transthoracic echocardiography

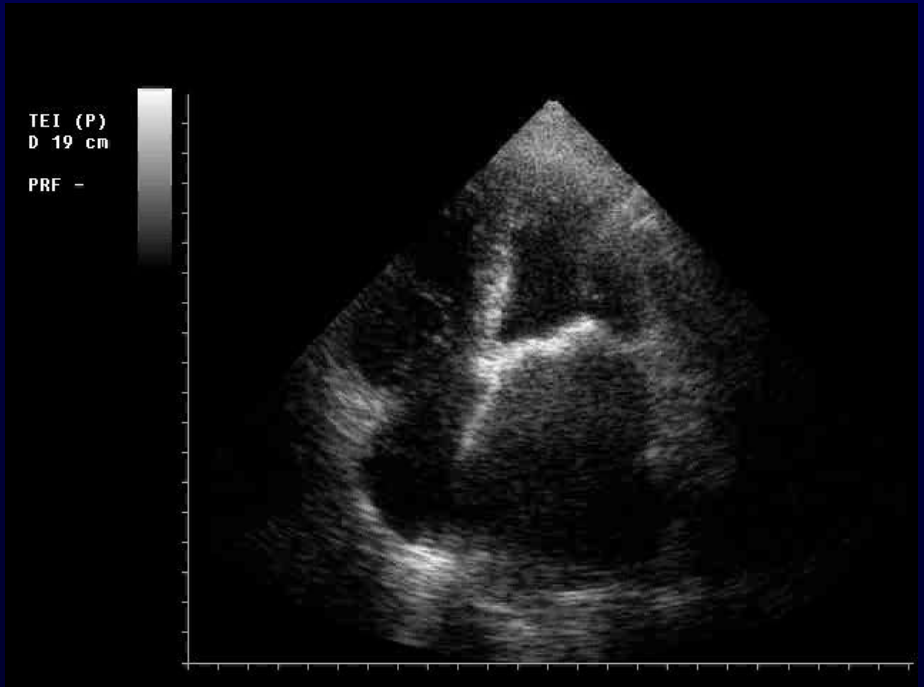
Key words: cardiac failure; echocardiography; ICU management; pulmonary artery catheter; sepsis

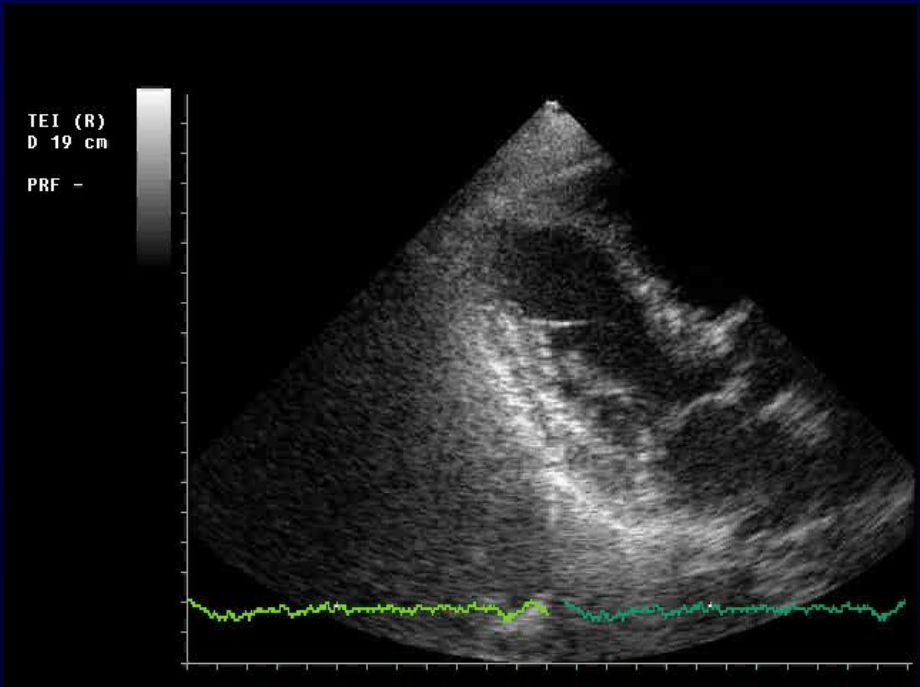


Copetti R. et al. Clinical integrated ultrasound of the thorax including causes of shock in nontraumatic critically ill patients. A practical approach. UMB 2012 Mar;38(3):349-59


TEI (R)
D 15 cm
PRF -


TEI (P)
D 17 cm
PRF -


TEI (P)
D 19 cm
PRF -


TEI (R)
D 19 cm
PRF -

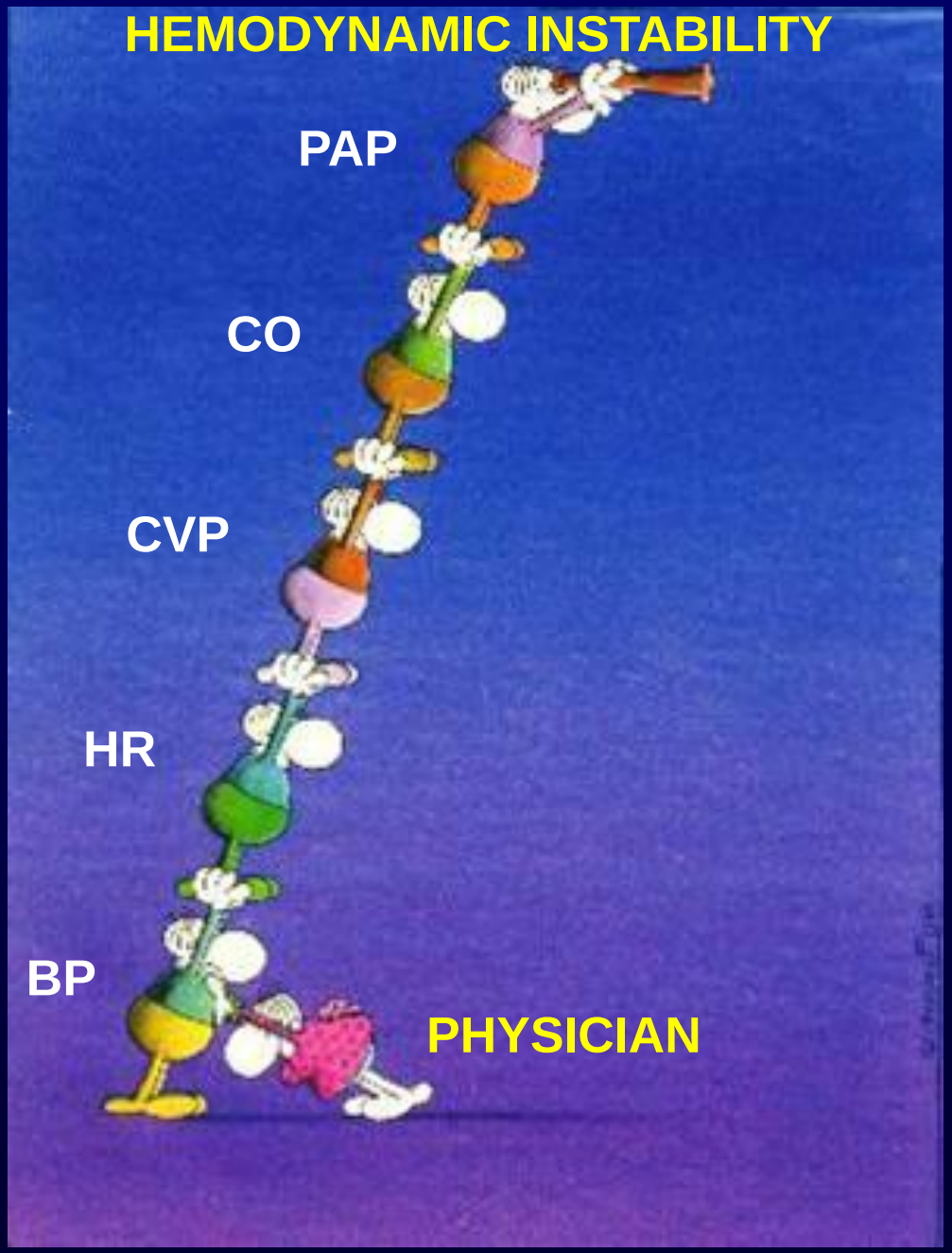
The term "hemodynamic instability" is most commonly associated with an abnormal or unstable blood pressure, especially hypotension.

~~HEMODYNAMIC INSTABILITY = HYPOTENSION~~

Hemodynamic instability will be defined as global or regional perfusion that is not adequate to support normal organ function.

Intensivists have numerous hemodynamic parameters that they monitor and can control:

- **heart rate**
- **blood pressure**
- **diuresis**
- **central venous pressure**
- **pulmonary artery pressure**
- **pulmonary artery occlusion pressure**
    - **cardiac output**


HEMODYNAMIC INSTABILITY
PAP
CO
CVP
HR
BP
PHYSICIAN

However, the two variables that most directly reflect organ perfusion are blood pressure and cardiac output.

Cardiac output and blood pressure are intimately intertwined.

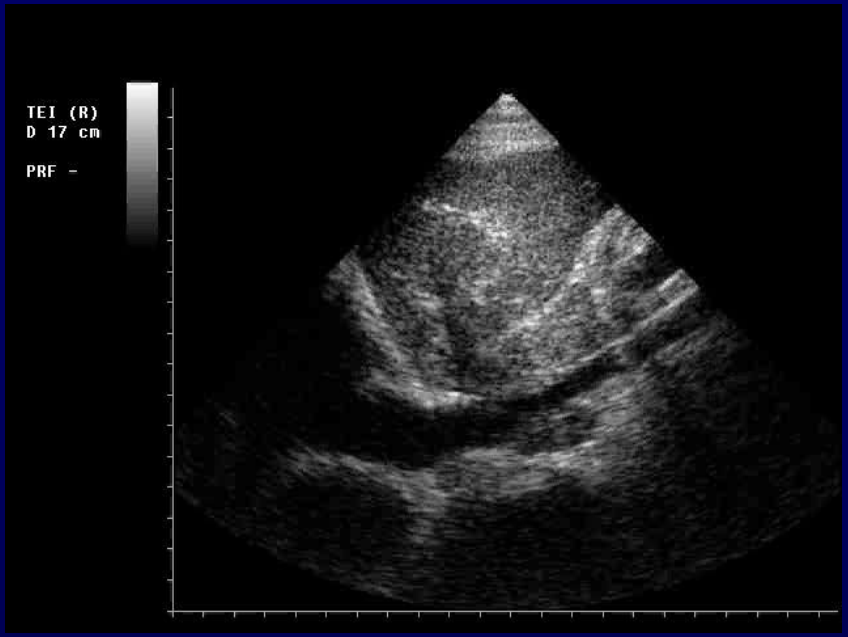
CO ⟺ BP

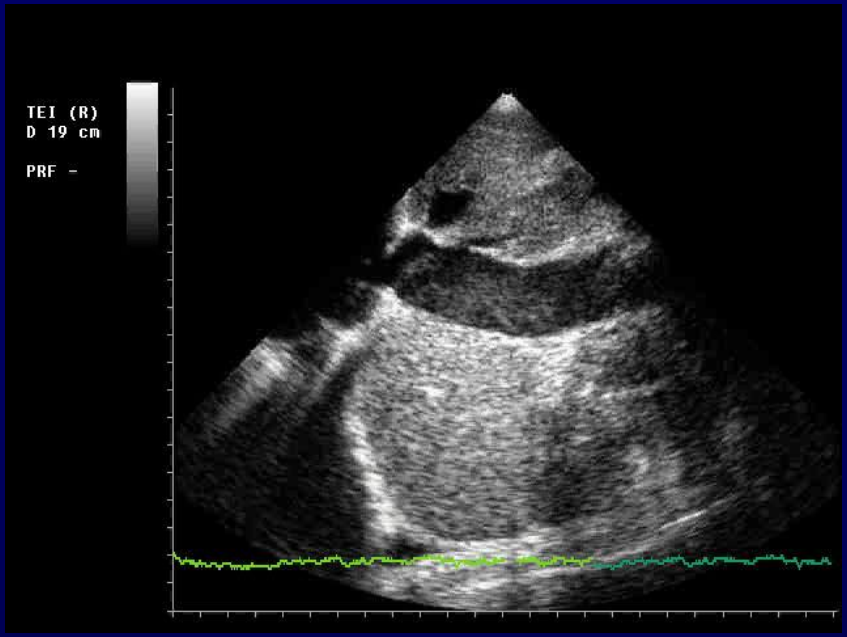
MAP = SVRxCO+CVP (volemia)

