Ultrazvuk v rychlé diagnostice šoku

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Koronární jednotka

.

Ultrazvuk v diagnostice urgentních/akutních stavů

- **FAST, eFAST** = *"Focused abdominal sonography for trauma"*
  Focused Assessment with Sonography for Trauma
  - *Extended FAST*
    - *1970-80s Německo - > Evropa, Asher 1976 senzitivita 80% (4 z 5 !! :)*
      - *Později v 90´ - senzitivita 65% - 95% (18 z 19 a 100% 256 z 256 !!)*
    - *1992 USA first reported by Tso et al., in a prospective study of 163 blunt trauma patients.*
    - *1993 - 476 patients by Rozycki et al. ,*
    - *1999 ,,Focused… Scalea TM, J Trauma 1999;46(3):466–472.*
    - *2004 E-FAST Kirgpartik : J Trauma 2004;57(2):288–295.*
    - *2010 ACEP consensus statemen*
    - *2015 NPV stabilních pacientů nízká ! Carter : Injury 2015;46(5):817–821*
    - *AIUM + ACEP J Ultrasound Med. 2014 Nov. 33 (11):2047-56*

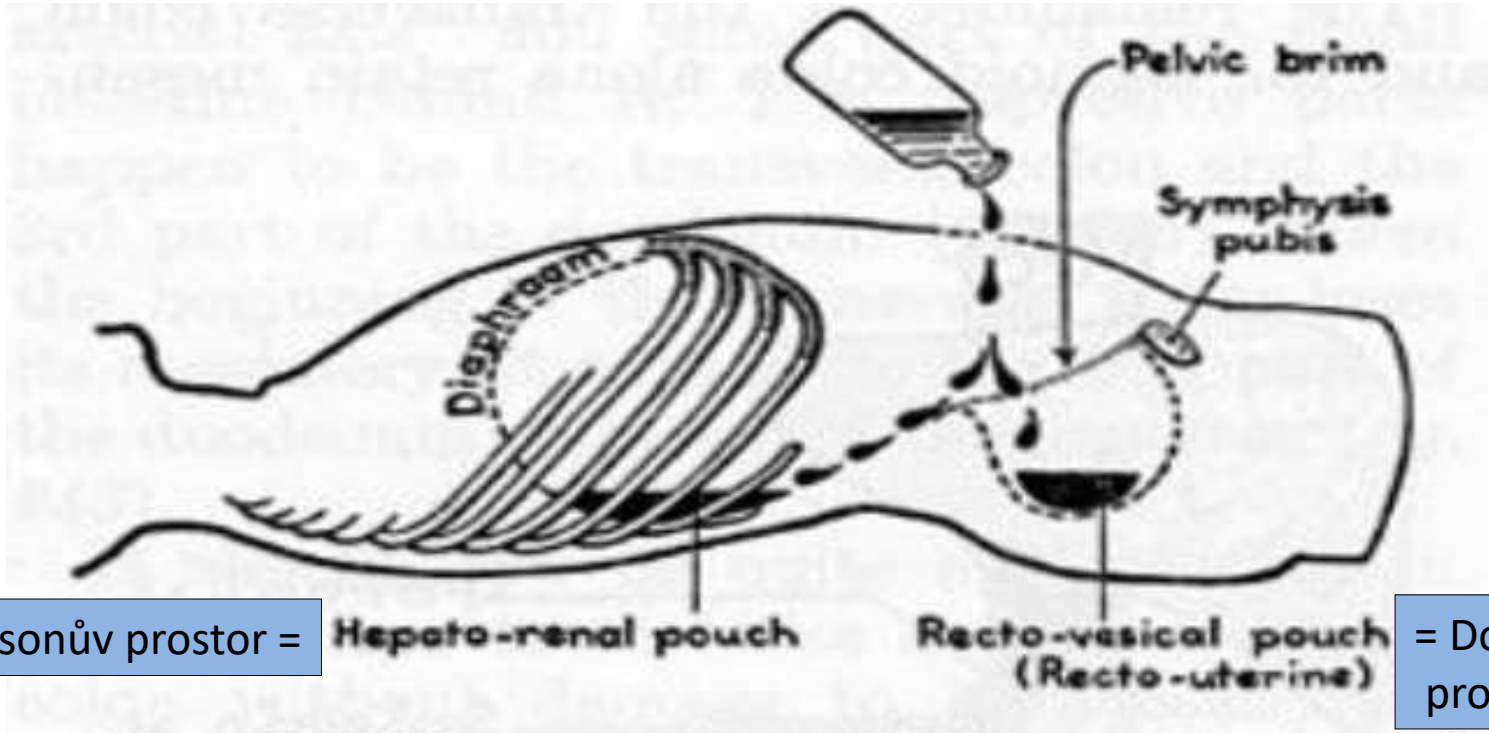
- **RUSH =** *Rapid US in Shock and Hypotension*
  - 2006-9 Weingart, Duque, Nelson
  - Critical Care Research and Practice Vol. 2012, Article ID 503254,
  - doi:10.1155/2012/503254

- **FoCUS =** *Focused Cardiac Ultrasound*
  - ASE and ACEP 2010 consensus statement – JASE 2010;23:1225-30
  - ASE 2013 aditional recomendation – JASE 2013;26:567-81

- **EE =** *Emergency Echocardiography*
  - EACVI recomendations: EE recommendations: EHJ – Cardiovascular imageing: (2013) 14, 1-11 doi:10.1093/ehjci/jes193
  - EACVI + EAEM Position Statement Eur Heart Journ Cardiovasc Imageing 2014:15, 956-60
  - EACVI The use of Echo in Acute Cardiac Care: Recomm of AECVI + ACCA in EHJ – CVI 2015: 16, 119-146

-

FAST – originální koncept



Morisonův prostor =

= Douglasův prostor

FIG. 262. Two pouches which are the lowest parts of the peritoneal cavity when the subject is supine.

Boileau Grant JC, Basmajian JV
Grant's Method of Anatomy, p 237. 7th ed
Williams & Wilkins, Baltimore 1965

EACVI_2015_Reom... ×

119 (1 z 28) 125%

European Heart Journal – Cardiovascular Imaging (2015) **16**, 119–146
doi:10.1093/ehjci/jeu210

The use of echocardiography in acute cardiovascular care: Recommendations of the European Association of Cardiovascular Imaging and the Acute Cardiovascular Care Association

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Echocardiography is one of the most powerful diagnostic and monitoring tools available to the modern emergency/ critical care practitioner. Currently, there is a lack of specific European Association of Cardiovascular Imaging/Acute Cardiovascular Care Association recommendations for the use of echocardiography in acute cardiovascular care. In this document, we describe the practical applications of echocardiography in

Downloaded from https://academic.oup.com/ehjcimaging/article-abstract/16/2/119

Protocol	ACES	BEAT	BLEEP	ECHO (Boyd)	EGLS	Elmer-Noble	FALLS	FATE	FEEL: RESUS	FEER	FREE	POCUS	RUSH: HIMAP	RUSH Pump Tank Pipes	Trinity	UHP	CORE	CAVEAT
Reference No.	32	33	34	35	36	37	38	39	40	41	42	43	44	51	45	46	47	48
Cardiac	1	1	1	1	2	1	3	1	1	1	1	3	1	1	1	3	5	1
IVC	2	2	2	2	3	2	4					4	2	2			7	4
FAST	4					3						1	3	3	3	1	8	5
Aorta	3											5	4	7	2	2	6	
Lungs PTX					1	4	2					2	5	6			2	2
Lungs effusion	5							2						4			3	3
Lungs edema					4	5	1					6		5			4	
DVT												7		8			9	
Ectopic pregnancy												8						
Trachea																	1	6
Bones																		7

ACES = abdominal and cardiac evaluation with sonography in shock;
BEAT = bedside echocardiographic assessment in trauma/critical care;
BLEEP = bedside limited echocardiography by the emergency physician;
ECHO = echocardiography;
EGLS = echo-guided life support;
FALLS = fluid administration limited by lung sonography;
FATE = focus assessed transthoracic echocardiography;
FEEL: RESUS = focused echocardiographic evaluation in resuscitation;
FEER = focused echocardiographic evaluation in resuscitation;
FREE = focused rapid echocardiographic examination;
POCUS = point of care US in the hypotensive patient;
RUSH = rapid US for shock and hypotension;
HIMAP = heart, IVC, Morison pouch, aortic aneurysm, pneumothorax;
UHP = undifferentiated hypotensive patient;
CORE = concentrated overview of resuscitative efforts;
CAVEAT = chest, abdomen, vena cava, and extremities for acute triage.

Emergency Echocardiography (EE)

= echokardiografie u **nestabilního** pacienta

- Není echokardiografie na JIP/KJ u stabilního pt
- Není focused cardiovascular ultrasound (pocket ULS - echo scanning)

- Prováděno zkušenými echokardiografisty se znalostmi a zkušenostmi ke komplexnímu posouzení nálezu.
  - V časové tísni, ve stresu, bez možnosti konzultace, špatné suboptimální vyšetřitelnosti /UPV/, off hours a nestabilní HD podmínky
  - častější interpretační chyby !!!
- Level III a osobně
  - TTE: basic 350/resonable +
  - adv 750/100r +
  - TEE adv 75/50r +
  - STRES Echo 100/100r .
  - Minimum : (ne)kardiolog + basic TTE LIII + TEE LII + stres LI (+ 150 emergency TTE)

= Expert level

= Independent operator

RUSH -
Rapid **U**ltrasound exam for **S**hock and **H**ypotension

- Rychlá UZ diagnostika – 2min
- Netraumatických nemocných
- Šok či hypotenze

Scott D. Weingart, MD RDMS,
Daniel Duque MD RDMS,
Bret Nelson MD RDMS
2006-2009

http://emcrit.org/rush-exam/

Critical Care Research and Practice
Volume 2012, Article ID 503254,
doi:10.1155/2012/503254

RUSH – Rapid Ultrasound in Shock and Hypotension

I. Srdce – *pumpa (pump)*

I. Náplň – *nádrž (tank)*

I. Cévy – *trubky (pipes)*

UZ DESATERO v šoku

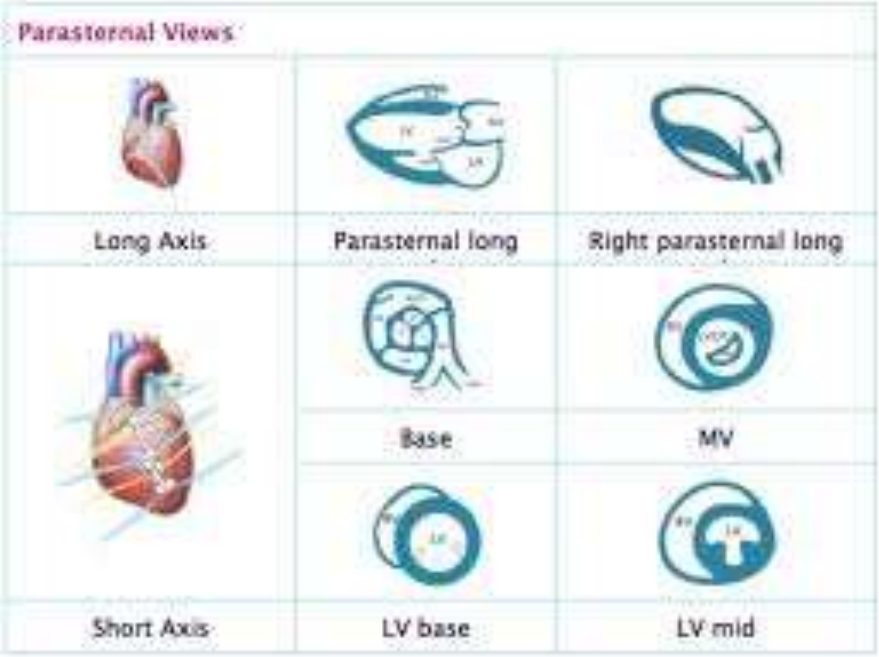
I. Srdce - */pumpa/*
   - A. perikard **1**
   - B. LK **2**
   - C. PK **3**

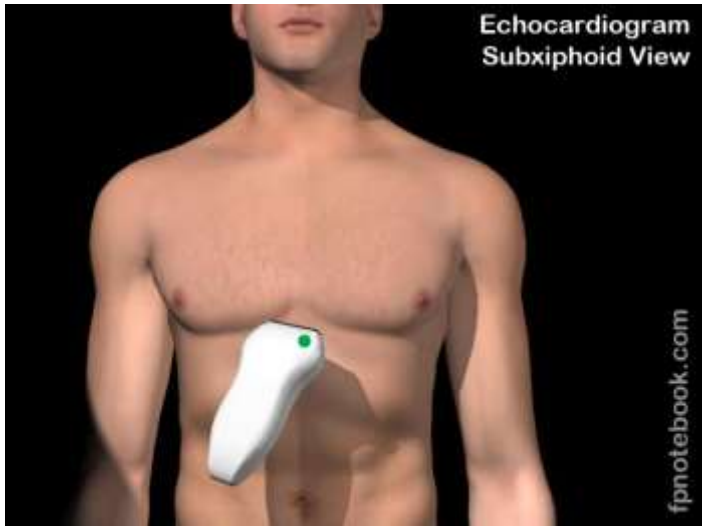
I. Náplň – */nádrž/*
   - *A. IVC* ***4***
   - *B. VJE* **5**
   - *C. FAST* **6**
   - *D. útlak v hrudníku – PNO, fluidothorax* **7**

II. Cévy – */trubky/*
   - *A. ASC Aorta + oblouk + descend. aorta* **8**
   - *B. abdom. Aorta - AAA* **9**
   - *C. žíly* **10**

I. SRDCE - pumpa

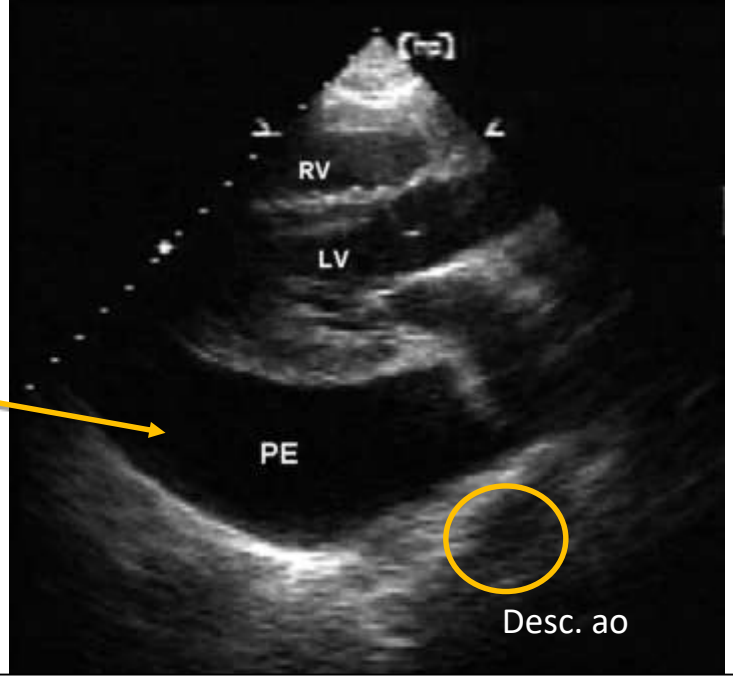
- PLAX
- PSAX – midventricle
- Apex : 4C /2C 3C/
- <u>SubXiph</u> – krátká/dlouhá