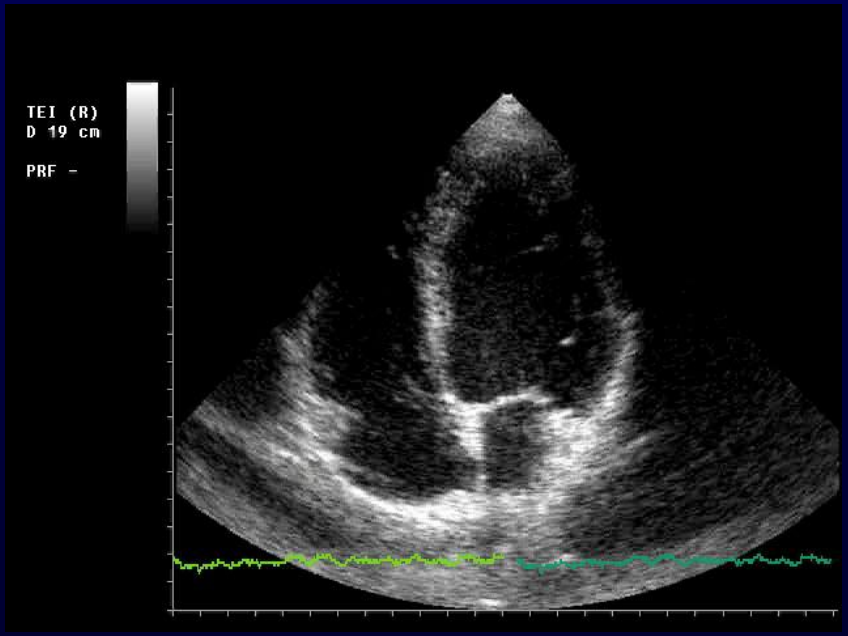
MAP = mean arterial systemic blood pressure
SVR = systemic vascular resistance
CO = cardiac output
CVP = central venous pressure/volemia

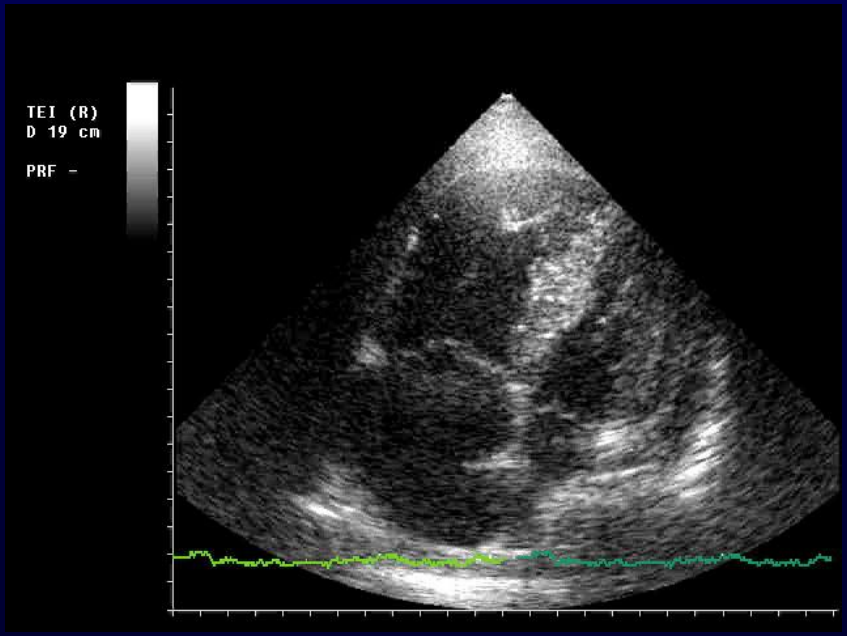
INFERIOR VENA CAVA AND CVP

DIAMETER INFERIOR VENA CAVA	% INSPIRATORY REDUCTION	RIGHT ATRIAL PRESSURE
< 1.5 cm	collapse	0 – 5 mmHg
1.5 – 2.0 cm	> 50%	5 – 10 mmHg
1.5 – 2.0 cm	33 – 50%	10 – 15 mmHg
2.0 – 2.5 cm	0 – 33%	15 – 20 mmHg
> 2.5 cm	absent	> 20 mmHg


TEI (R)
D 17 cm
PRF -


TEI (R)
D 19 cm
PRF -


TEI (R)
D 19 cm
PRF -


TEI (R)
D 19 cm
PRF -

MAP = SVRxCO+CVP (volemia)

This equation is very informative; it warns us that a normal blood pressure does not guarantee an adequate cardiac output.

Recognition of hemodynamic instability requires monitoring of both blood pressure and cardiac output.

MAP = SVRxCO+CVP (volemia)

(1) Hypotension due to vasodilation
(SEPTIC SHOCK)

(2) Hypotension due to low cardiac output
(CARDIOGENIC SHOCK)

(3) Low cardiac output with preserved blood pressure
(SEVERE CARDIAC FAILURE)

(4) Hypotension due to hypovolemia
(HYPOVOLEMIC SHOCK)

INTENSIVIST AND HEMODYNAMIC INSTABILITY

The NEW ENGLAND JOURNAL of MEDICINE

EDITORIALS

Ultrasound: the best cardiovascular “monitor” in critically ill patients

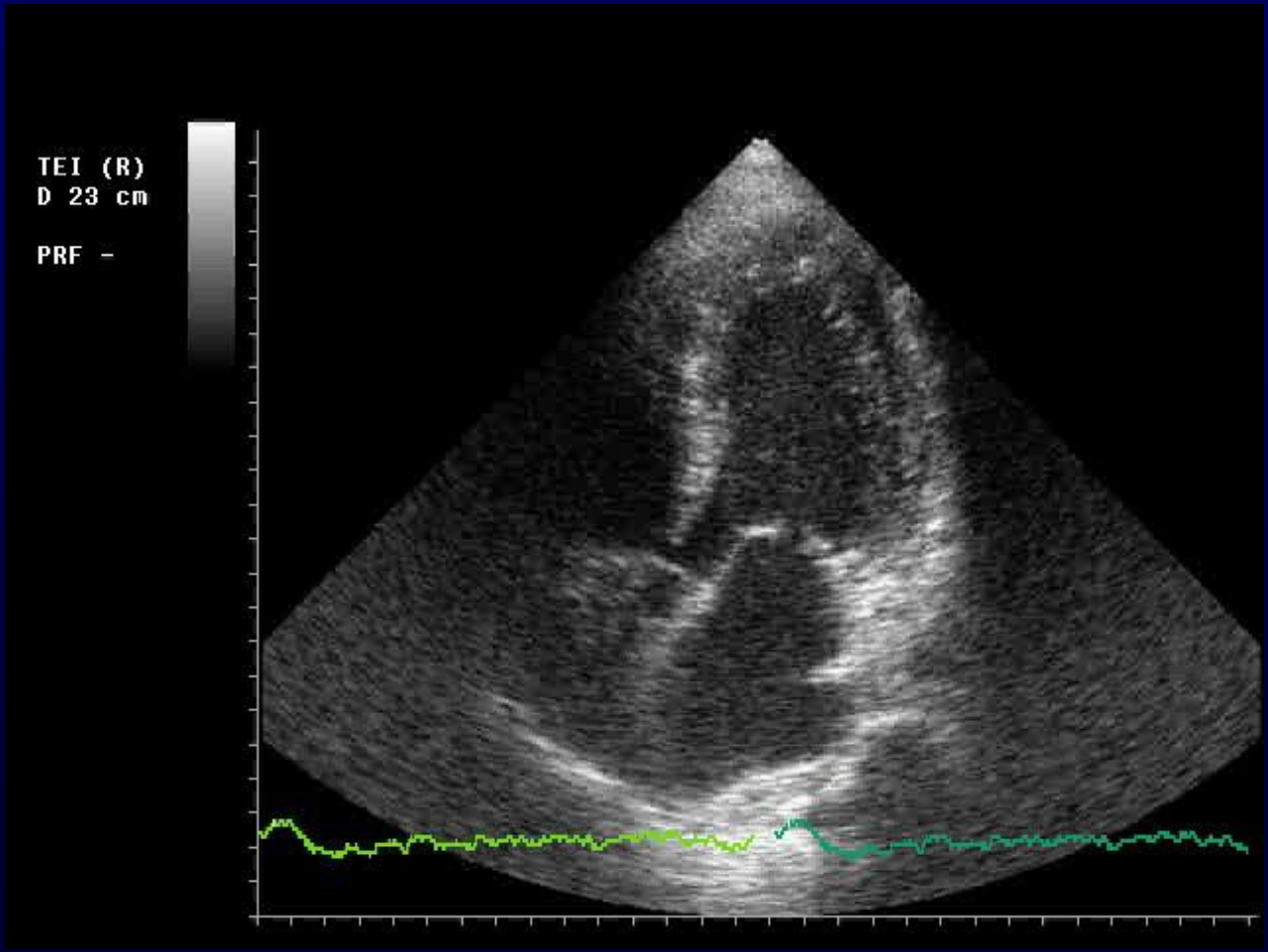
Roberto Copetti, M.D.

LATISANA GENERAL HOSPITAL – (ITALY)

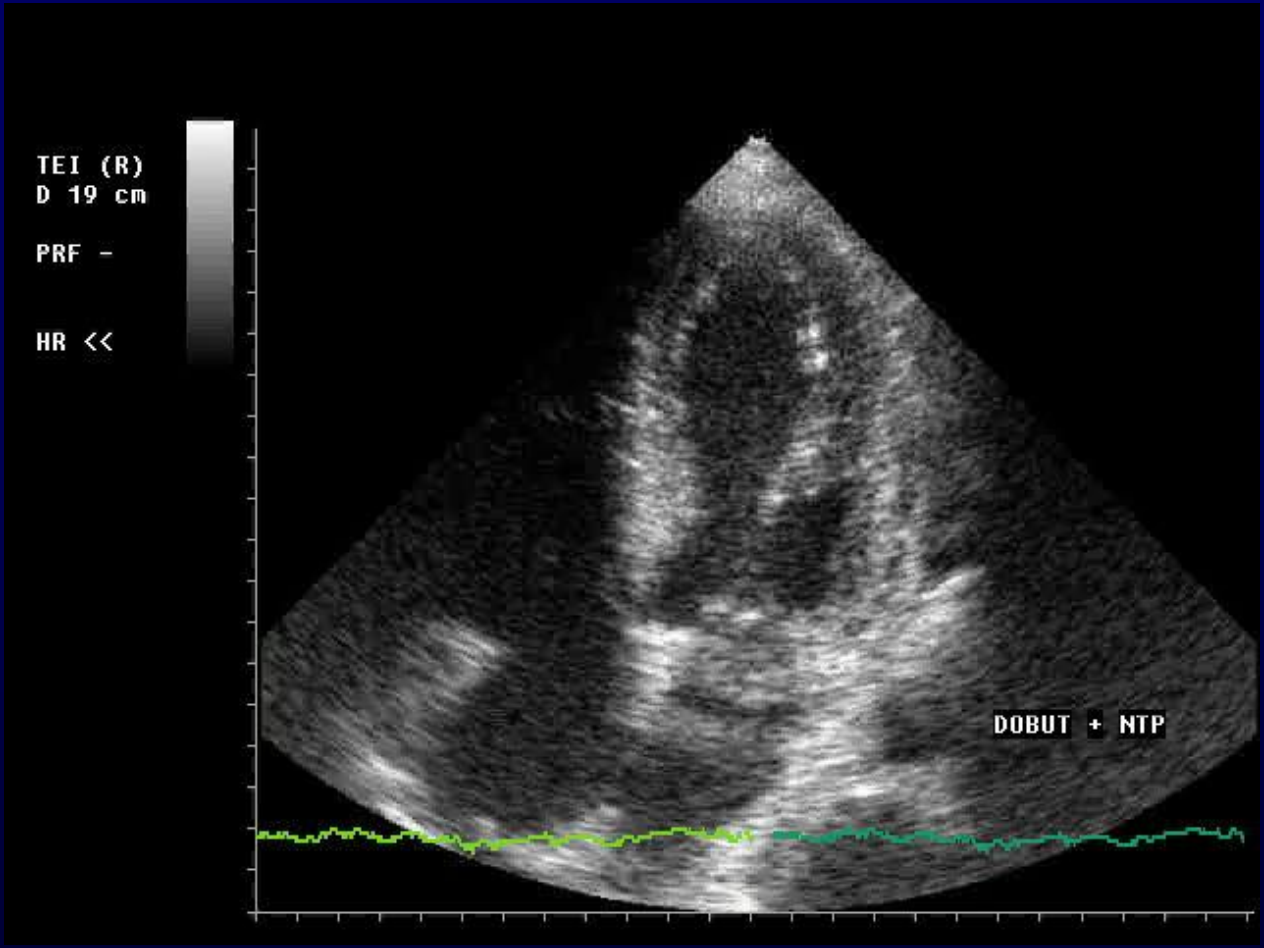
Low cardiac output with preserved blood pressure

$$MAP = SVR x CO + CVP$$

- M 36 Y
- STROKE (CT = ISCHEMIA)
- BP 250/140, HR 60/m
- Sat O_2 98% r.a.
- HYPERTENSION (ATENOLOL 100 mg)
- PSYCHIATRIC PROBLEMS - ALCOOLISM
- ECHOCARDIOGRAPHY FOR SOURCE OF EMBULUS

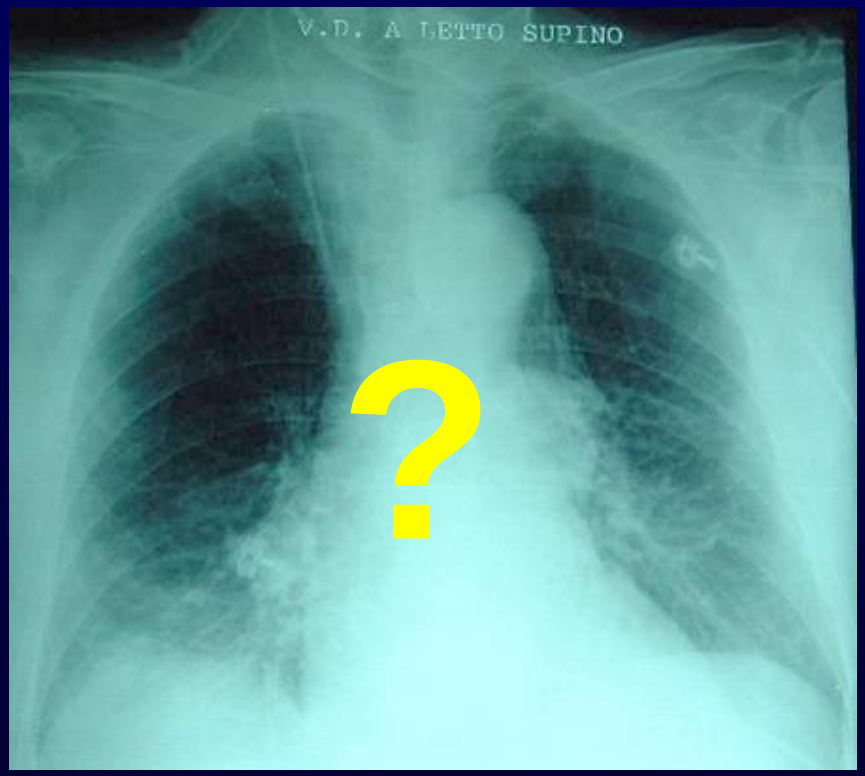


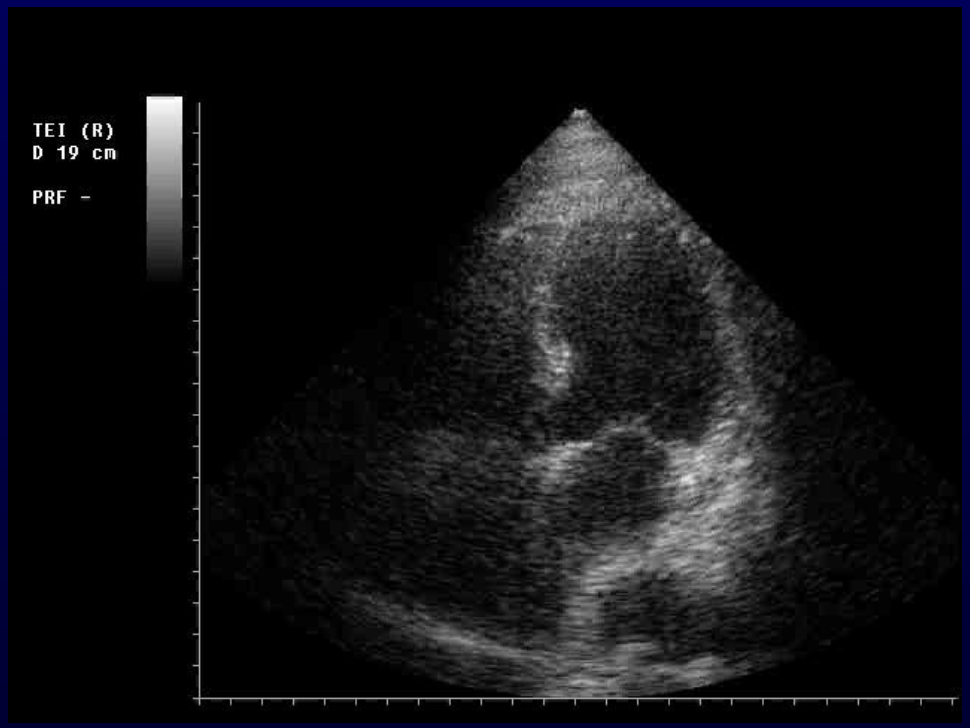
DOBUTAMINE + NTP

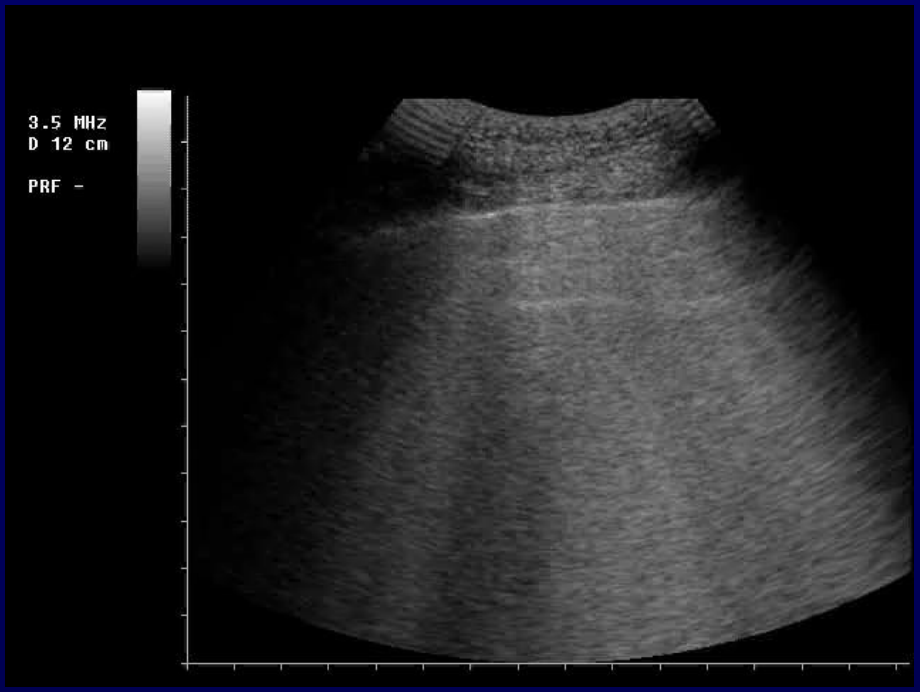


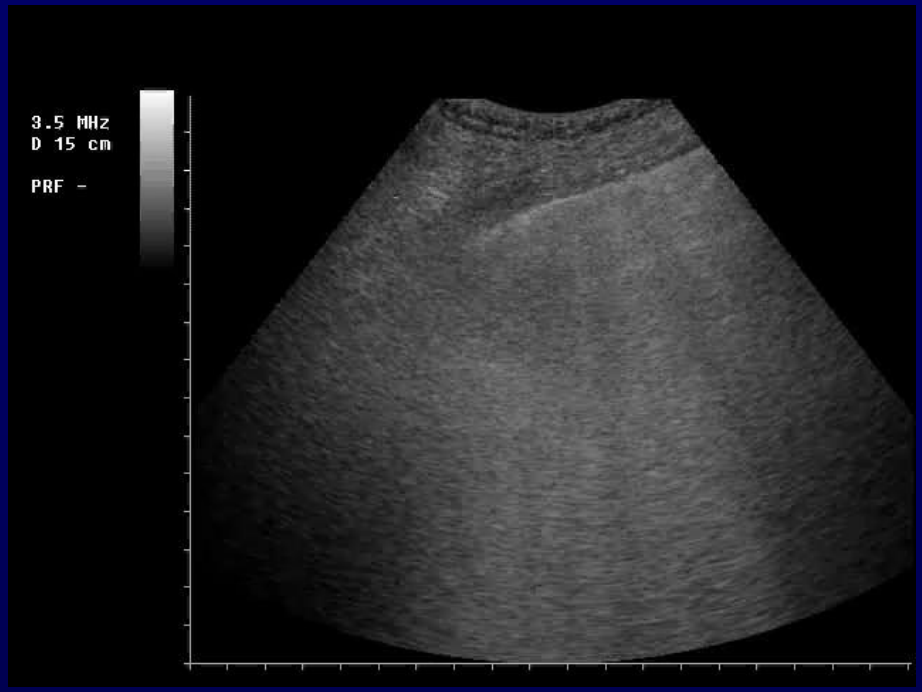
2 H AFTER BP = 160/100

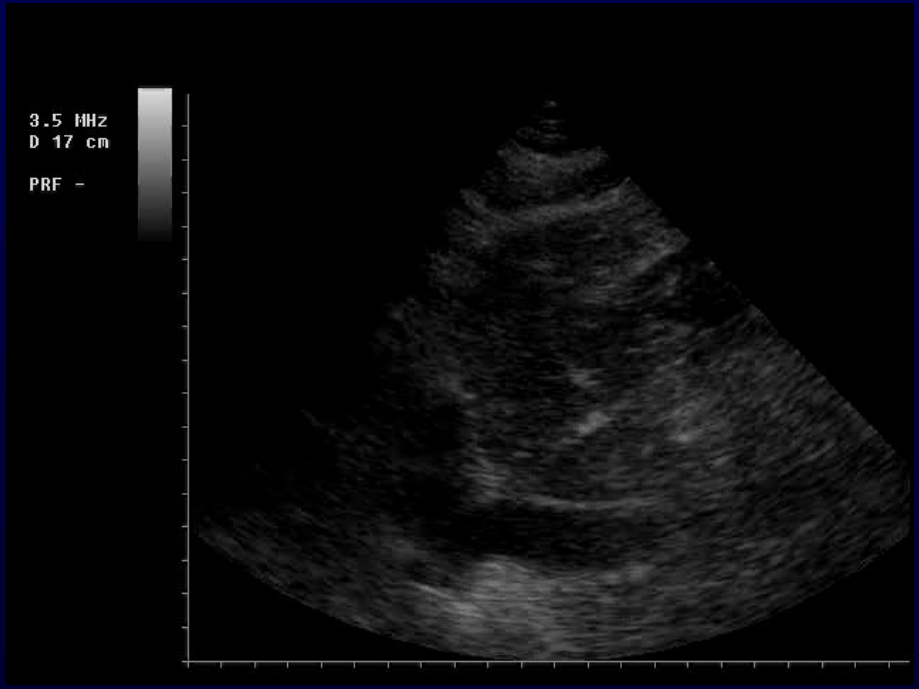
- ACUTE RESPIRATORY DISTRESS AFTER AORTIC FEMORAL BYPASS
- HYPERTENSION, CHRONIC A.F.
- RALES ON RIGHT LUNG BASE
- BP 180/115. HR 115 AF. Sat O_2 90% (FiO_2 0.4). TT 38.5°C