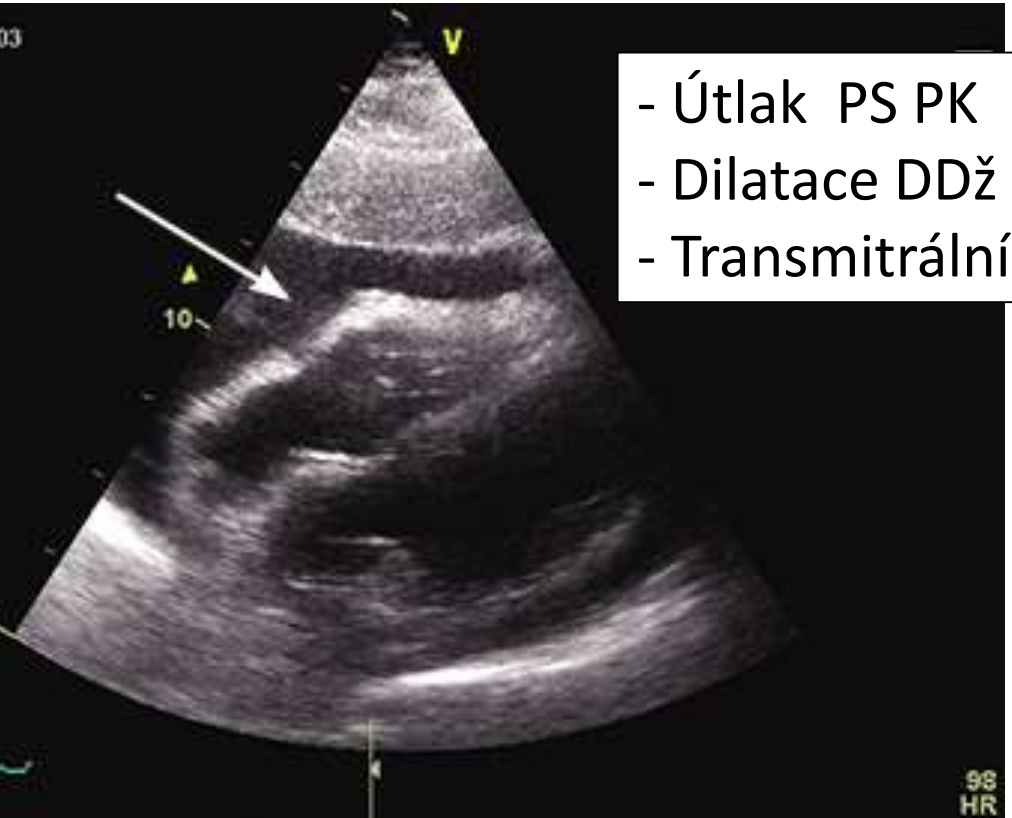




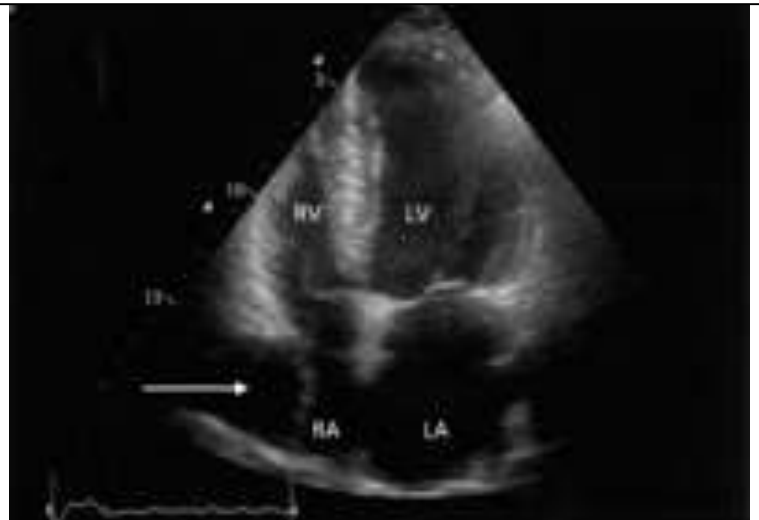
IA. SRDCE - PV

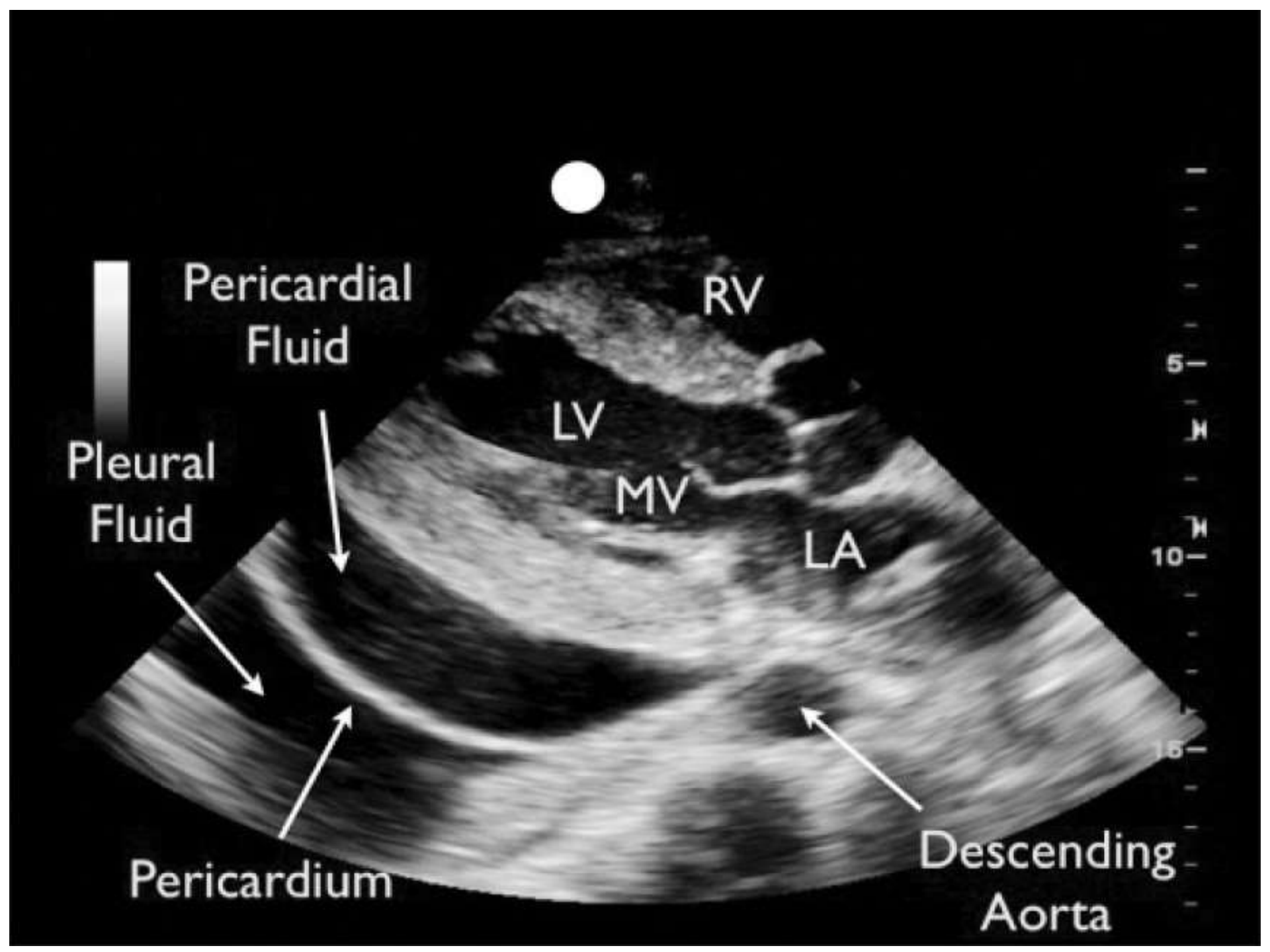
- Perikardiální výpotek
  - Dif. dg. pleurální
- Známky tamponády

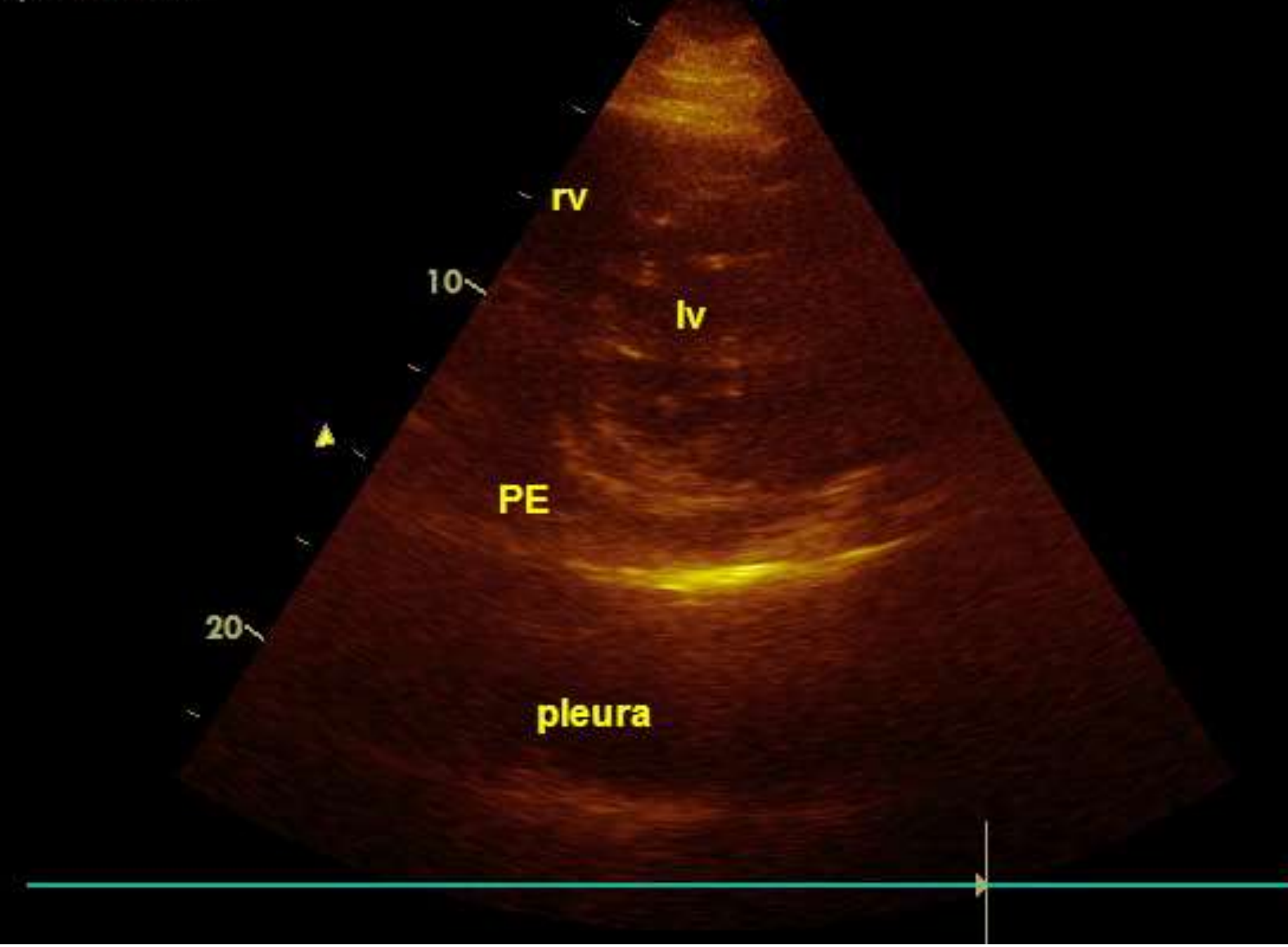


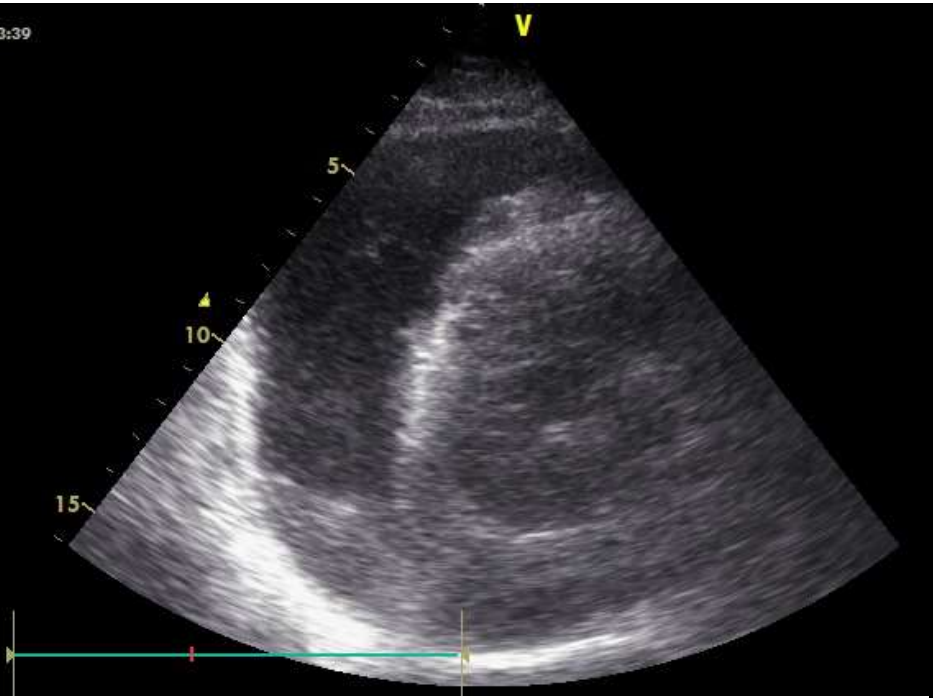


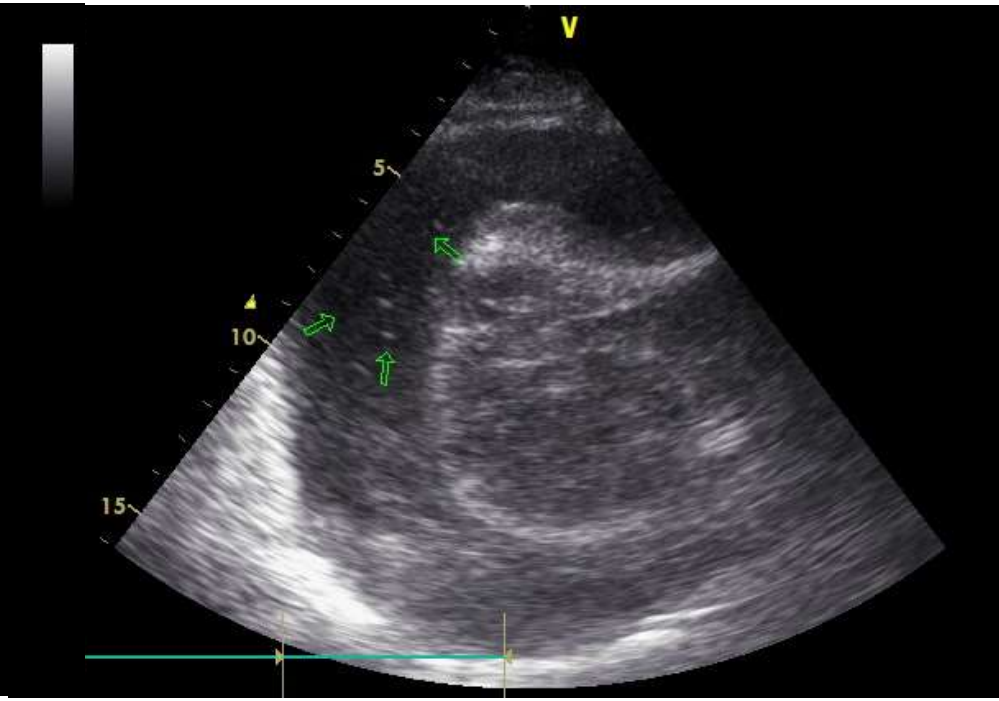
- Útlak PS PK
- Dilatace DDž bez respirační variace
- Transmitrální kolísání toku s respirací > 20%