3.5 MHz
D 12 cm
PRF -


3.5 MHz
D 15 cm
PRF -


3.5 MHz
D 17 cm
PRF -

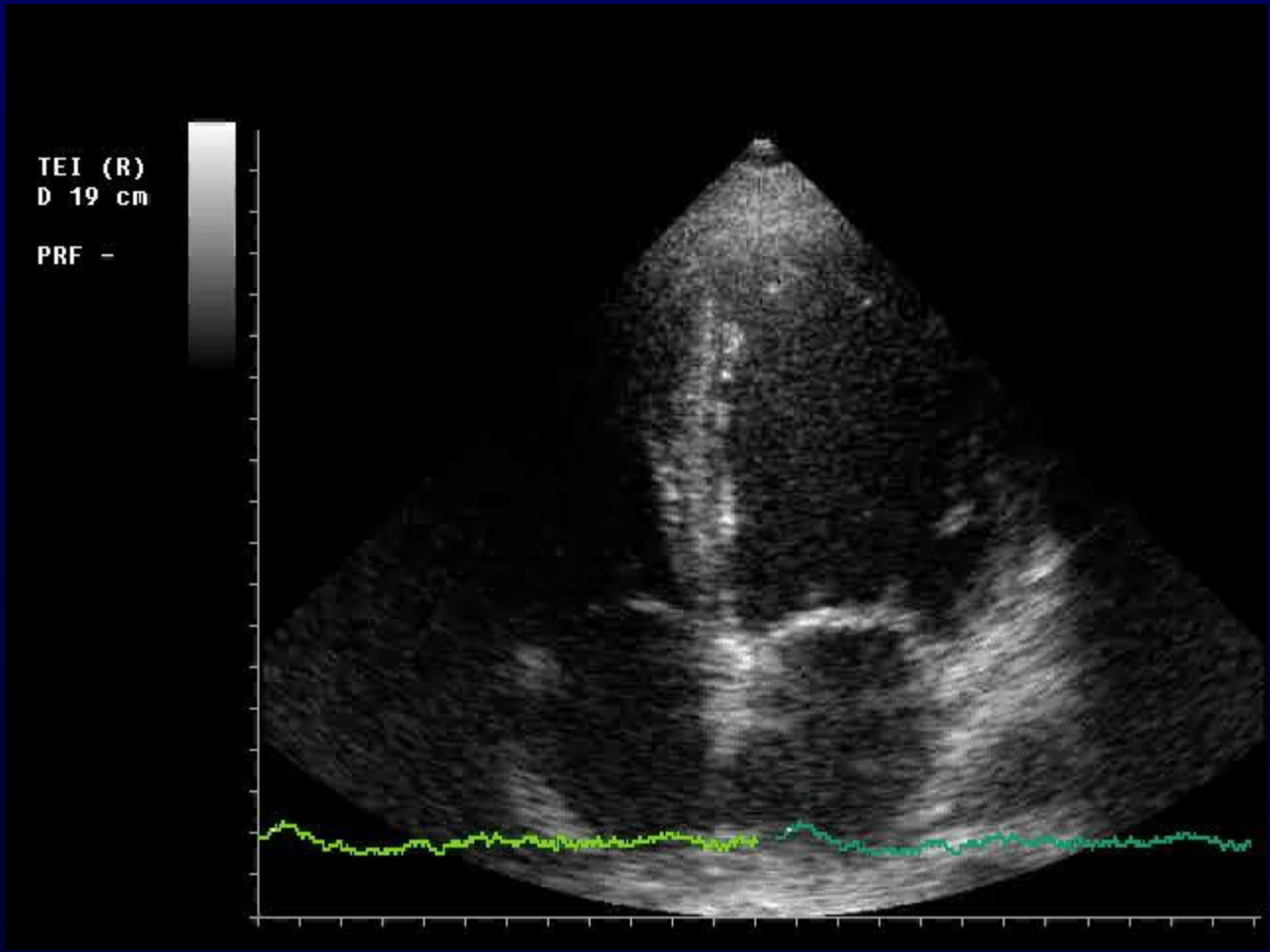
- “FLASH” PULMONARY EDEMA
- DIASTOLIC DYSFUNCTION

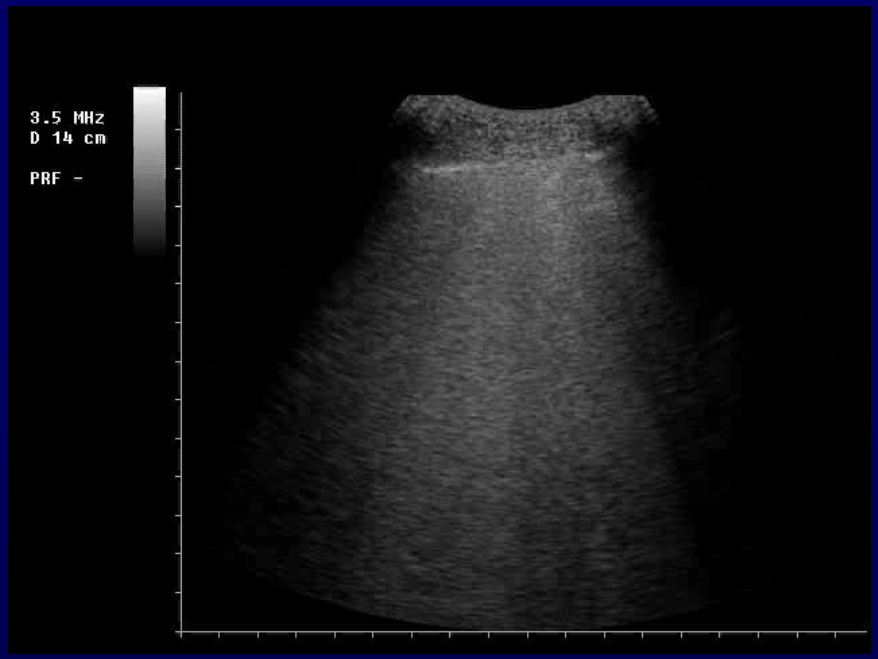
DIURETICS ?

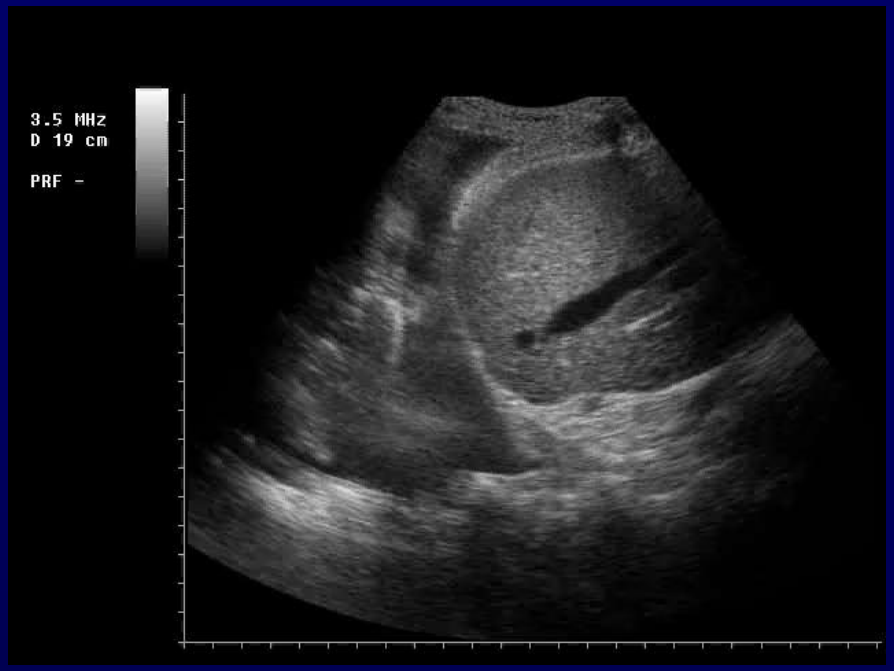
Hypotension due to low cardiac output

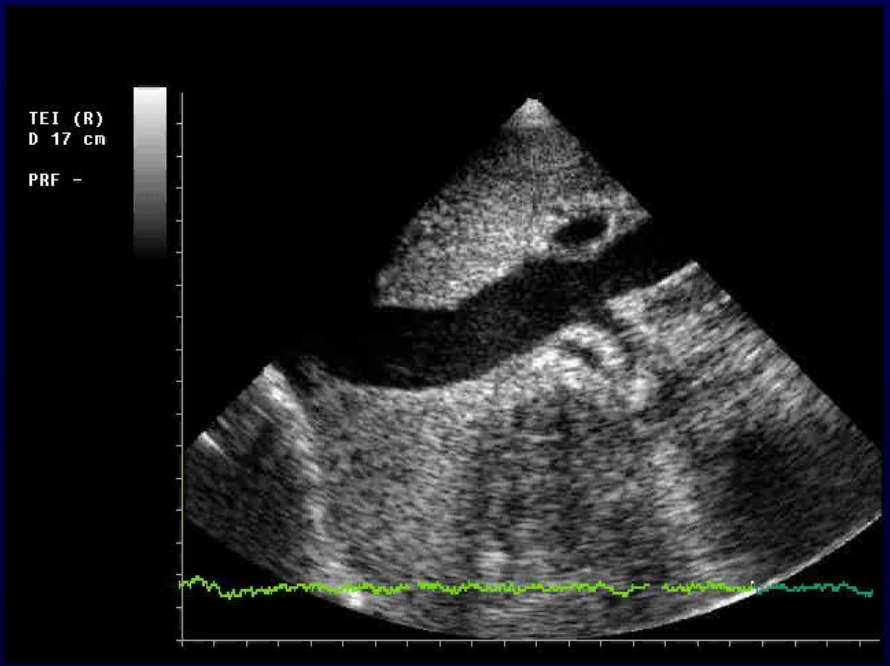
MAP = SVRxCO+CVP

- PREVIOUSLY HEALTHY M 48 y
- DYSPNEA IN THE LAST 5 DAYS
- RESPIRATORY DISTRESS
- HR 65/m, BP 90/60 mmHg, Sat O_2 87% (FiO_2 0.6)

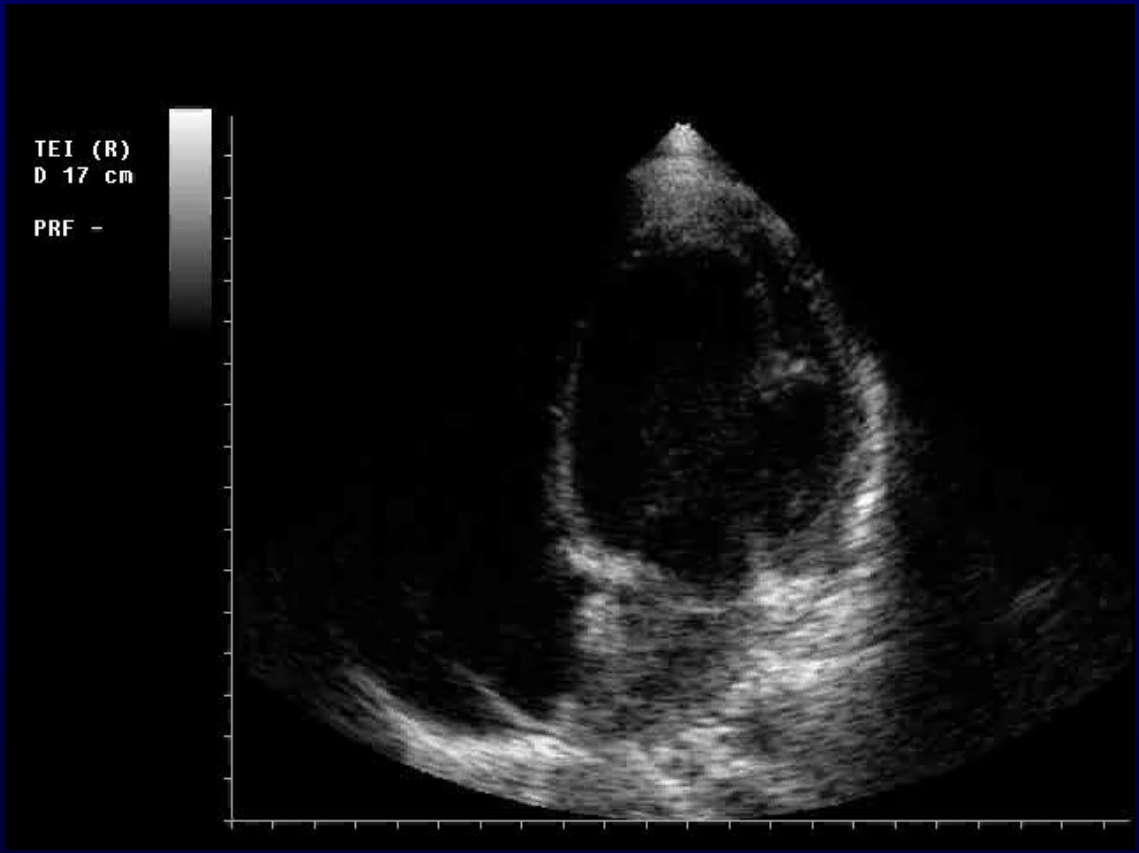



3.5 MHz
D 14 cm
PRF -


3.5 MHz
D 19 cm
PRF -

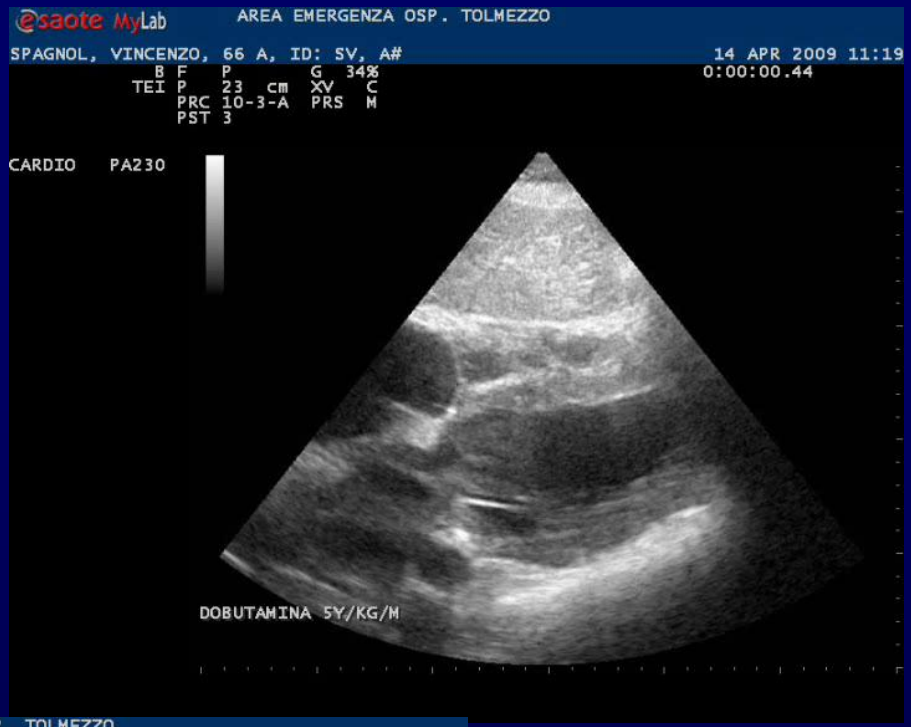

TEI (R)
D 17 cm
PRF -

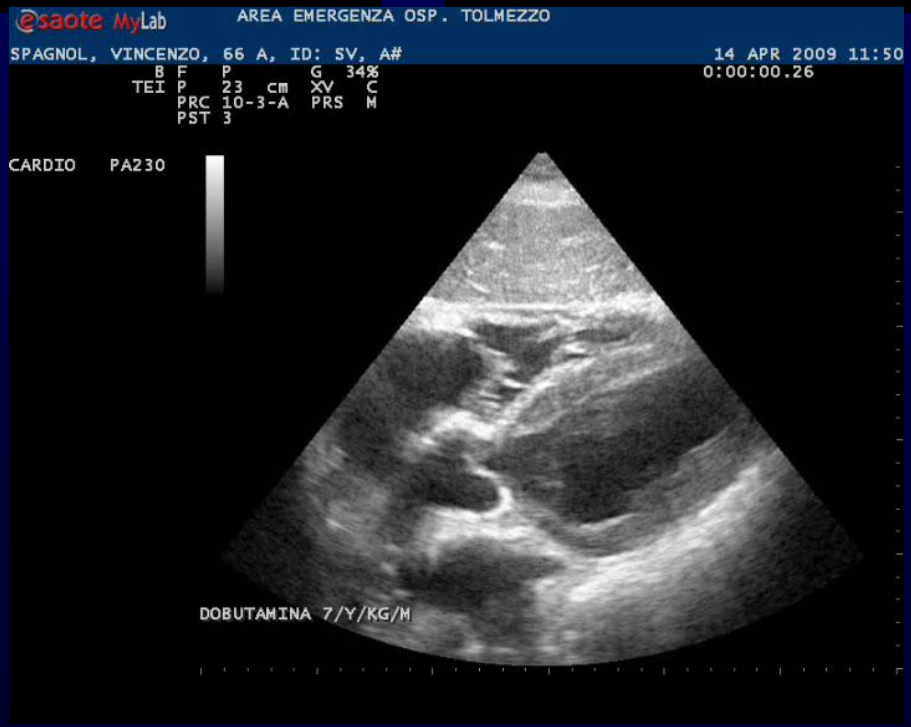
- 2 H LATER
- MECHANICAL VENTILATION, DIURETIC, DOPAMINE, DOBUTAMINE
- BP 125/80, Sat O2 100% (FiO_2 0.4- PEEP 5 cm H_2O)

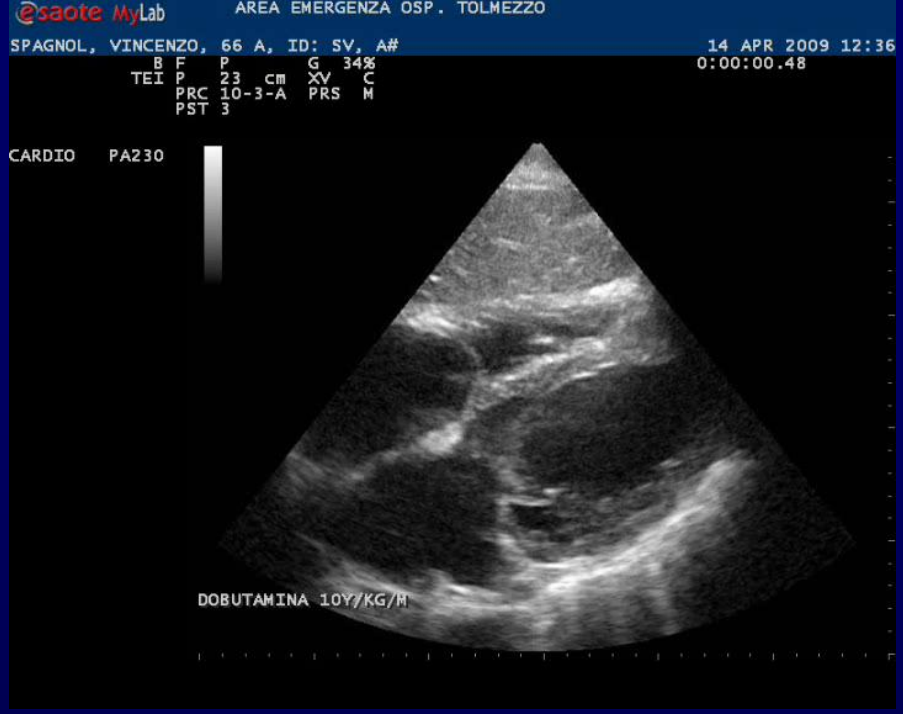


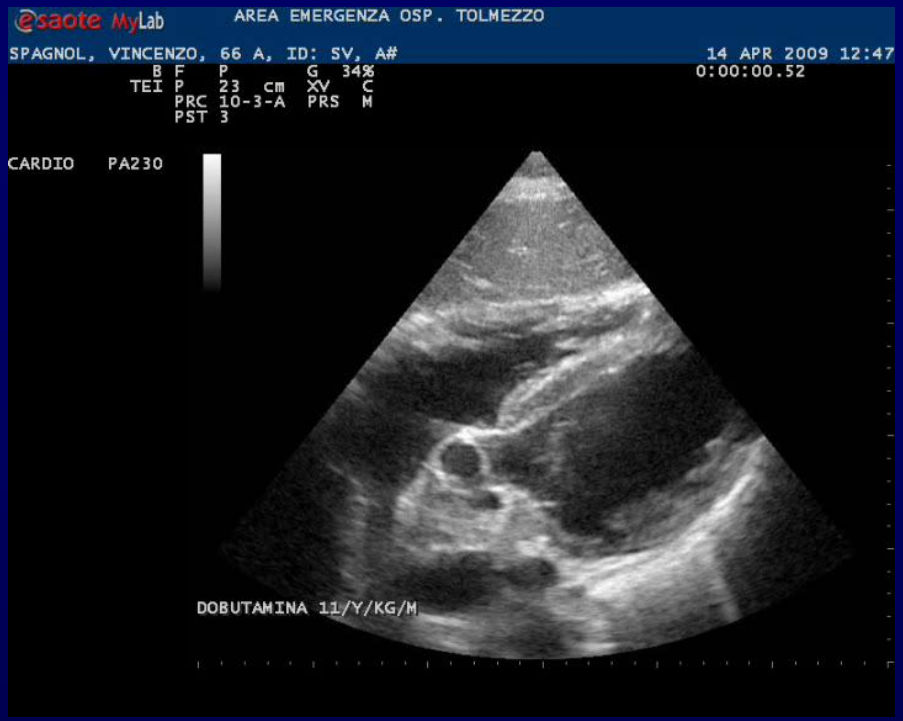
MYOCARDITIS


esaote MyLab
AREA EMERGENZA OSP. TOLMEZZO
SPAGNOL, VINCENZO, 66 A, ID: SV, A#
14 APR 2009 10:44
0:00:00.37
B F P G 34%
TEI P 23 cm XV C
PRC 10-3-A PRS M
PST 3
CARDIO PA230


esaote MyLab
AREA EMERGENZA OSP. TOLMEZZO
SPAGNOL, VINCENZO, 66 A, ID: SV, A#
14 APR 2009 11:19
0:00:00.44
B F P G 34%
TEI P 23 cm XV C
PRC 10-3-A PRS M
PST 3
CARDIO PA230
DOBUTAMINA 5Y/KG/M


esaote MyLab
AREA EMERGENZA OSP. TOLMEZZO
SPAGNOL, VINCENZO, 66 A, ID: SV, A#
14 APR 2009 11:50
0:00:00.26
B F P G 34%
TEI P 23 cm XV C
PRC 10-3-A PRS M
PST 3
CARDIO PA230
DOBUTAMINA 7/Y/KG/M

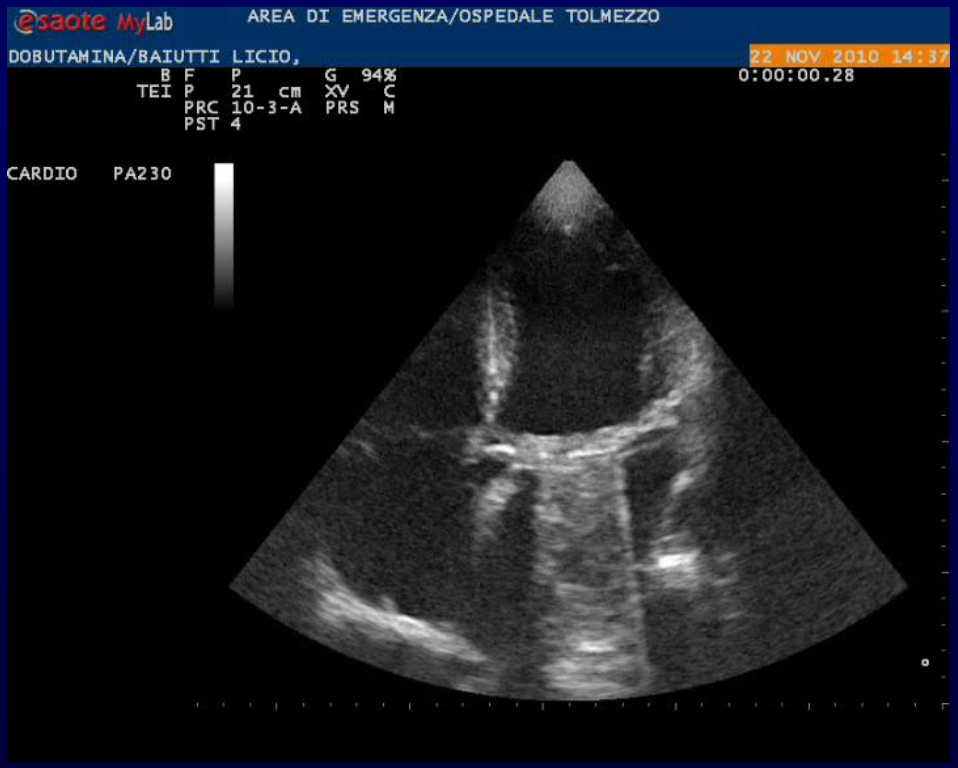

esaote MyLab
AREA EMERGENZA OSP. TOLMEZZO
SPAGNOL, VINCENZO, 66 A, ID: SV, A#
14 APR 2009 12:36
0:00:00.48
B F P G 34%
TEI P 23 cm XV C
PRC 10-3-A PRS M
PST 3
CARDIO PA230
DOBUTAMINA 10Y/KG/M

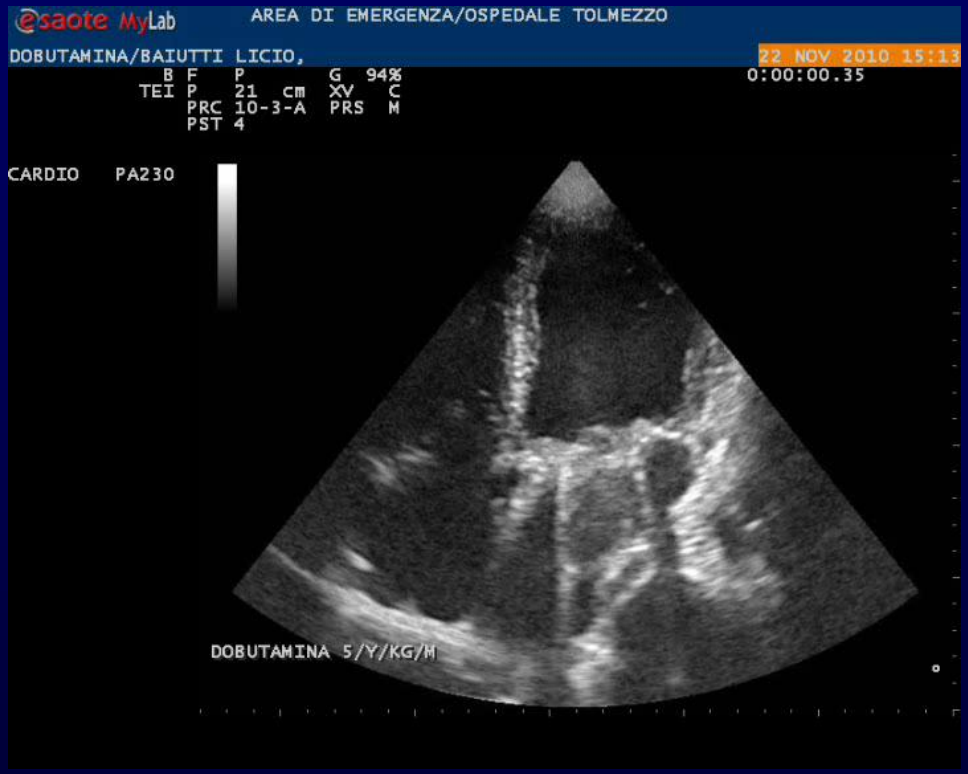

esaote MyLab
AREA EMERGENZA OSP. TOLMEZZO
SPAGNOL, VINCENZO, 66 A, ID: SV, A#
14 APR 2009 12:47
0:00:00.52
B F P G 34%
TEI P 23 cm XV C
PRC 10-3-A PRS M
PST 3
CARDIO PA230
DOBUTAMINA 11/Y/KG/M


esaote MyLab
AREA EMERGENZA OSP. TOLMEZZO
SPAGNOL, VINCENZO, 66 A, ID: SV, A#
14 APR 2009 13:25
0:00:00.22
B F P G 34%
TEI P 23 cm XV C
PRC 10-3-A PRS M
PST 3
CARDIO PA230
DOBUTAMINA 12/Y/KG/M


esaote MyLab
AREA EMERGENZA OSP. TOLMEZZO
SPAGNOL, VINCENZO, 66 A, ID: SV, A#
14 APR 2009 10:44
0:00:00.37
B F P G 34%
TEI P 23 cm XV C
PRC 10-3-A PRS M
PST 3
CARDIO PA230