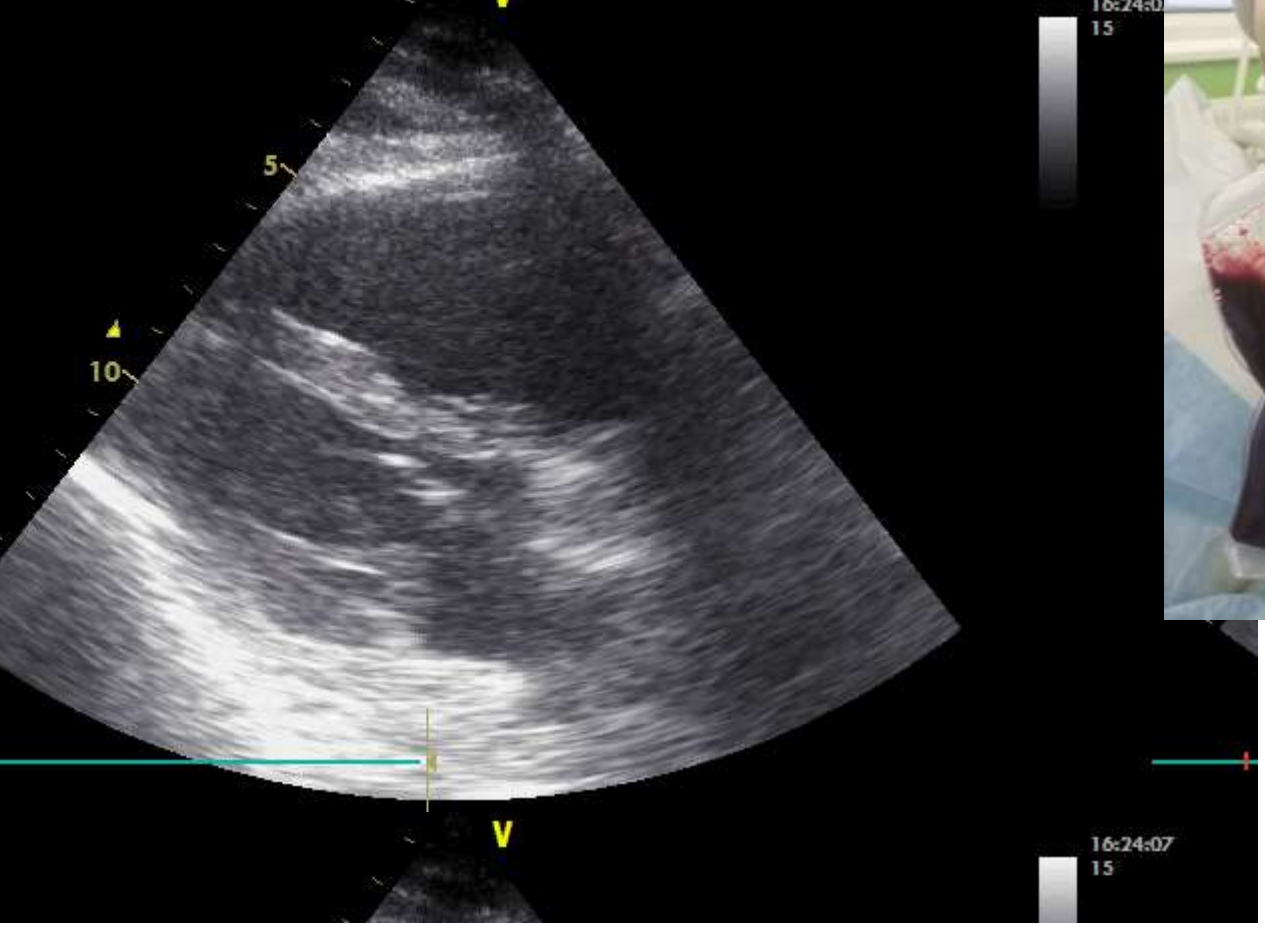

Pericardial Fluid
Pleural Fluid
RV
LV
MV
LA
Pericardium
Descending Aorta
5
10
15


rv
10
lv
PE
20
pleura


V
5
10
15


V
5
10
15


5
wire
10
15
15
V
16:06:19
4


5
10
16:24:07
15

IB. SRDCE – levá komora

Velikost

- Normální
- Dilatovaná
- Malá

Ž- do 52mm!! **M**- do58 mm
Ž- do 31mm/m2, M- do 30mm/m2 BSA
32-33mm/1m výšky

Systolická funkce

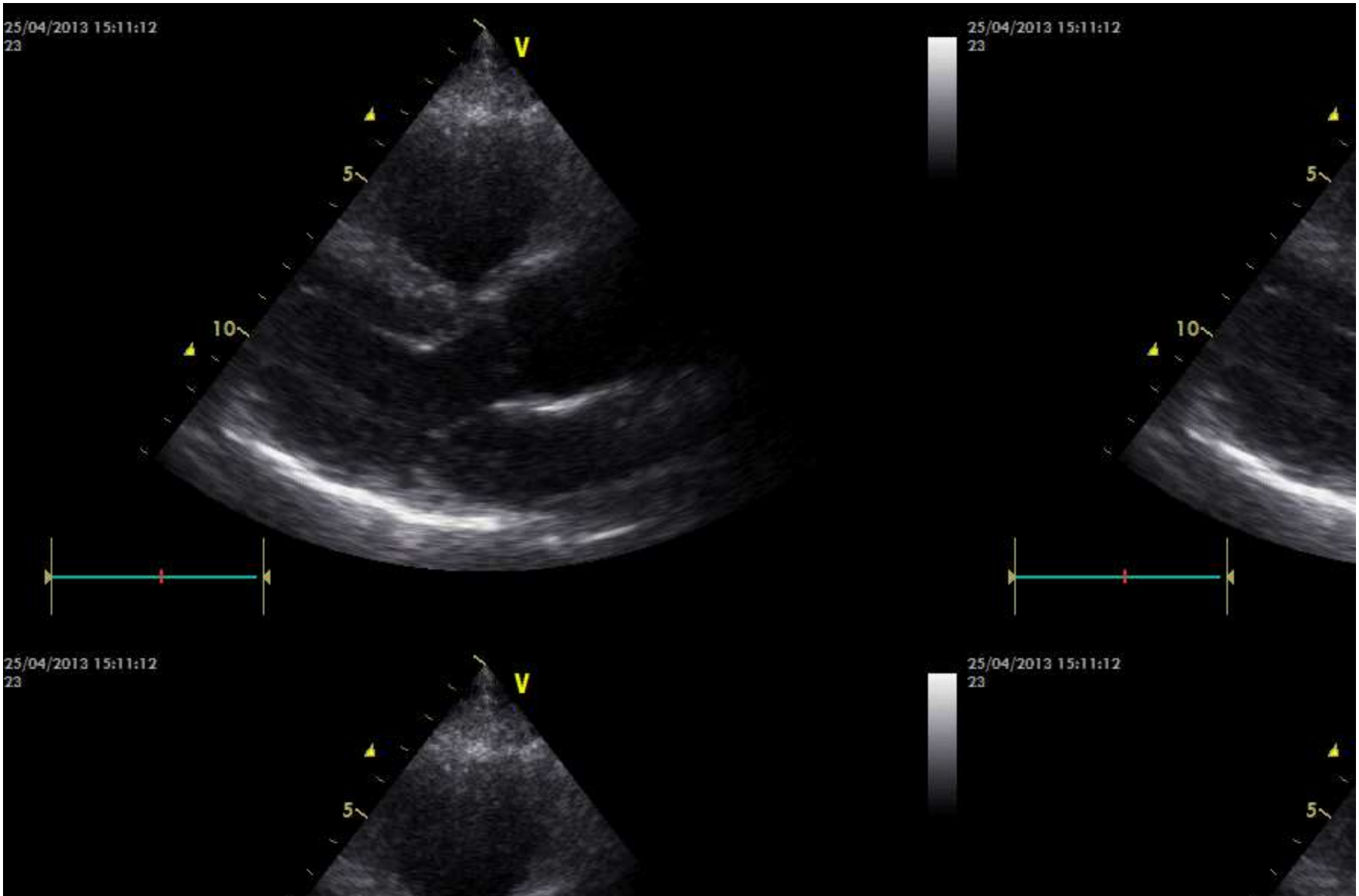
- Normální
- Lehce až středně omezená
- Těžká dysfunkce
- Hyperkontraktilní

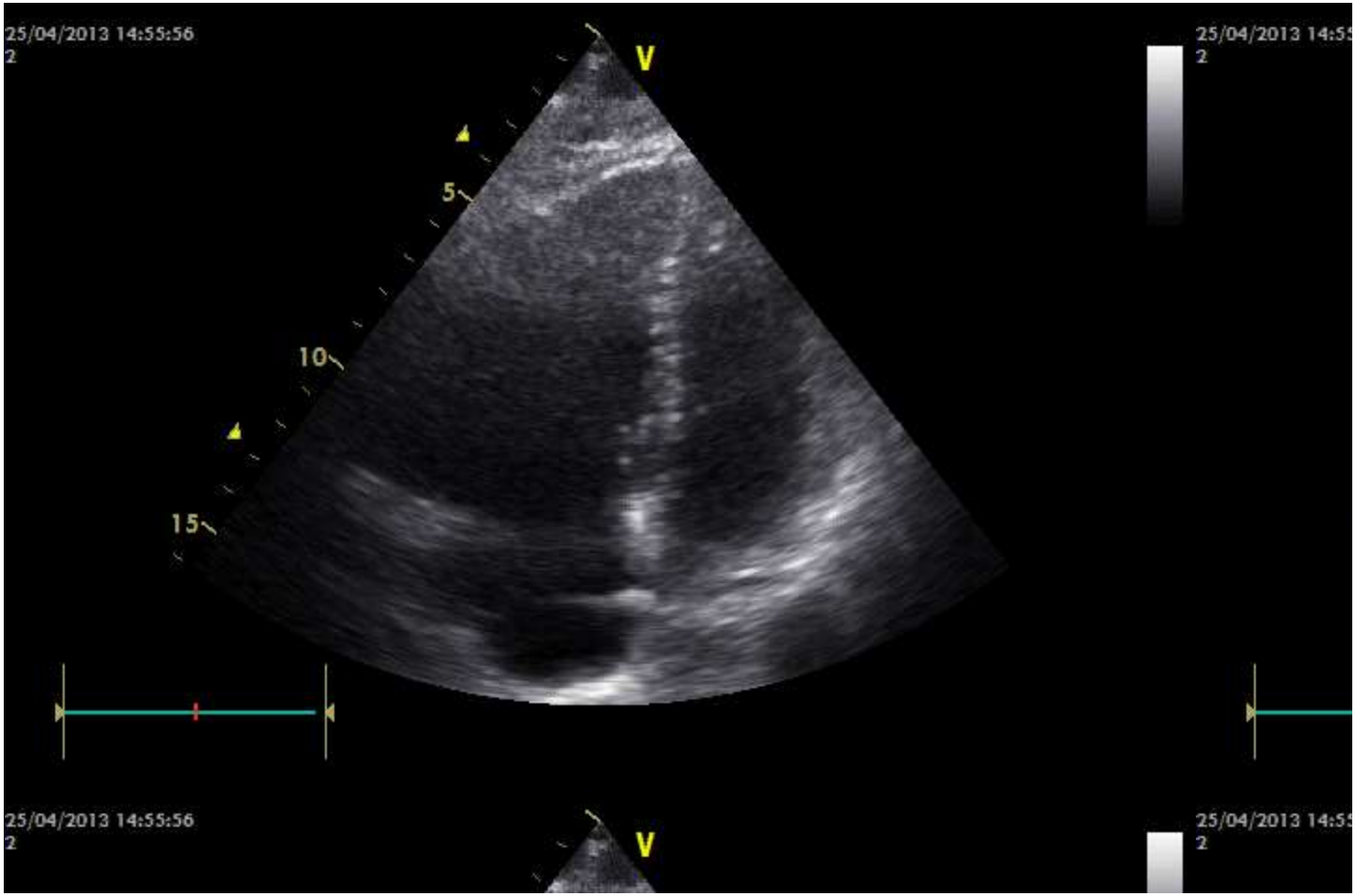
EFLK (%):

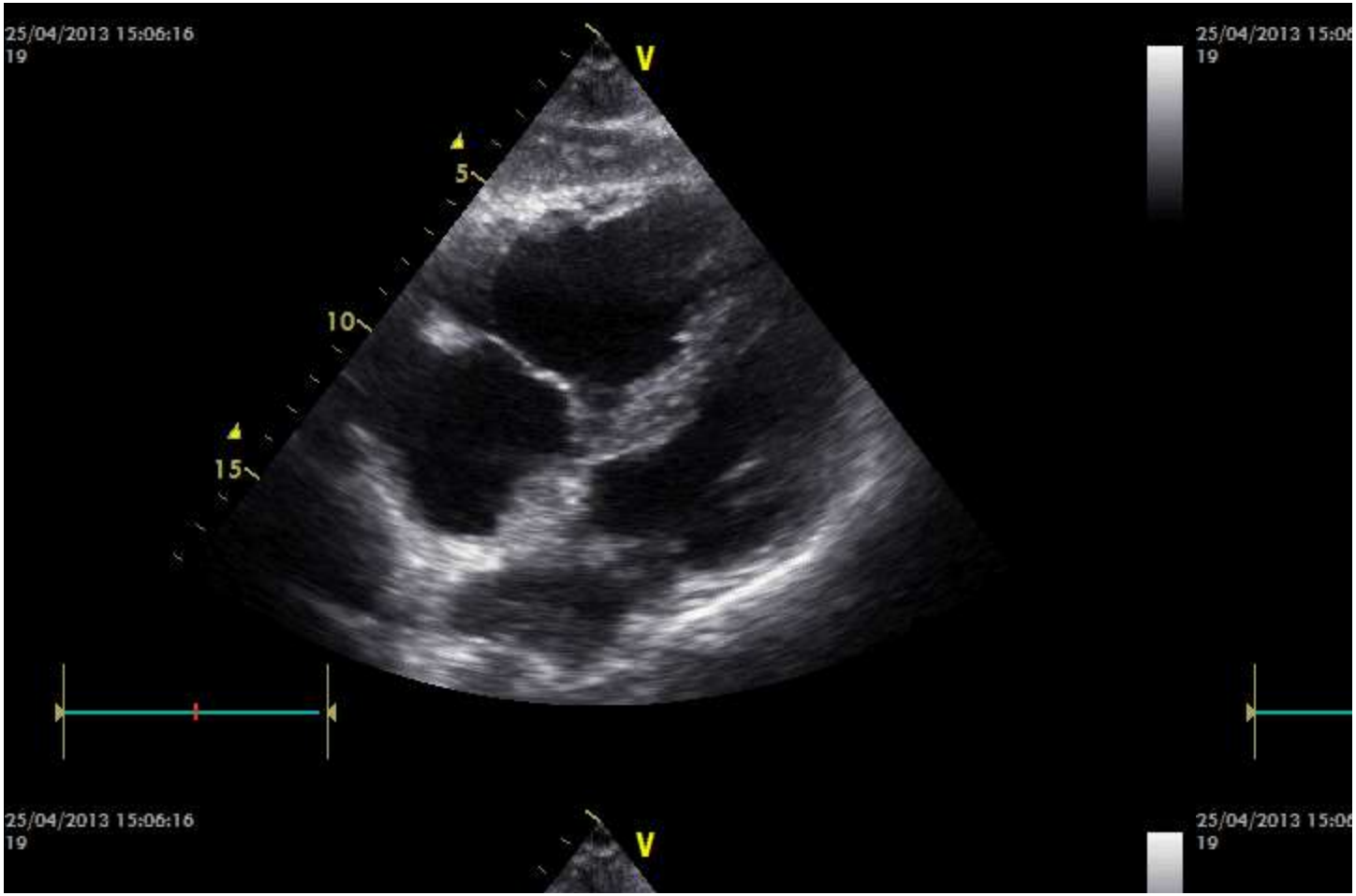
N	lehk	stř.	těž
72-52	51-41	40-30	<

Lang RM: Journ Am Soc Echo 2018
From Chamber Quantification Guideline (2015,28:1-39)

IC. SRDCE – Pravá komora




25/04/2013 14:55:56
2
V
5
10
15
25/04/2013 14:55:56
2
V
25/04/2013 14:55:56
2


25/04/2013 15:06:16
19
V
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15
25/04/2013 15:06:16
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25/04/2013 15:06:16
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25/04/2013 15:06:16
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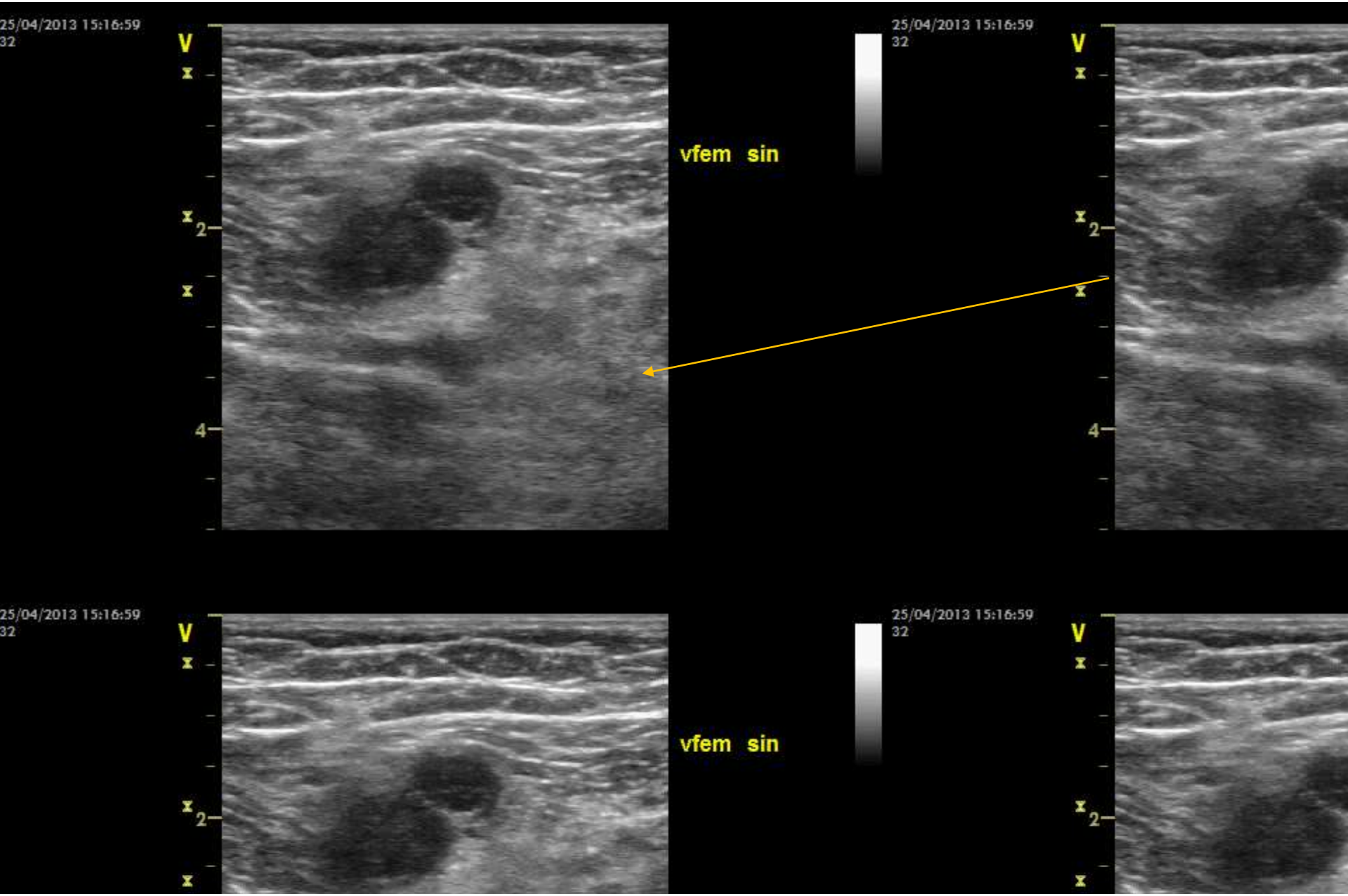
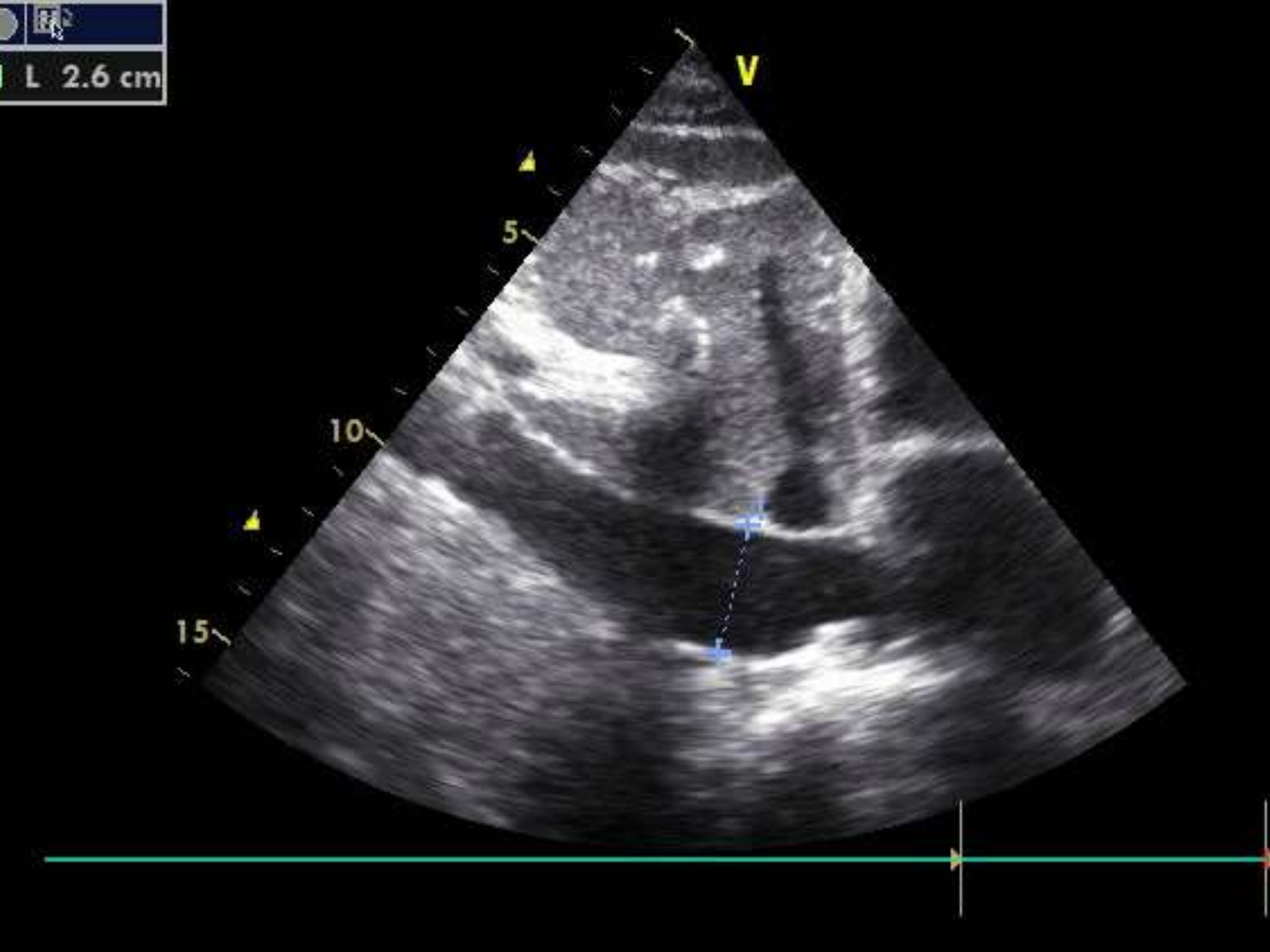

25/04/2013 15:16:59
32
V
2
4
vfem sin
25/04/2013 15:16:59
32
V
2
4
25/04/2013 15:16:59
32
V
2
vfem sin
25/04/2013 15:16:59
32
V
2

II. Náplň oběhu

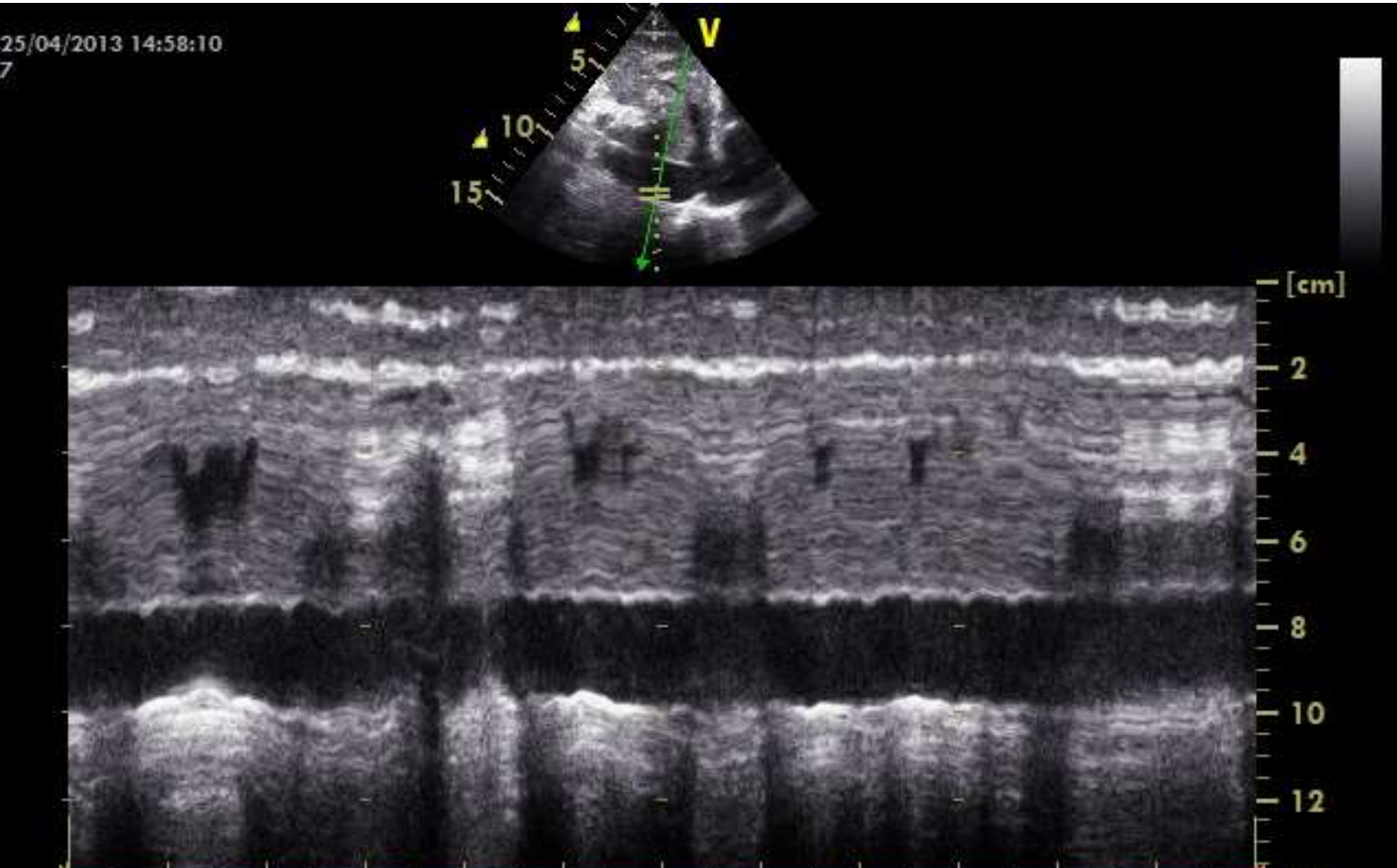
- IVC
  - Spontánní ventilace:
  - CAVE: UPV (18%)

CVP	0-5	5-10 mmHg		15
IVC	< 21mm	< 21mm	> 21mm	> 21mm
Inspirační kolaps	> 50%	< 50%	> 50%	< 50%

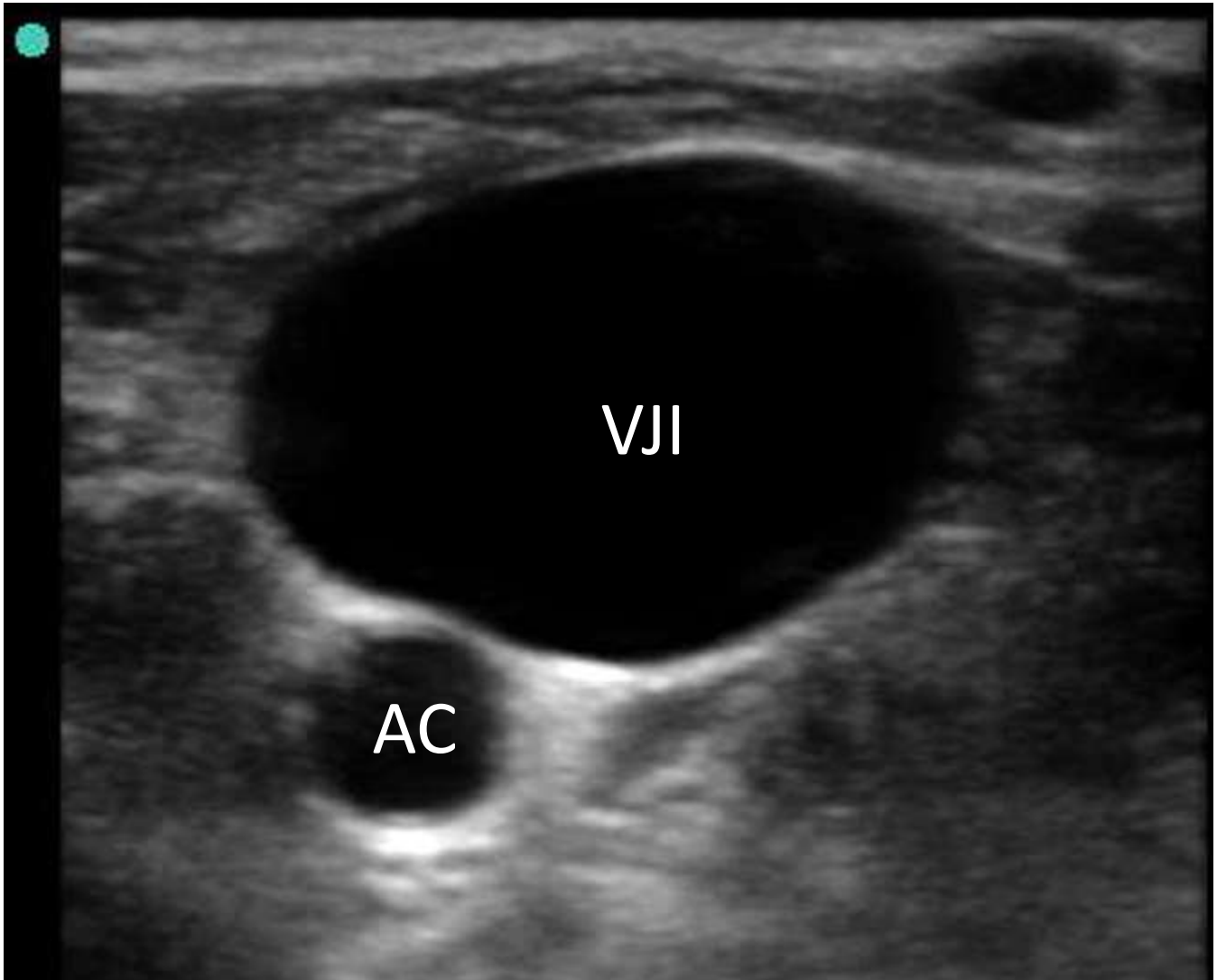
J Am Soc Echocardiogr 2010;23:685-713


L 2.6 cm
V
5
10
15

Respirační kolaps DDž (%)