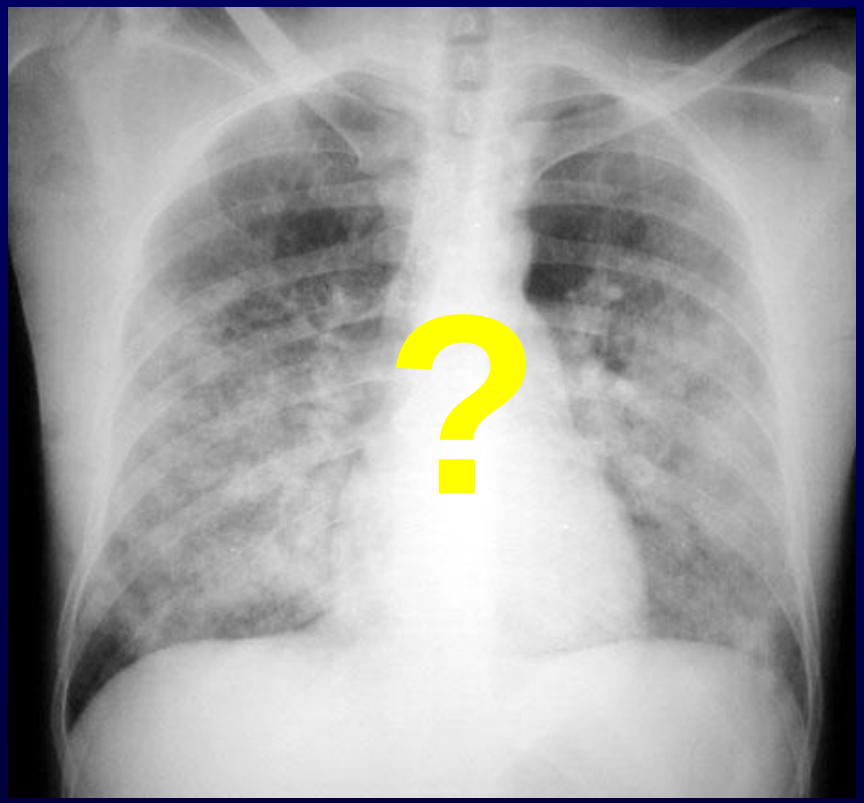
ULTRASOUND GUIDED DRUG MANAGEMENT



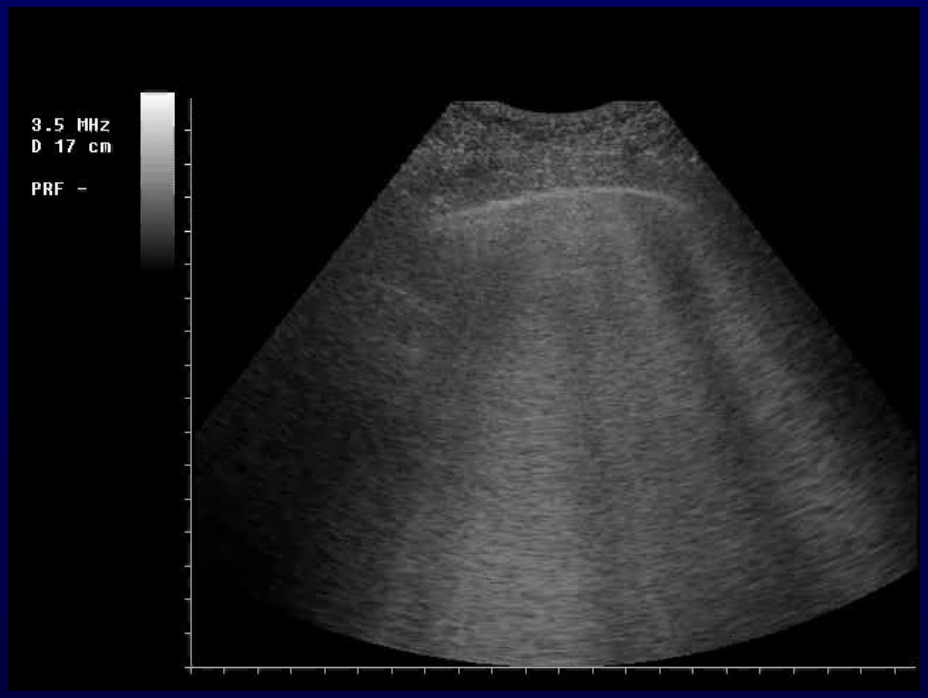


- M 68 Y
- FEVER IN THE LAST 4 DAYS (38.5° C)
- RESPIRATORY DISTRESS
- SEVERE HYPOXEMIA (Sat. O_2 80% - FiO_2 0.6)
- HR 130/m, BP 95/60 mmHg, TT 38° C
- INTUBATED AND VENTILATED

CHEST X-RAY

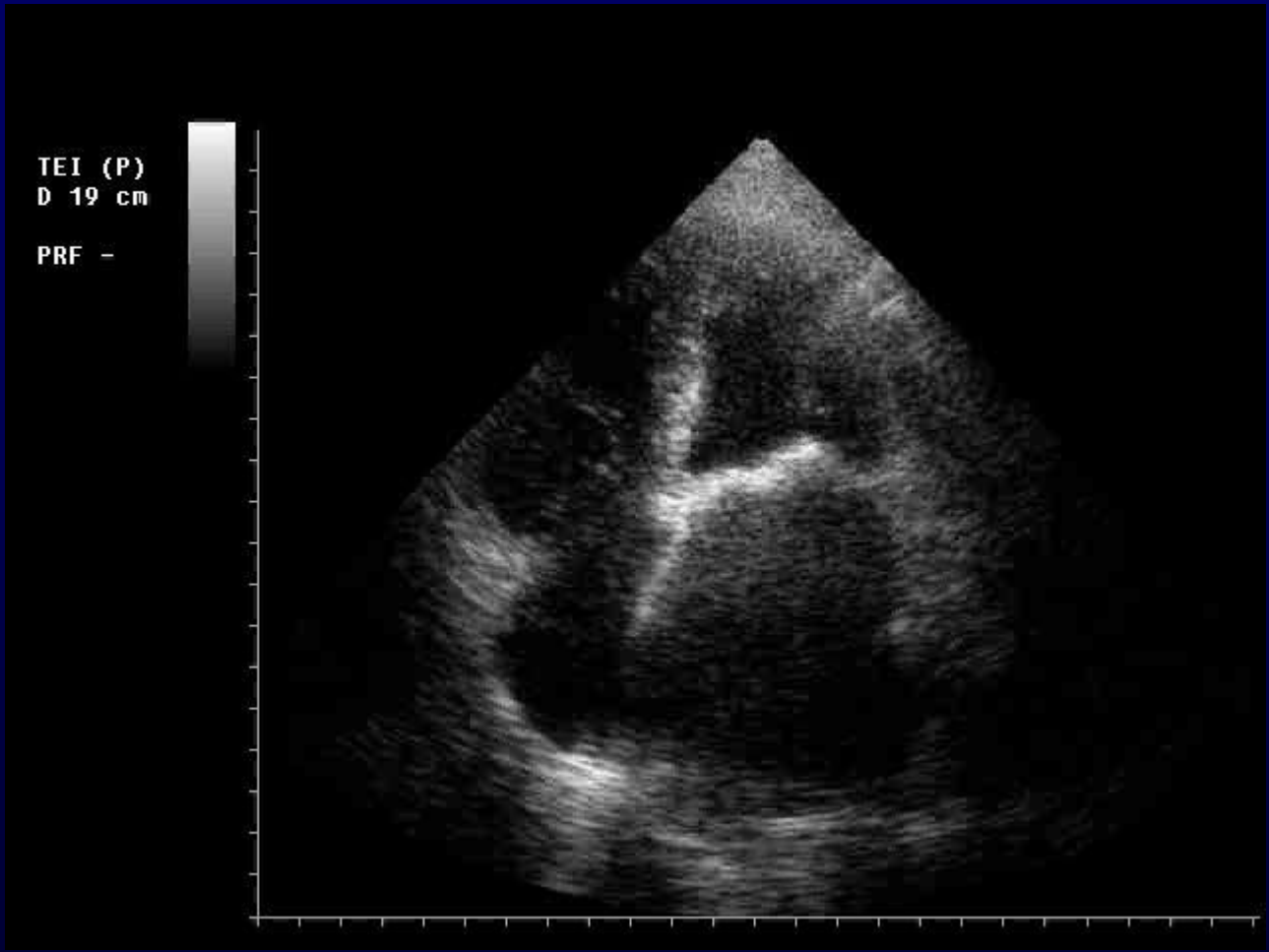


LUNG ULTRASOUND



“SILENT” SEVERE MITRAL STENOSIS

(valvular area 0.6 cm^2)