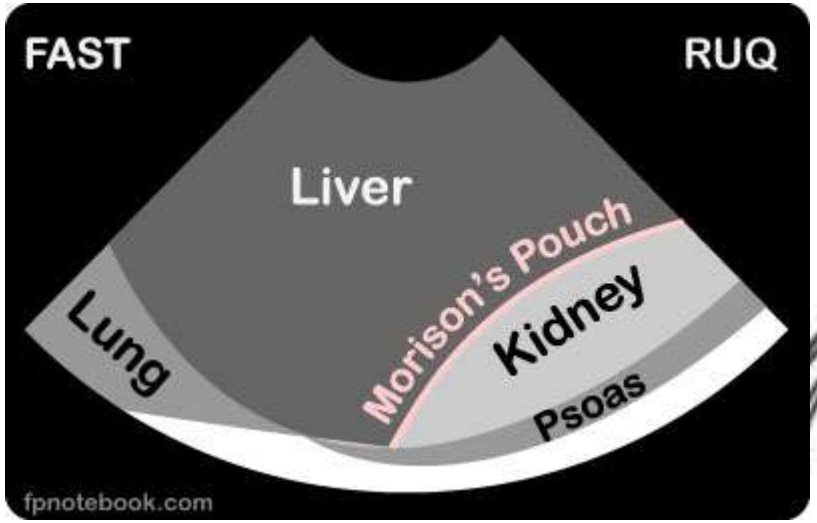


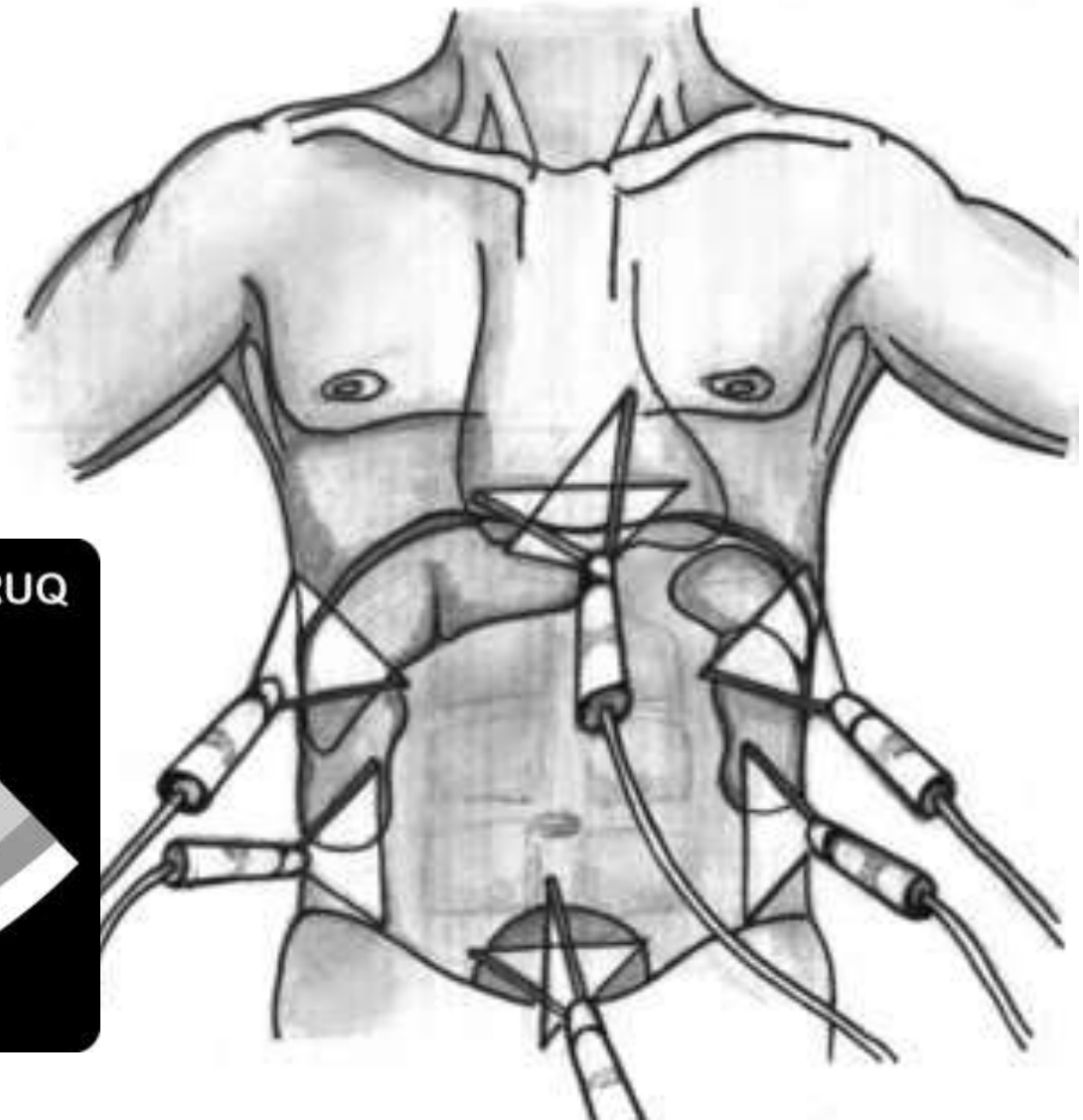
IIB. Krční žíly



IIC. Náplň oběhu - krvácení

- FAST protokol : 20s
  - Morrisonův prostor + pleury
  - Douglasův prostor





① Cardiac tamponade

② Right upper abdominal bleeding

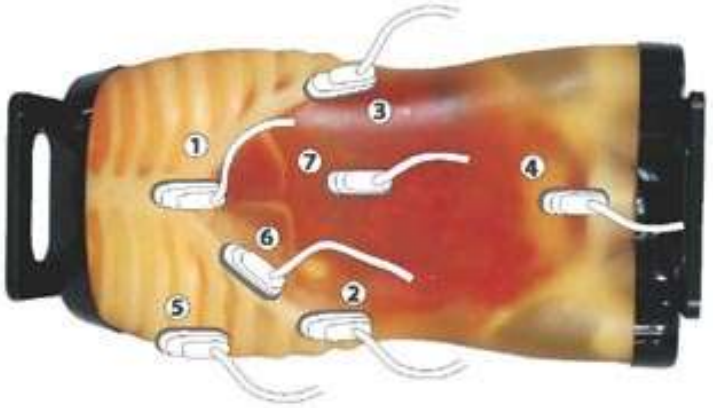
③ Left upper abdominal bleeding

④ Pelvic bleeding

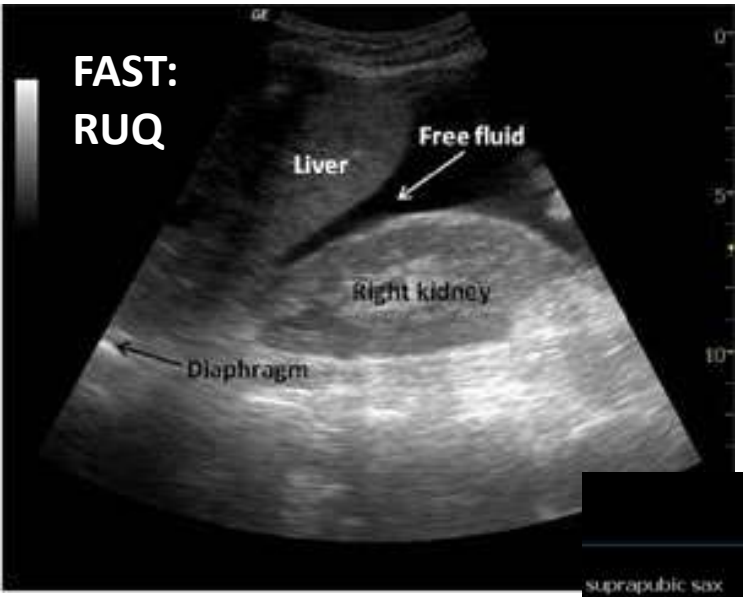
⑤ Pleural bleeding

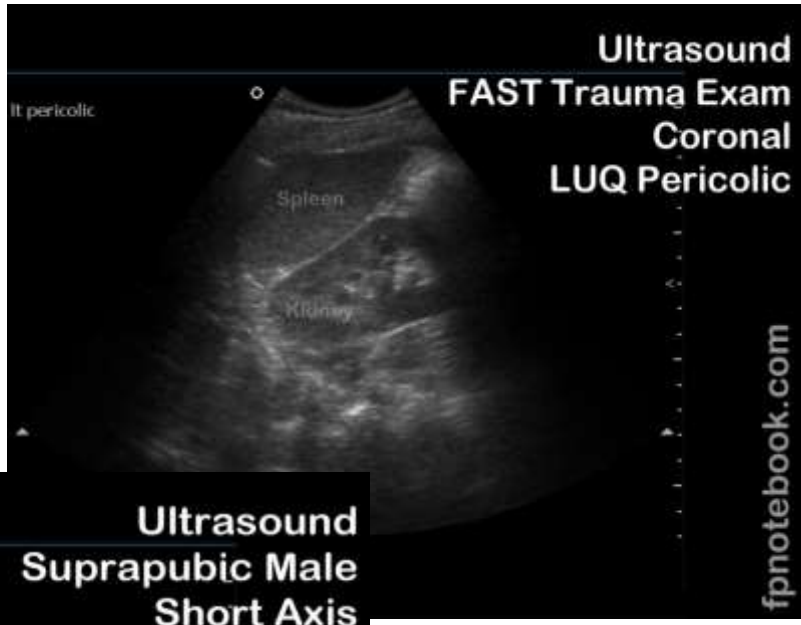
⑥ Peri-hepatic bleeding

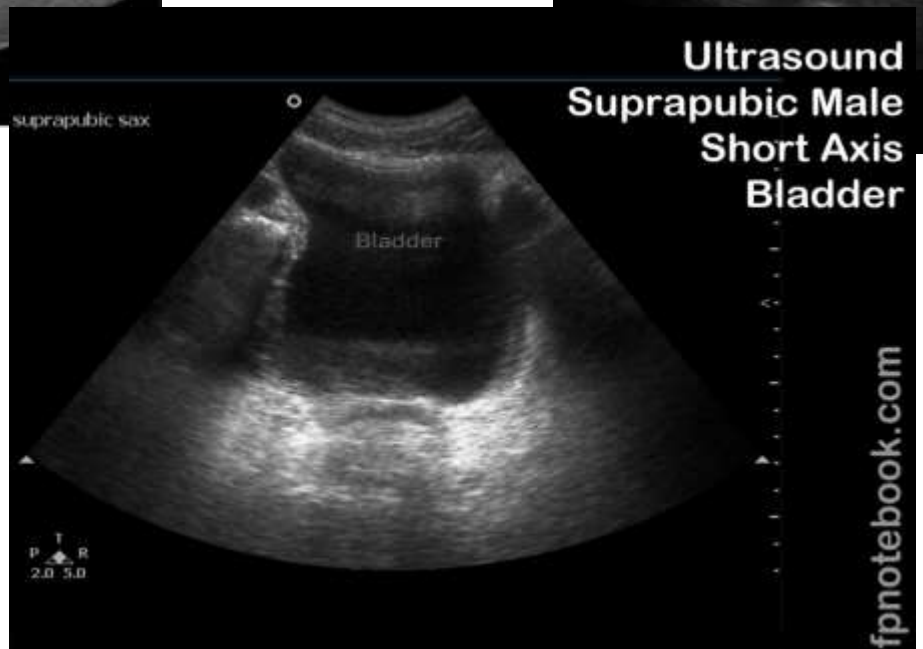
⑦ Abdominal aortic aneurysm



IIC. FAST

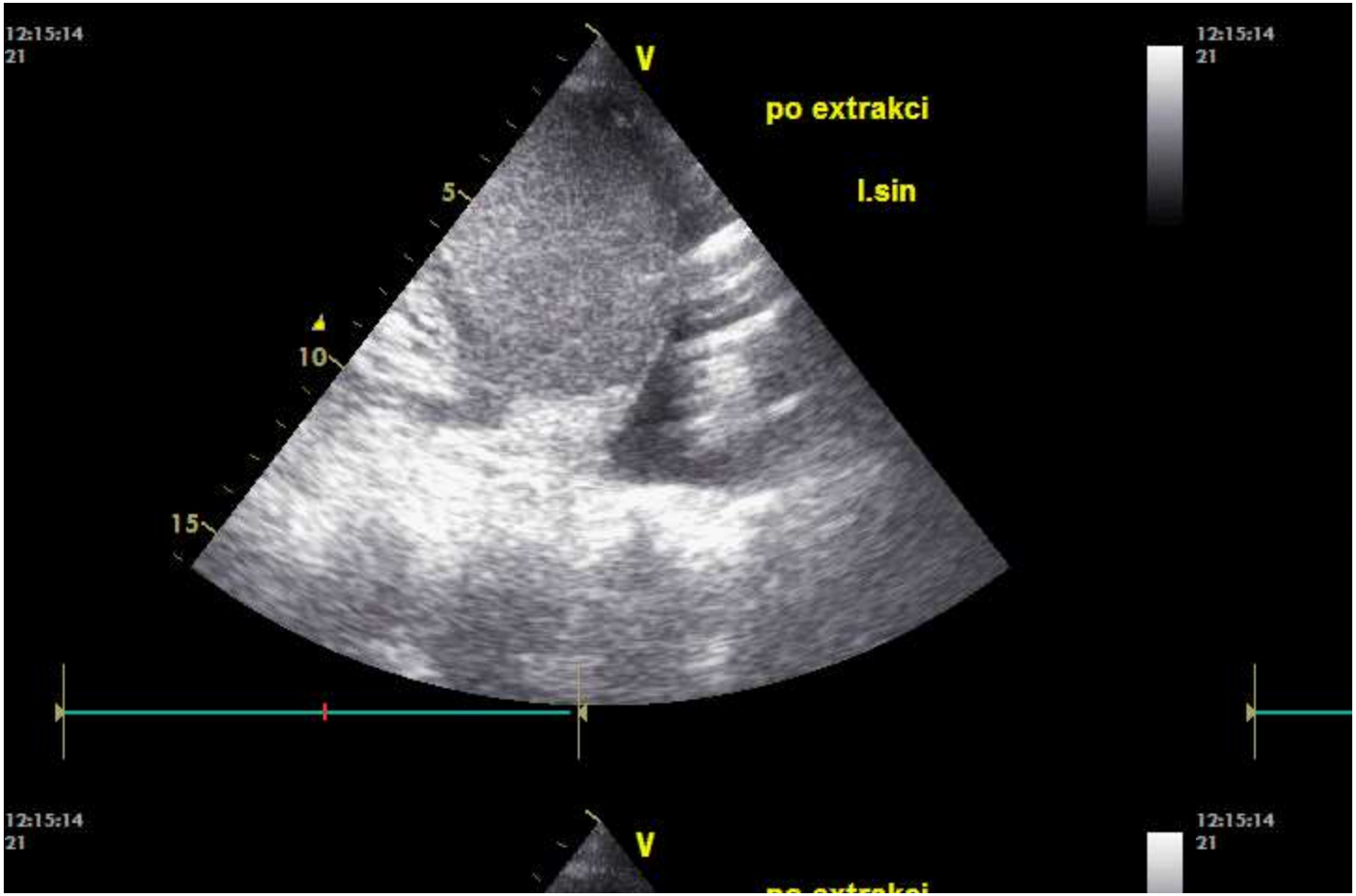

FAST:
RUQ
Liver
Free fluid
Right kidney
Diaphragm


Ultrasound
FAST Trauma Exam
Coronal
LUQ Pericolic
lt pericolic
Spleen
Kidney
fpnotebook.com


Ultrasound
Suprapubic Male
Short Axis
Bladder
suprapubic sax
Bladder
fpnotebook.com


930
14
0
Spin: 21
Tilt: -16
A


Spin: 170
Tilt: 9
P


12:15:14
21
V
po extrakci
l.sin
5
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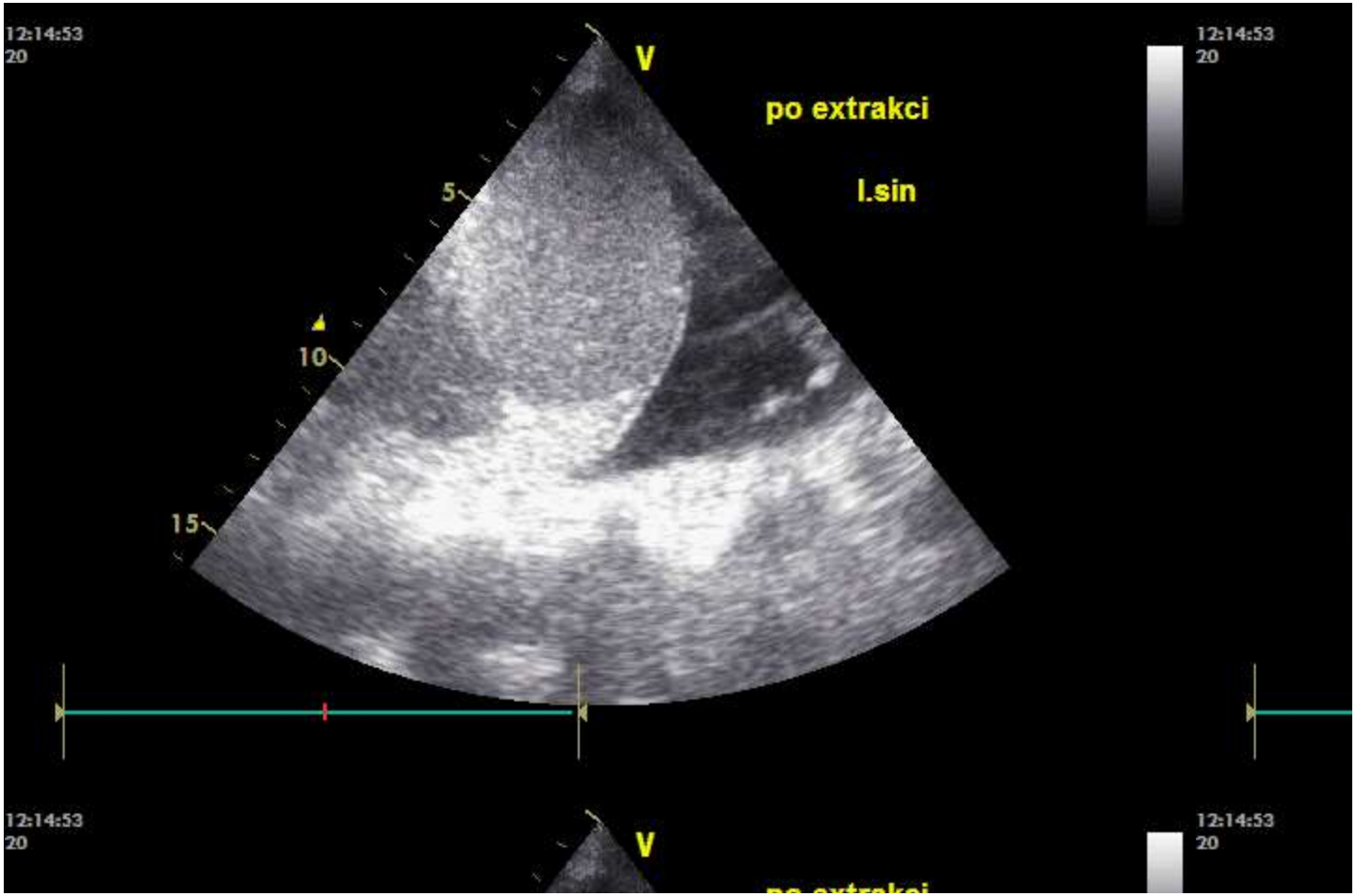
12:15:14
21
12:15:14
21
V
12:15:14
21


12:14:53
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po extrakci
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15
12:14:53
20
12:14:53
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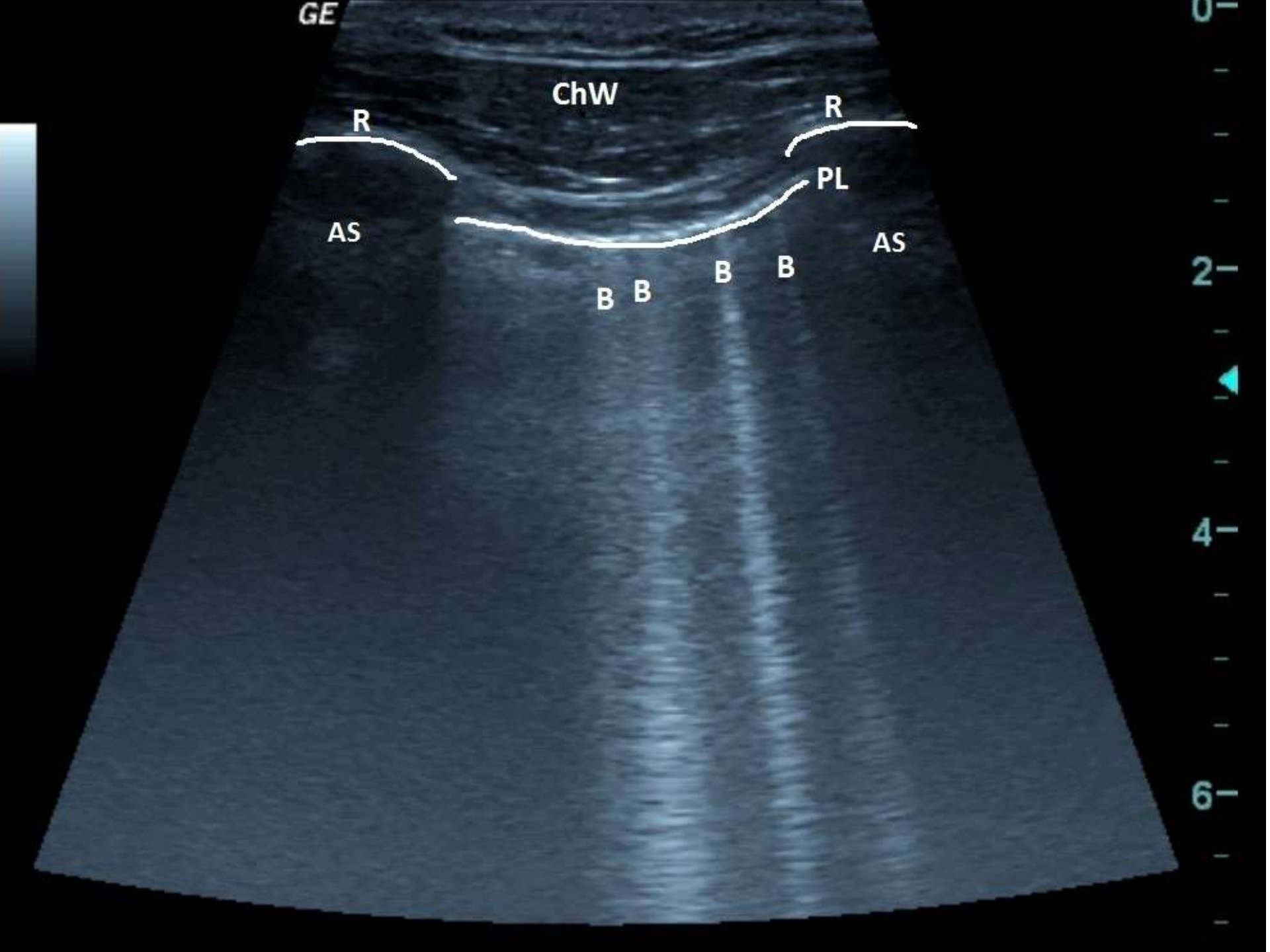
12:14:53
20

IID. Náplň oběhu – útlak
Pneumothorax


ChW
PL
A1
A2
5
10
15


GE
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PL
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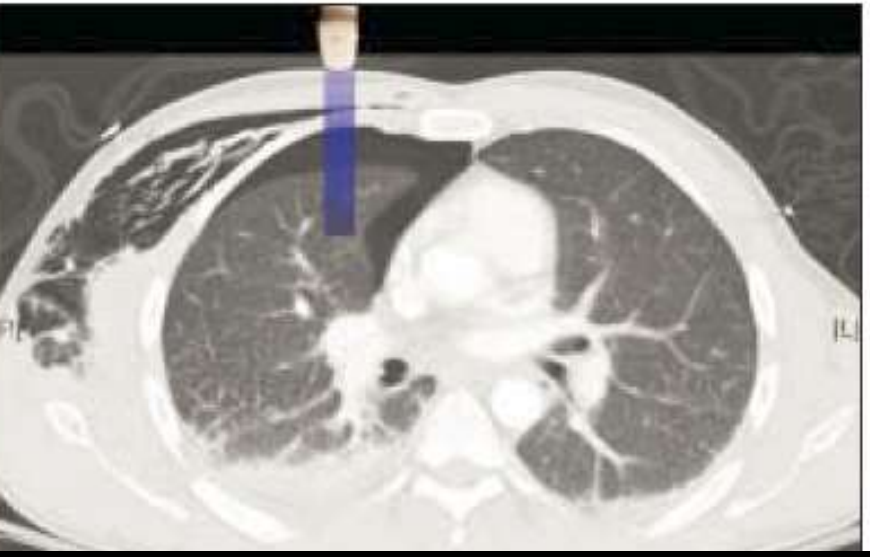
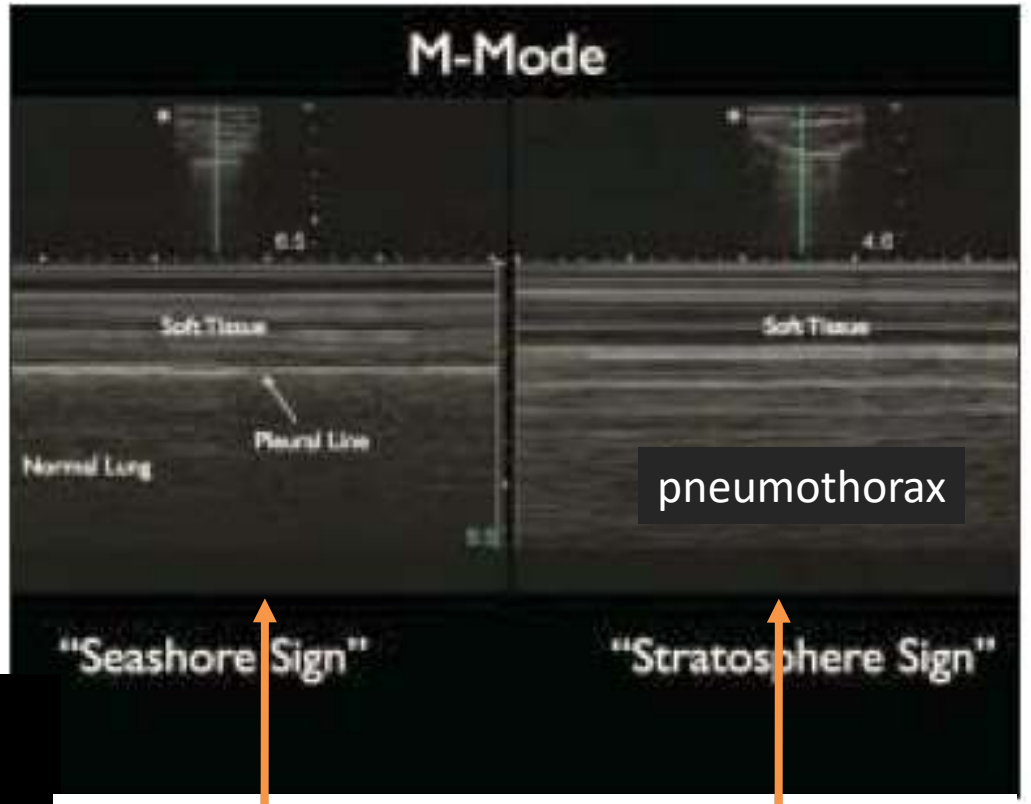
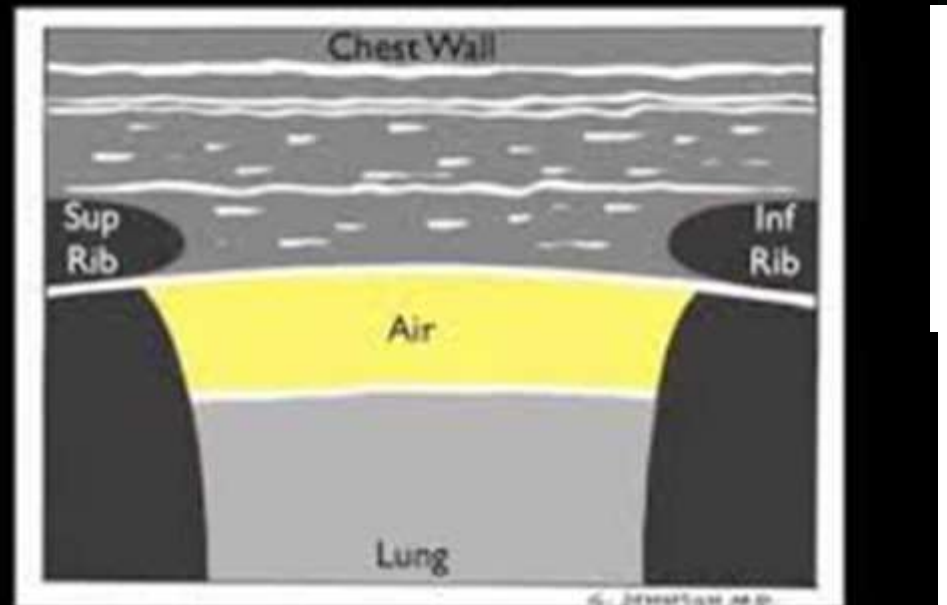
B
0
2
4
6