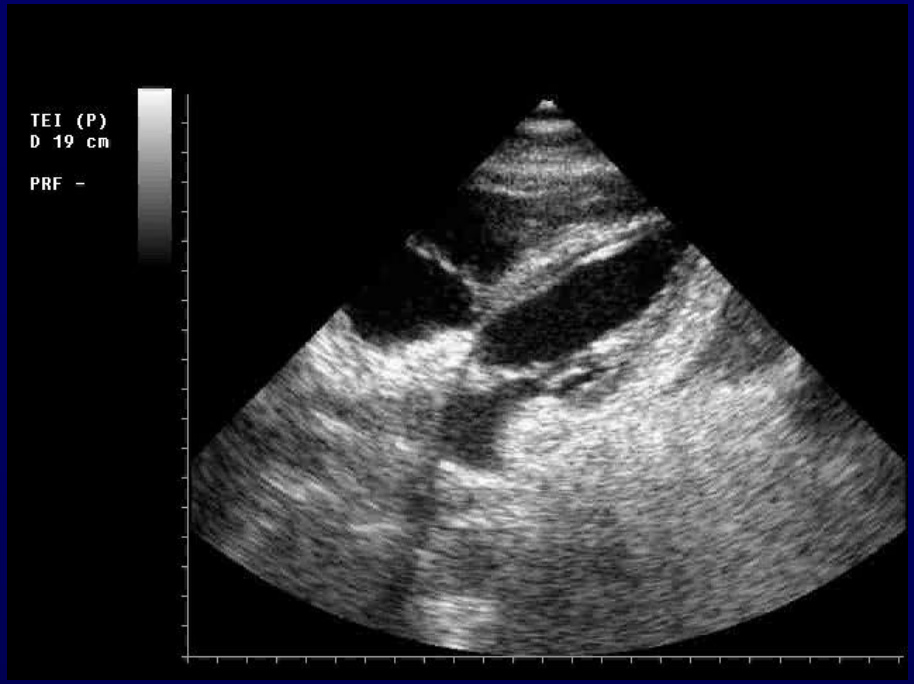


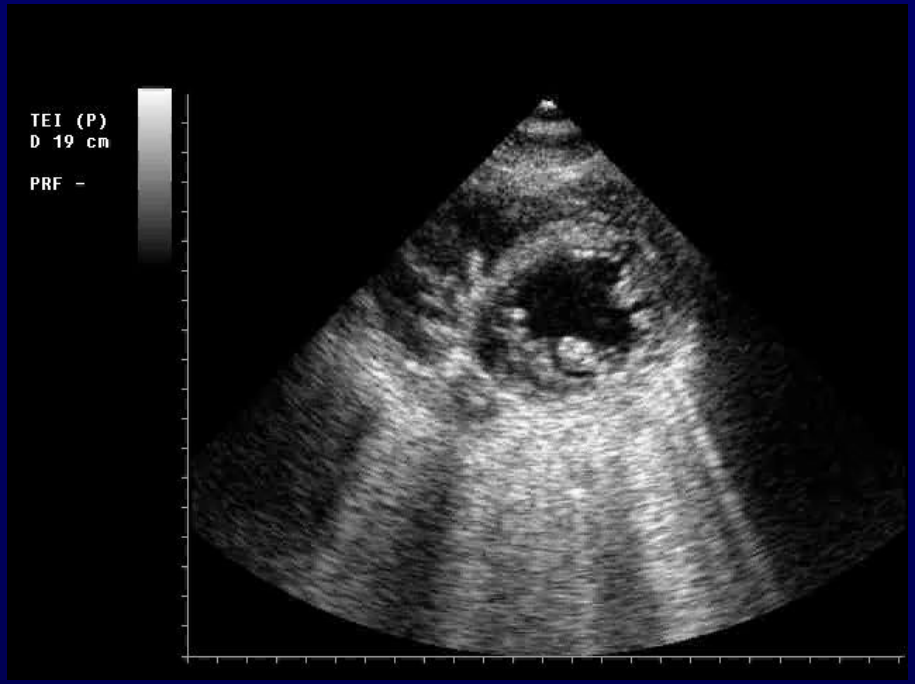
THERAPY: DIURETIC, BETABLOCKER

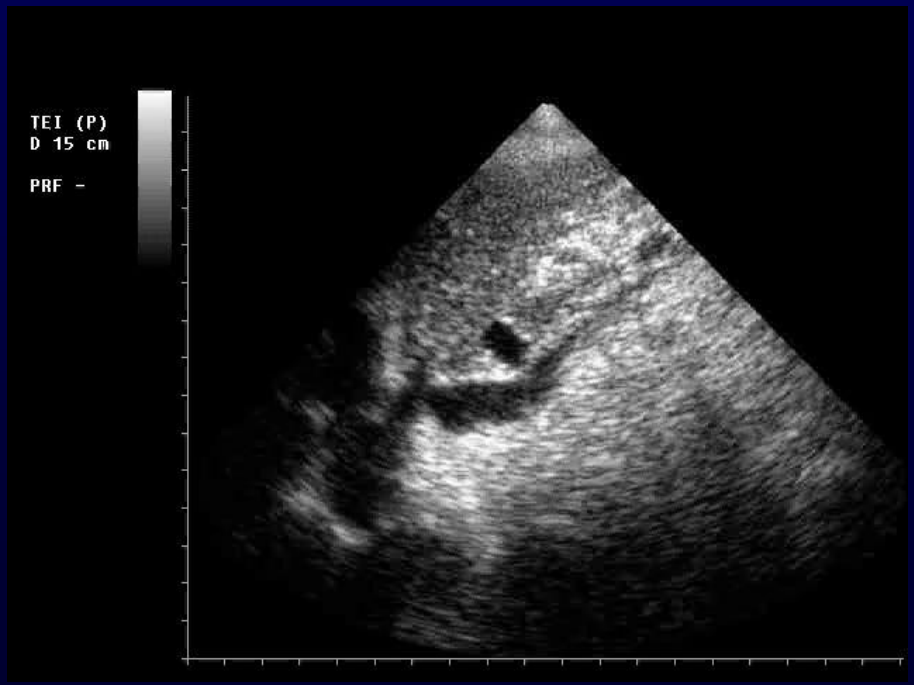
Hypotension due to hypovolemia

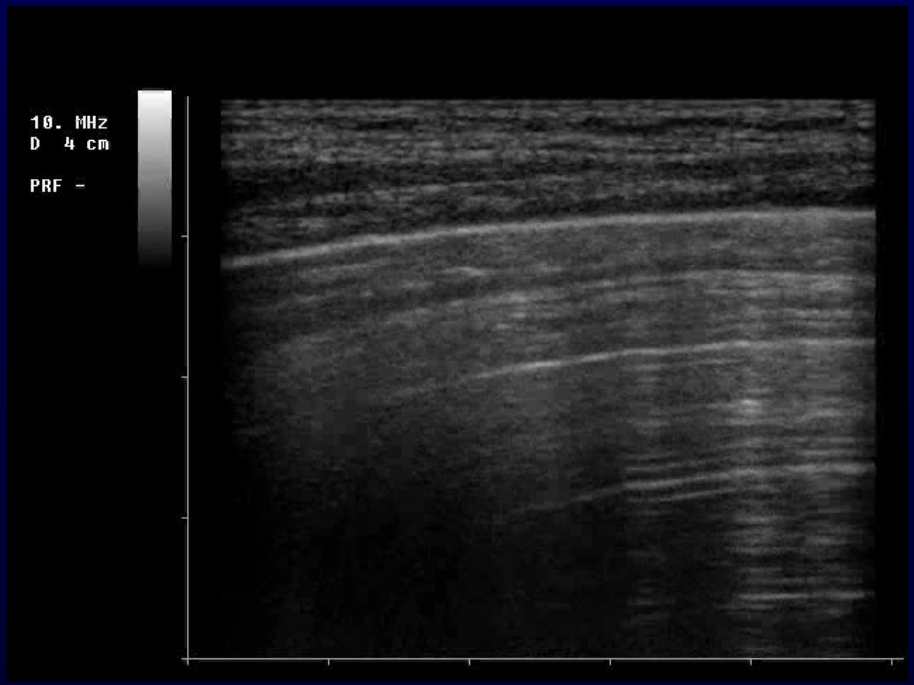
$$MAP = SVR \times CO + CVP$$

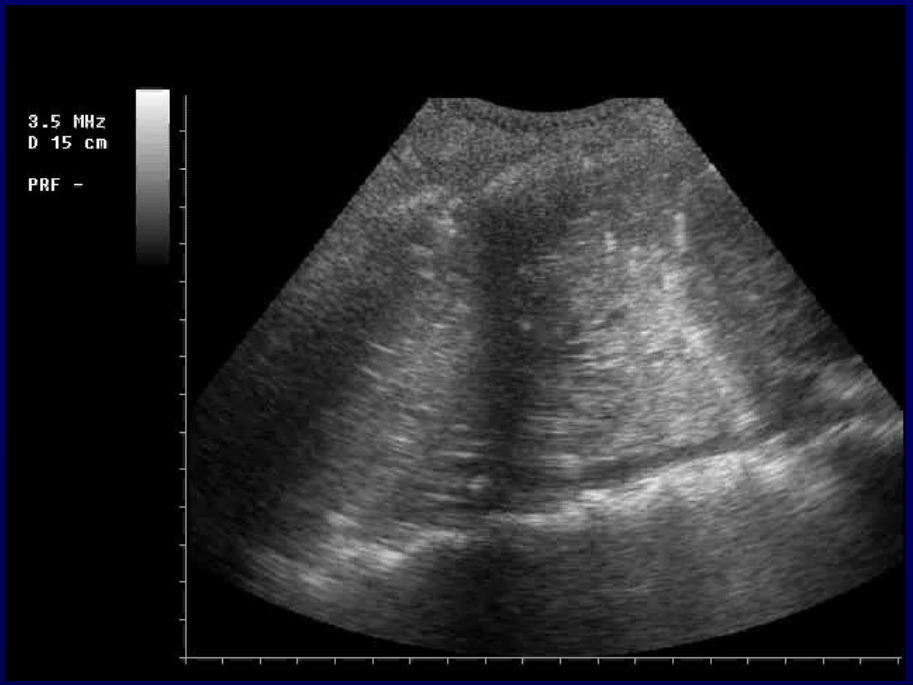
FULL OR EMPTY ?