IID.Pneumothorax



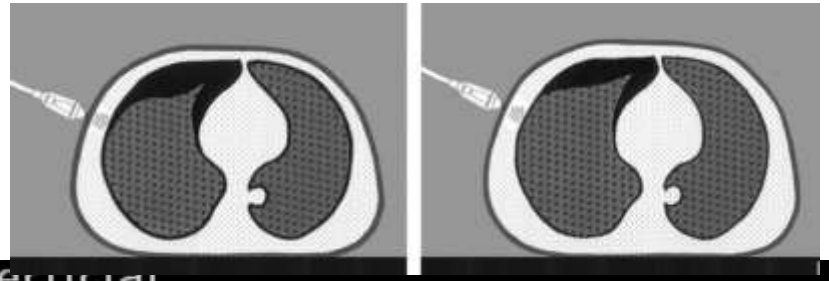




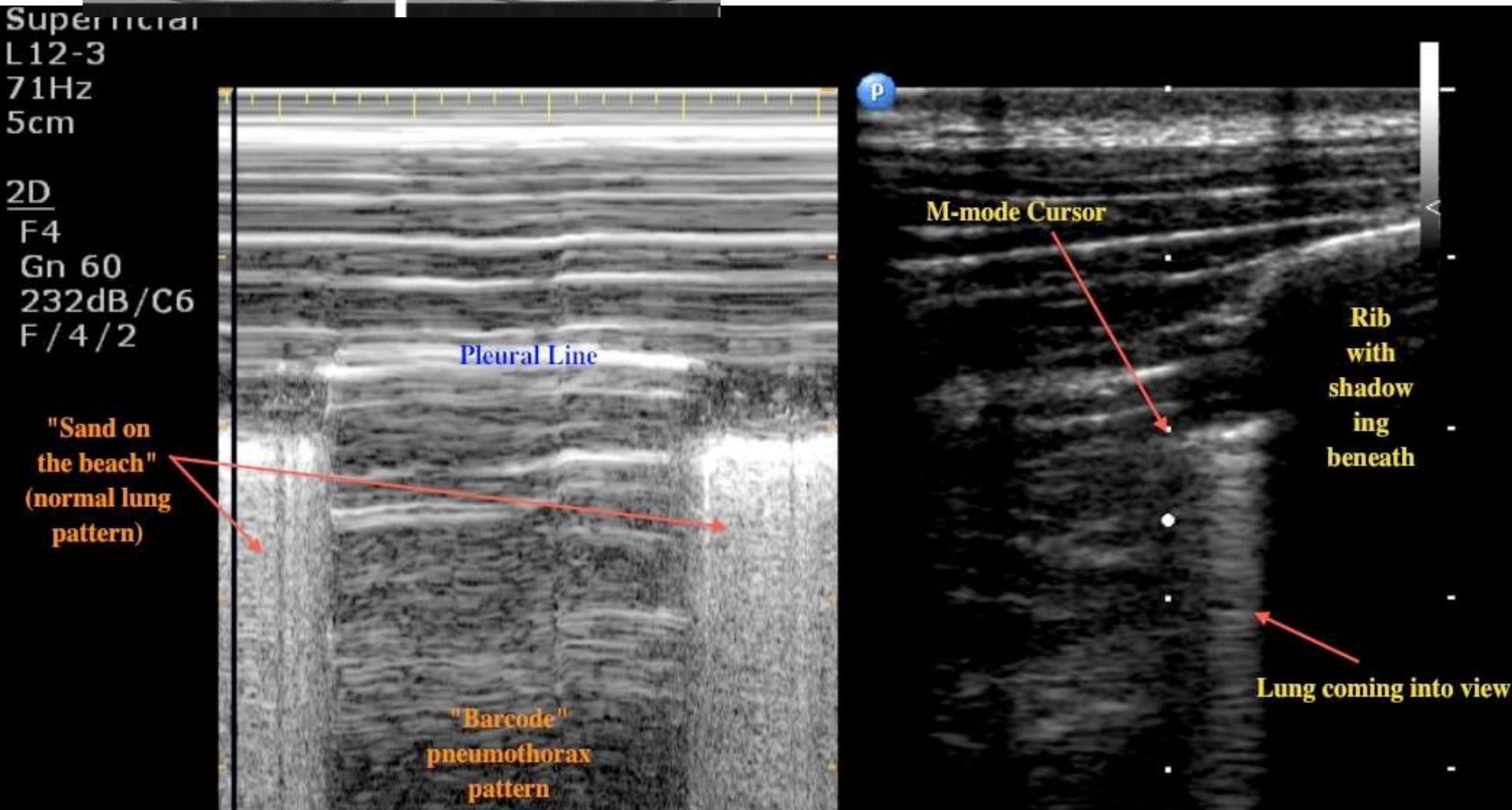
- **Seashore sign**
- **Stratosphere sign (barrcode sign)**

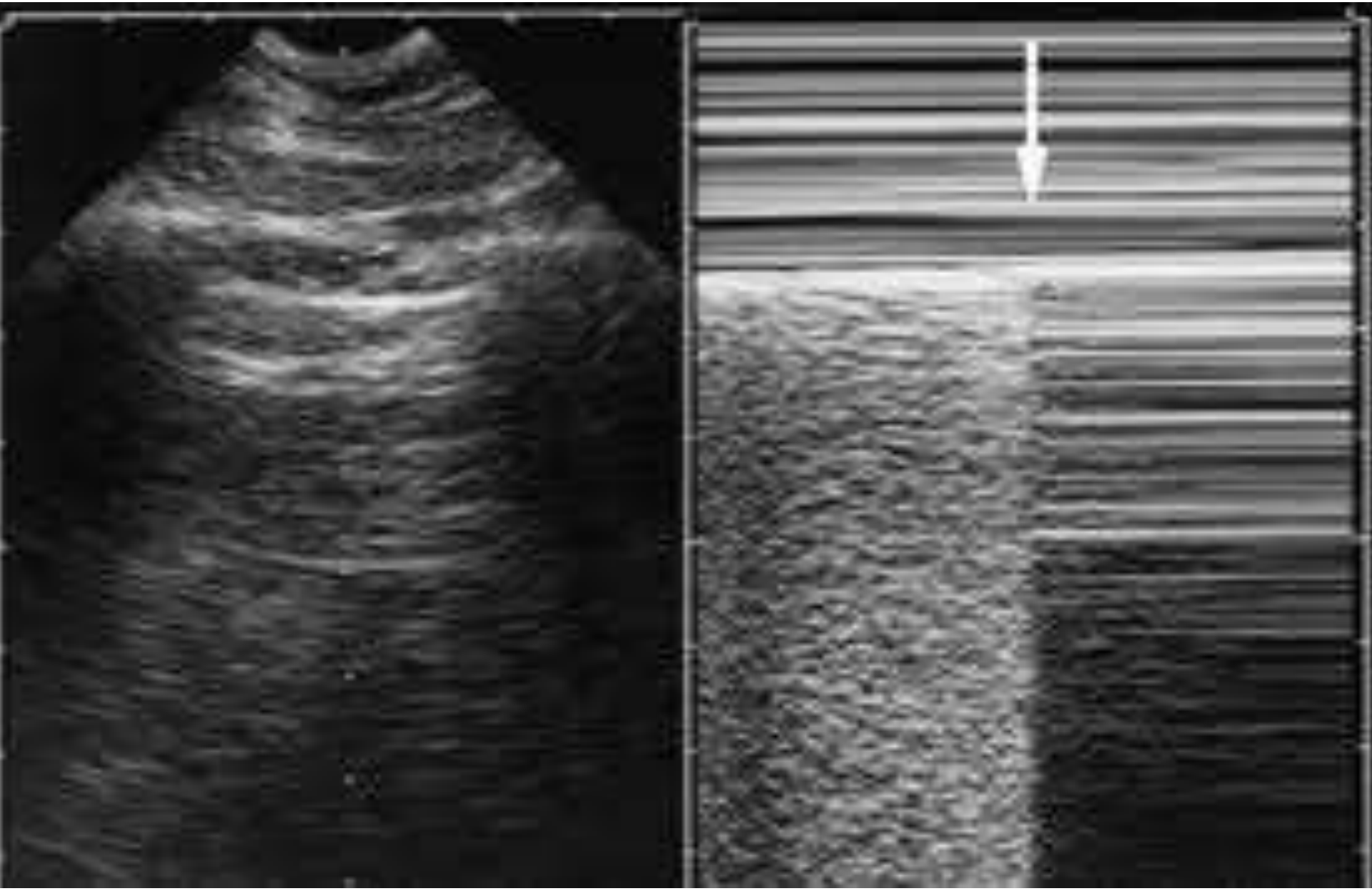
Nagdev, A, Murphy, M, : Ultrasound Detection of Traumatic Anterior Pneumothorax: ACEP News Dec 2008

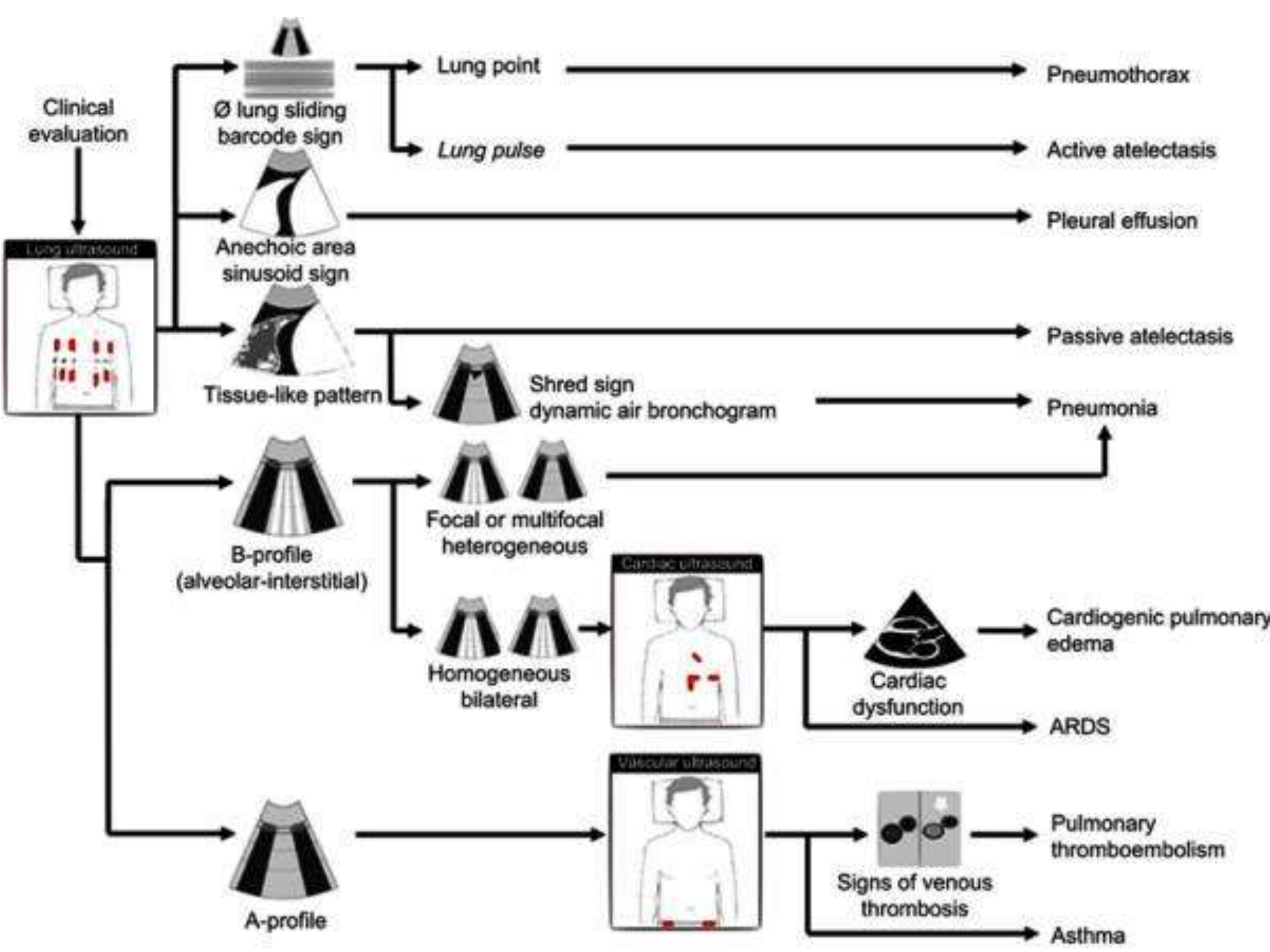
Lung point



Nagdev, A, MD, and Murphy, M, MD: Ultrasound Detection of Traumatic Anterior Pneumothorax: ACEP News December 2008






Clinical evaluation
Lung ultrasound
Ø lung sliding barcode sign
Lung point
Pneumothorax
Lung pulse
Active atelectasis
Anechoic area sinusoid sign
Pleural effusion
Tissue-like pattern
Passive atelectasis
Shred sign dynamic air bronchogram
Pneumonia
B-profile (alveolar-interstitial)
Focal or multifocal heterogeneous
Homogeneous bilateral
Cardiac ultrasound
Cardiac dysfunction
Cardiogenic pulmonary edema
ARDS
A-profile
Vascular ultrasound
Signs of venous thrombosis
Pulmonary thromboembolism
Asthma

PNX u E-FAST

Retrospektivní studie 6 let : leden 2013 - prosinec 2018:
3320 konsekventních traumatických pt. X 2 = 6640 vyšetřených plicních křídel
1244 PNX definitivních (MDCT či únik vzduchu při emergentní punkci)
E-FAST : 1328 Diagnostikovaných PNX

FN 84 : 38 obézních (BMI nad 27), 12 podkožní emfyzém, 6 hematom , 4 penetrující trauma hrudníku