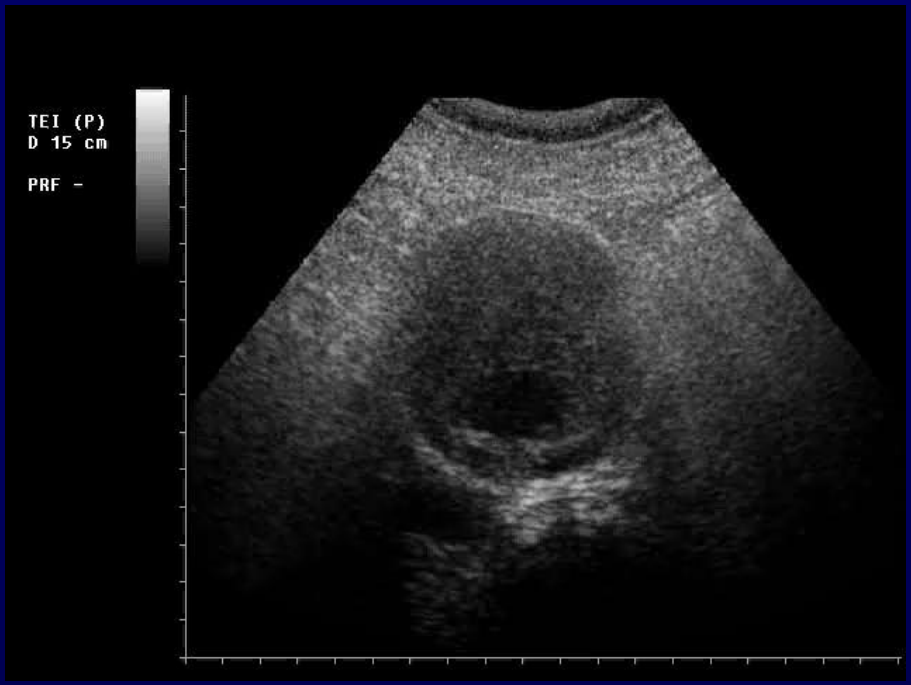

TEI (P)
D 19 cm
PRF -

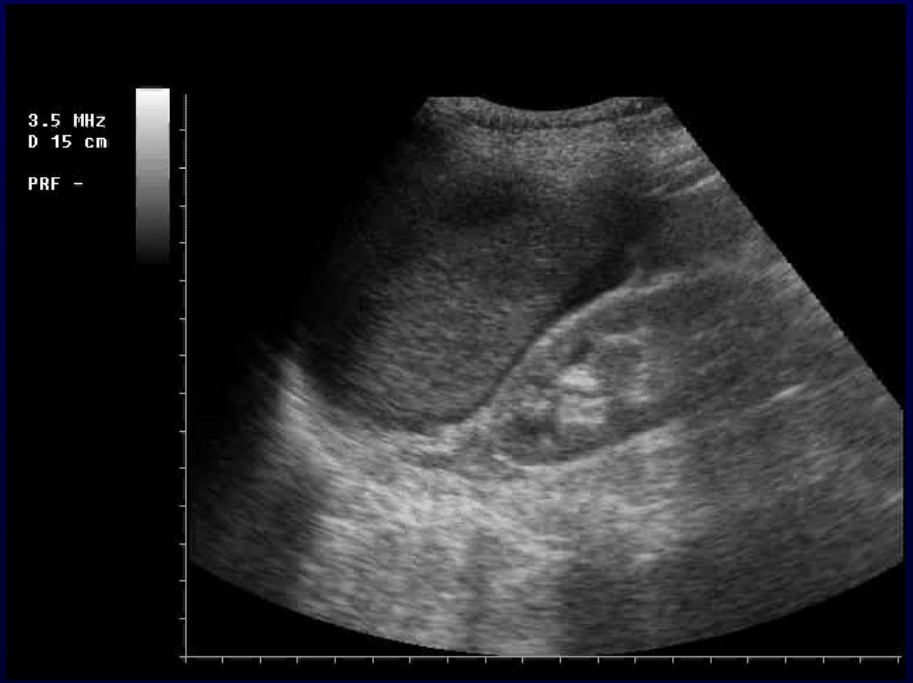

TEI (P)
D 19 cm
PRF -

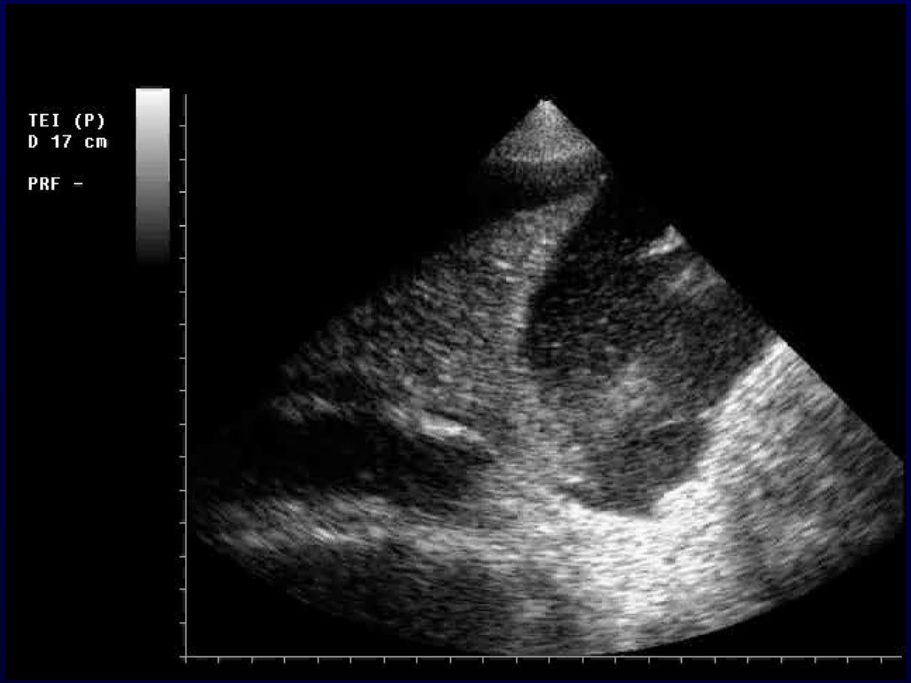

TEI (P)
D 15 cm
PRF -

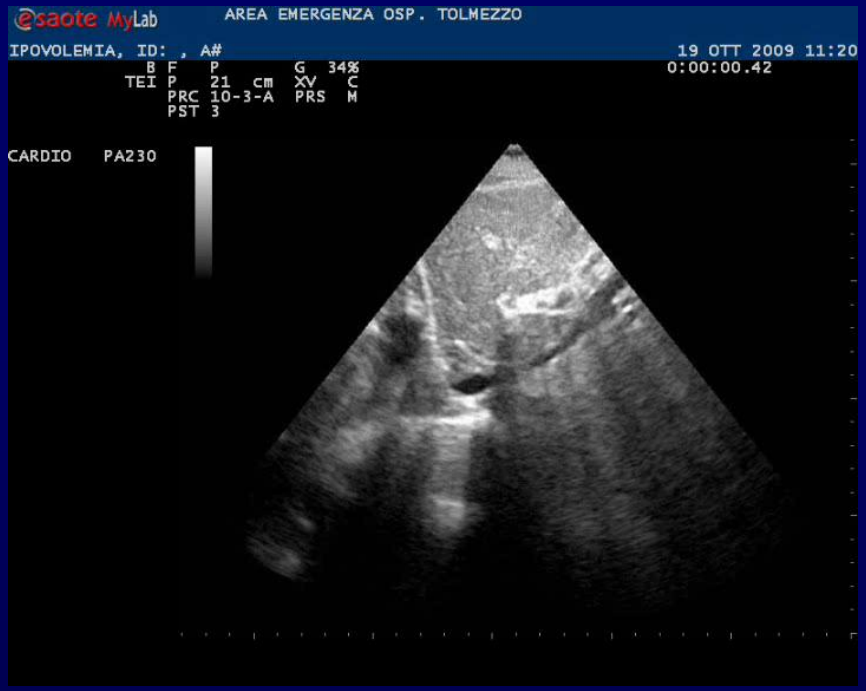

10. MHz
D 4 cm
PRF -

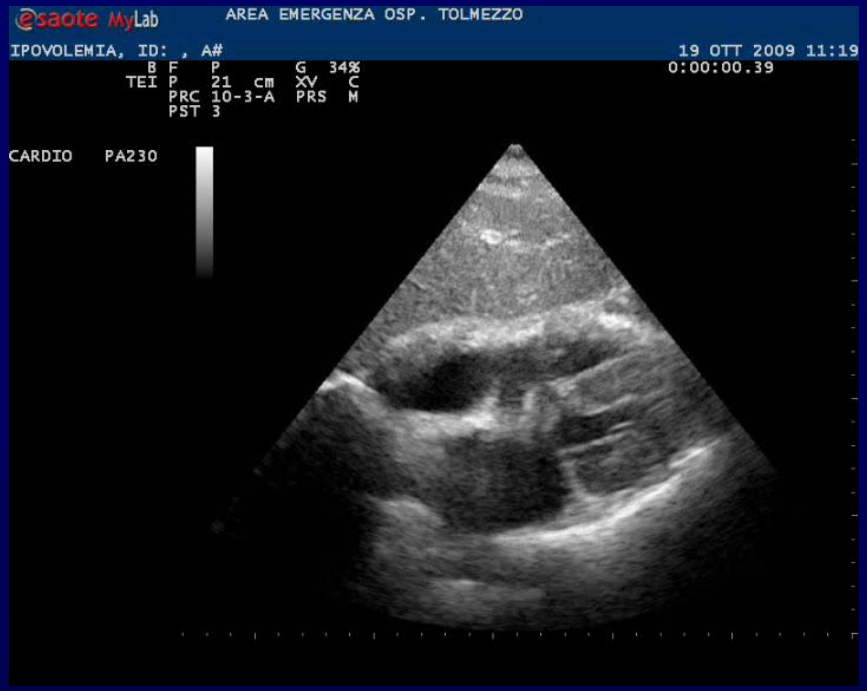

3.5 MHz
D 15 cm
PRF -

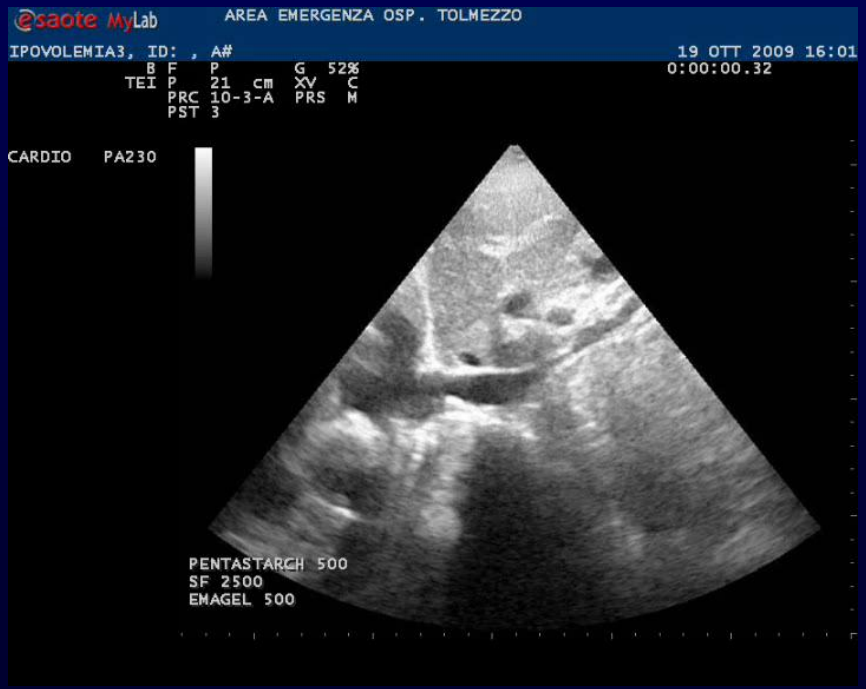

TEI (P)
D 15 cm
PRF -

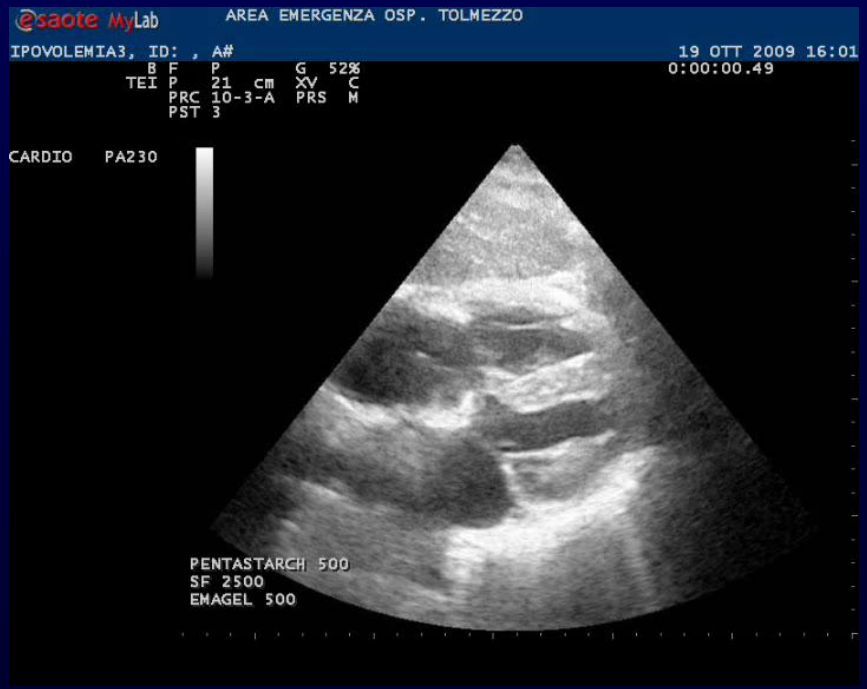

3.5 MHz
D 15 cm
PRF -


TEI (P)
D 17 cm
PRF -

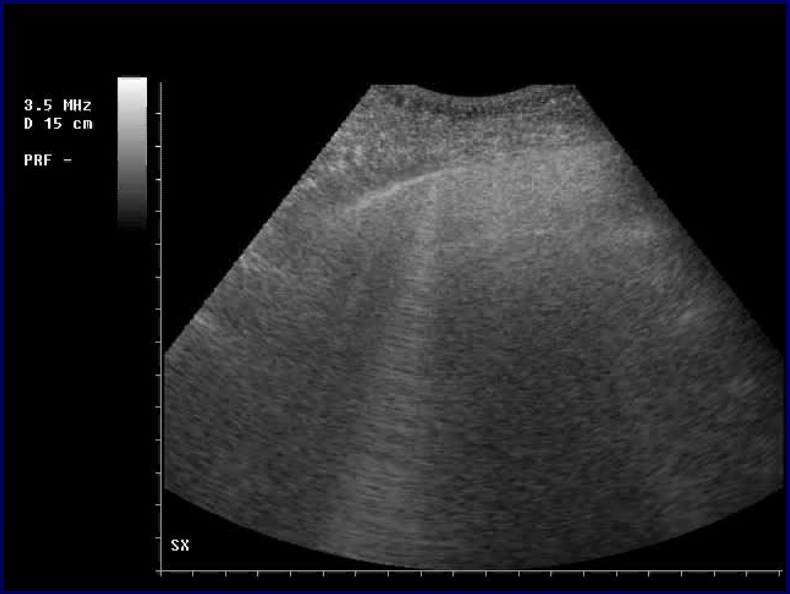

esaote MyLab
AREA EMERGENZA OSP. TOLMEZZO
IPOVOLEMIA, ID: , A#
19 OTT 2009 11:20
0:00:00.42
B F P G 34%
TEI P 21 cm XV C
PRC 10-3-A PRS M
PST 3
CARDIO PA230


esaote MyLab
AREA EMERGENZA OSP. TOLMEZZO
IPOVOLEMIA, ID: , A#
19 OTT 2009 11:19
0:00:00.39
B F P G 34%
TEI P 21 cm XV C
PRC 10-3-A PRS M
PST 3
CARDIO PA230


esaote MyLab
AREA EMERGENZA OSP. TOLMEZZO
IPOVOLEMIA3, ID: , A#
19 OTT 2009 16:01
0:00:00.32
B F P G 52%
TEI P 21 cm XV C
PRC 10-3-A PRS M
PST 3
CARDIO PA230
PENTASTARCH 500
SF 2500
EMAGEL 500

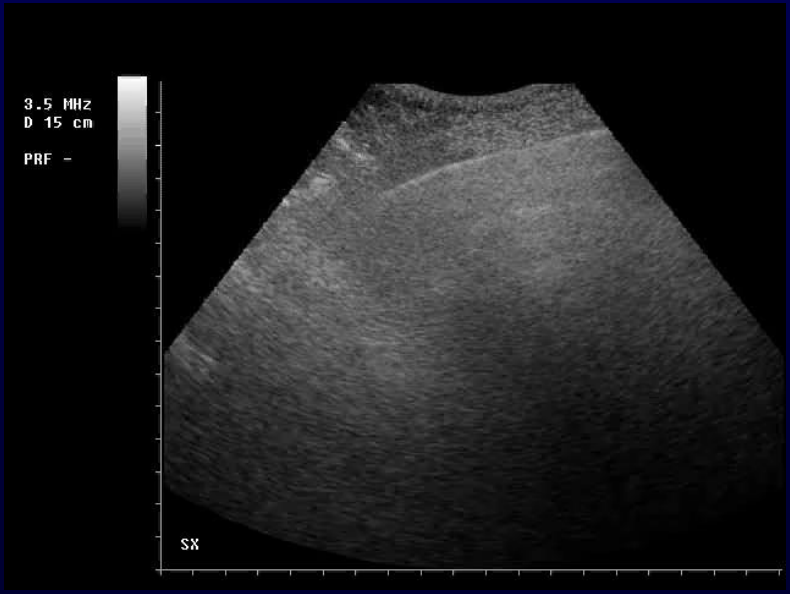

esaote MyLab
AREA EMERGENZA OSP. TOLMEZZO
IPOVOLEMIA3, ID: , A#
19 OTT 2009 16:01
0:00:00.49
B F P G 52%
TEI P 21 cm XV C
PRC 10-3-A PRS M
PST 3
CARDIO PA230
PENTASTARCH 500
SF 2500
EMAGEL 500

H 9.40



H 10.45

H 11.19



H 11.45

THE PHYSIOPATHOLOGY NEEDS TO BE KNOWN …BETTER IF ALSO SEEN

GRAZIE PER LA VOSTRA ATTENZIONE