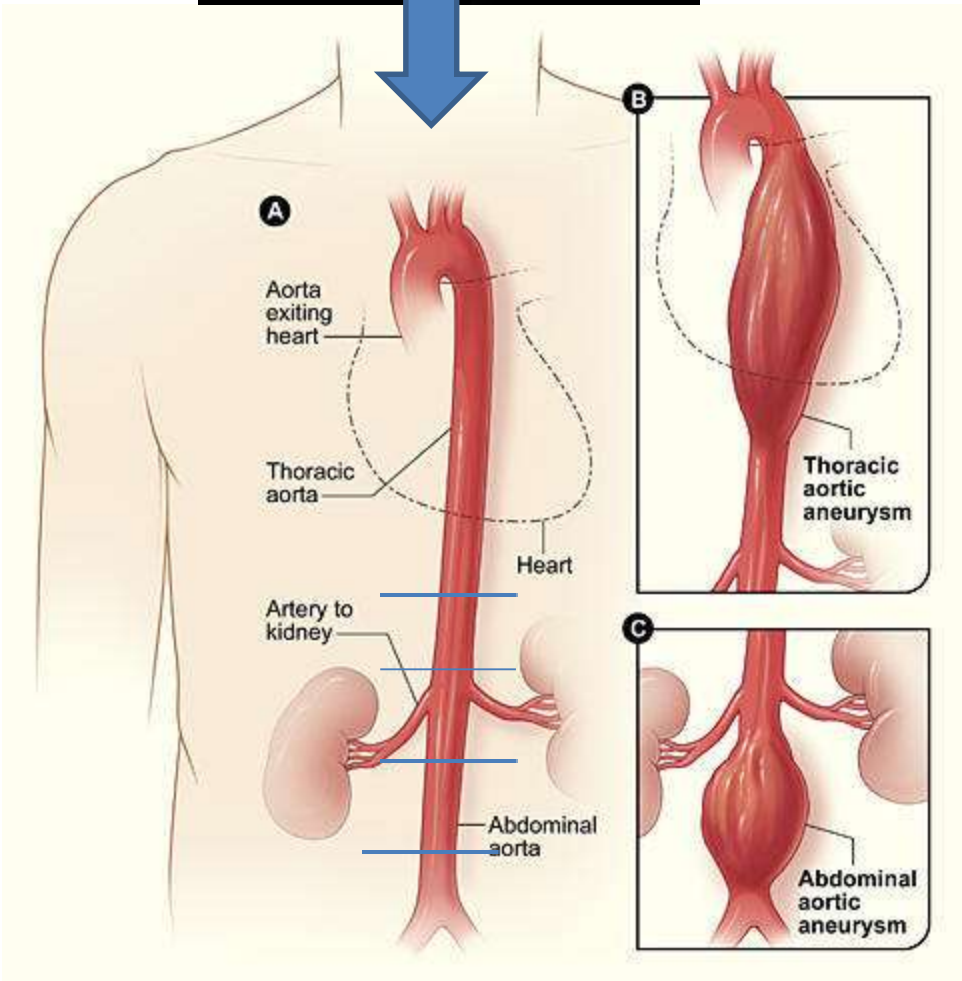
FP 10 : široký rozptyl vysvětlení

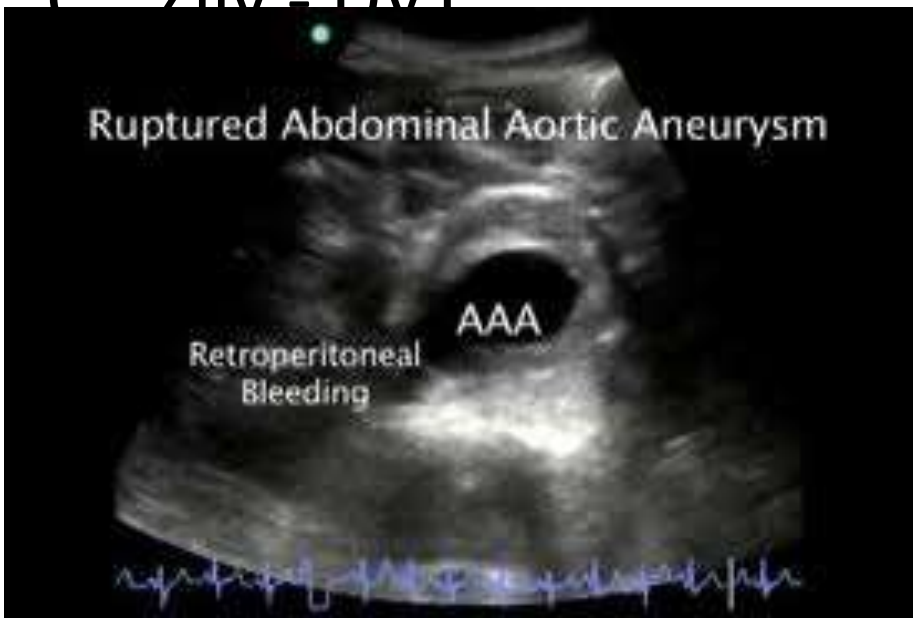
Sensitivita E-FAST pro PNX	93.6% (1244/1328),
Specificita E-FAST pro PNX	99.8% (5312/5322),
NPV	98.4% (5312/5396),
PPV	99.2% (1328/1338).

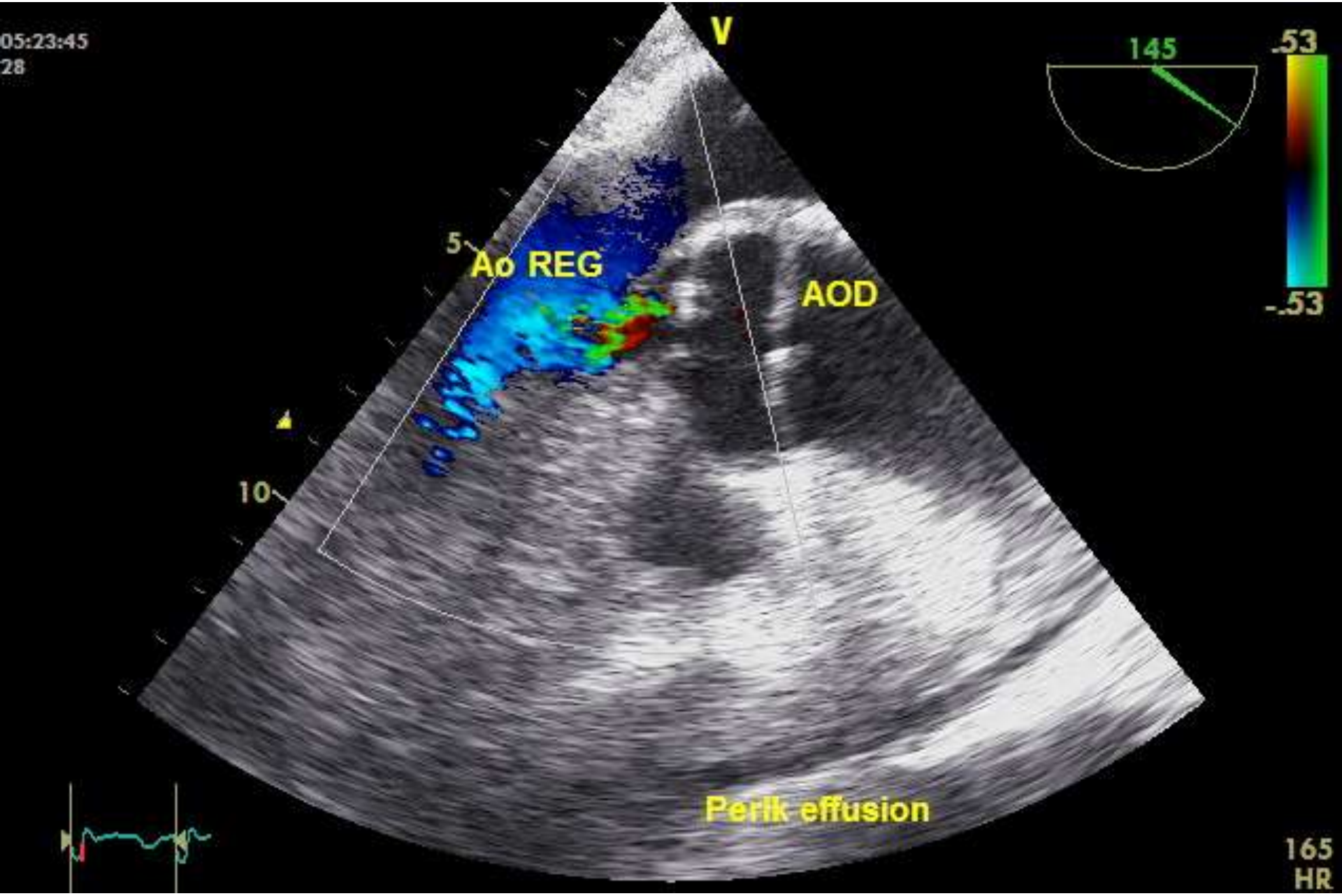
Ianniello S, Piccolo CL, Trinci M, Ajmone Cat CA, Miele V.J.
Extended-FAST plus MDCT in pneumothorax diagnosis of major trauma: time to revisit ATLS imaging approach?
J Ultrasound. 2019 Dec;22(4):461-469. doi: 10.1007/s40477-019-00410-4. Epub 2019 Nov 4.

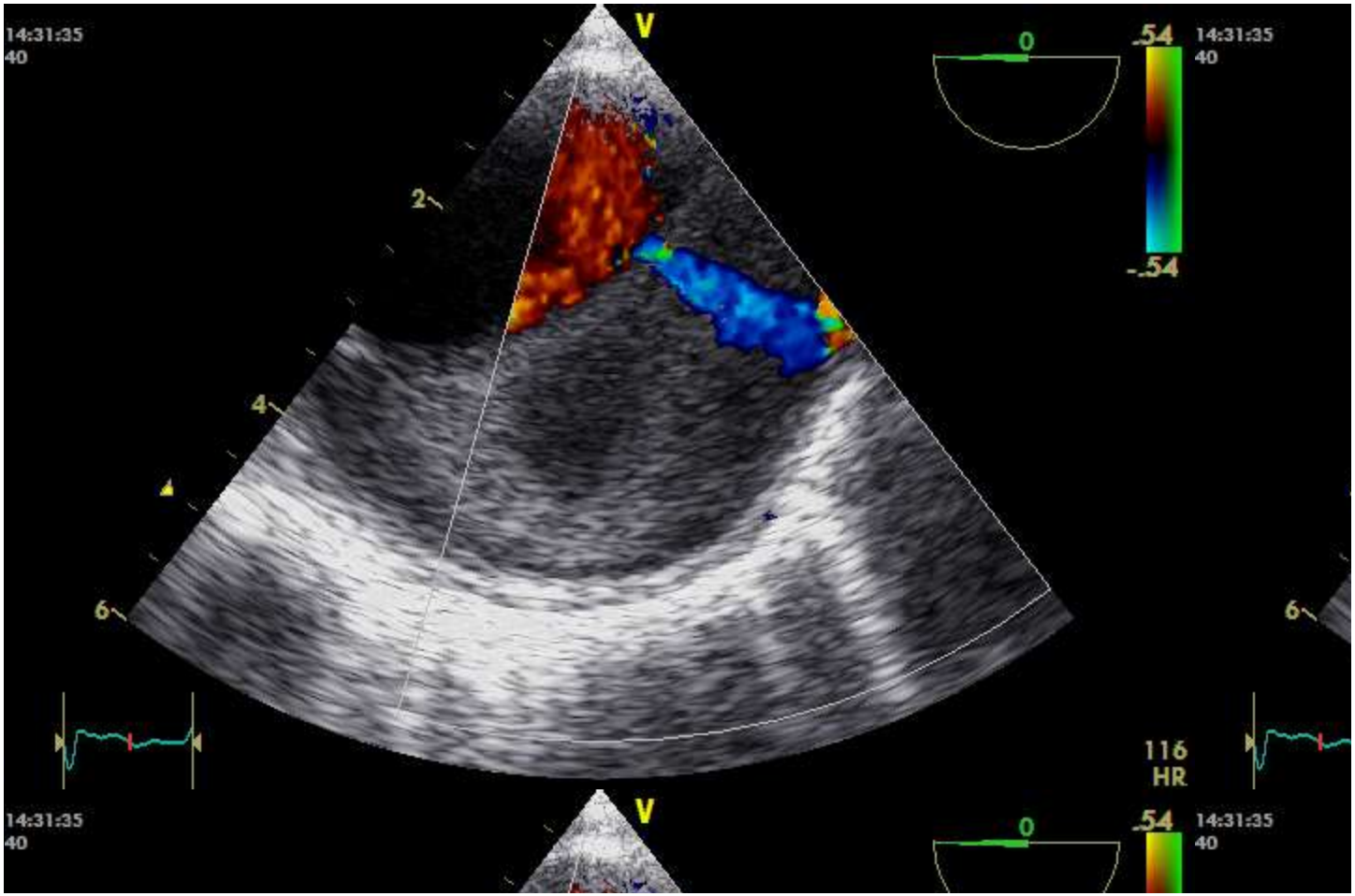
III. Velké cévy

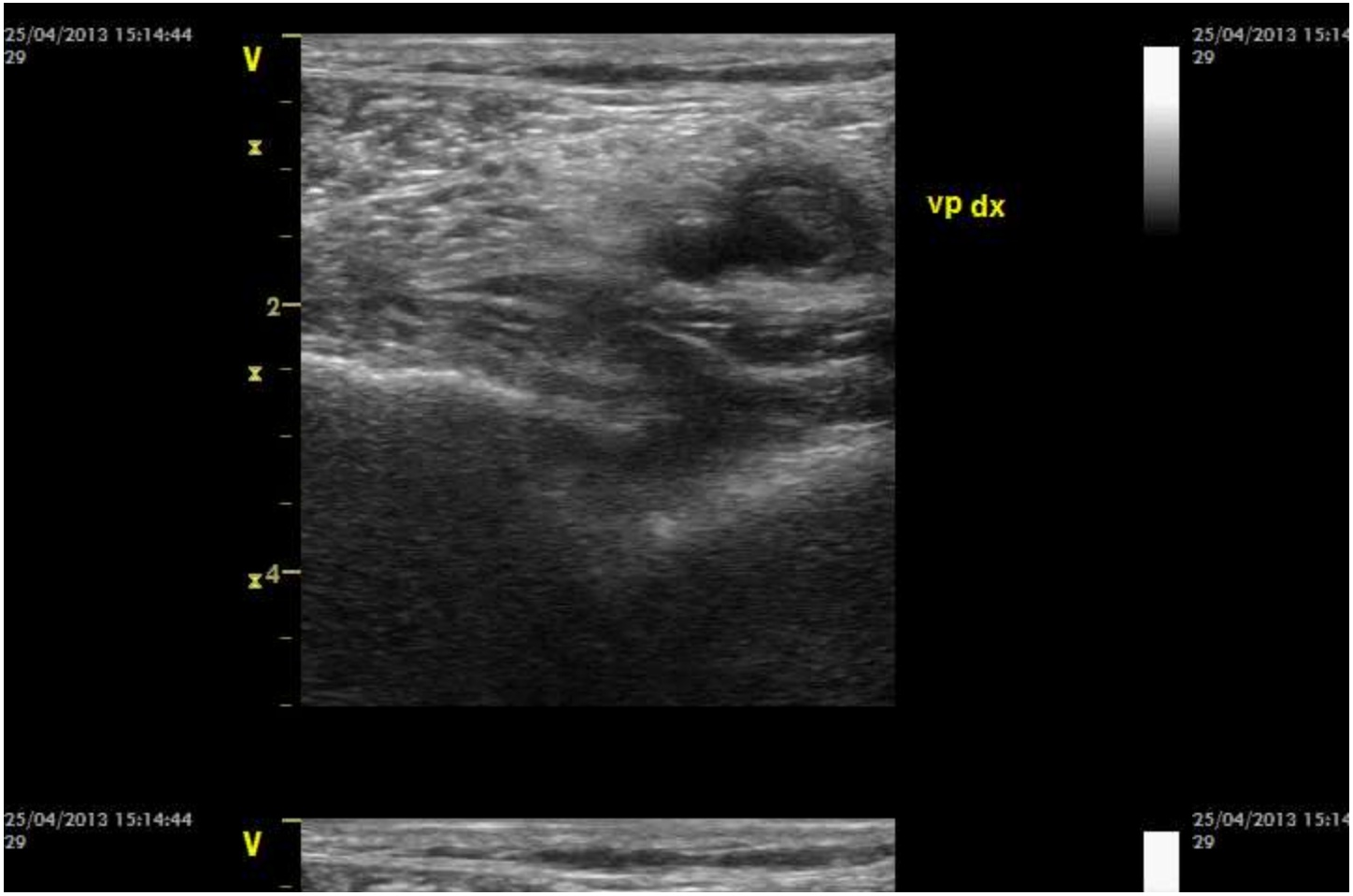
A. Ascendentní Aorta + Oblouk + Descendentní Aorta
B. AAA
C. Žíly - DVT

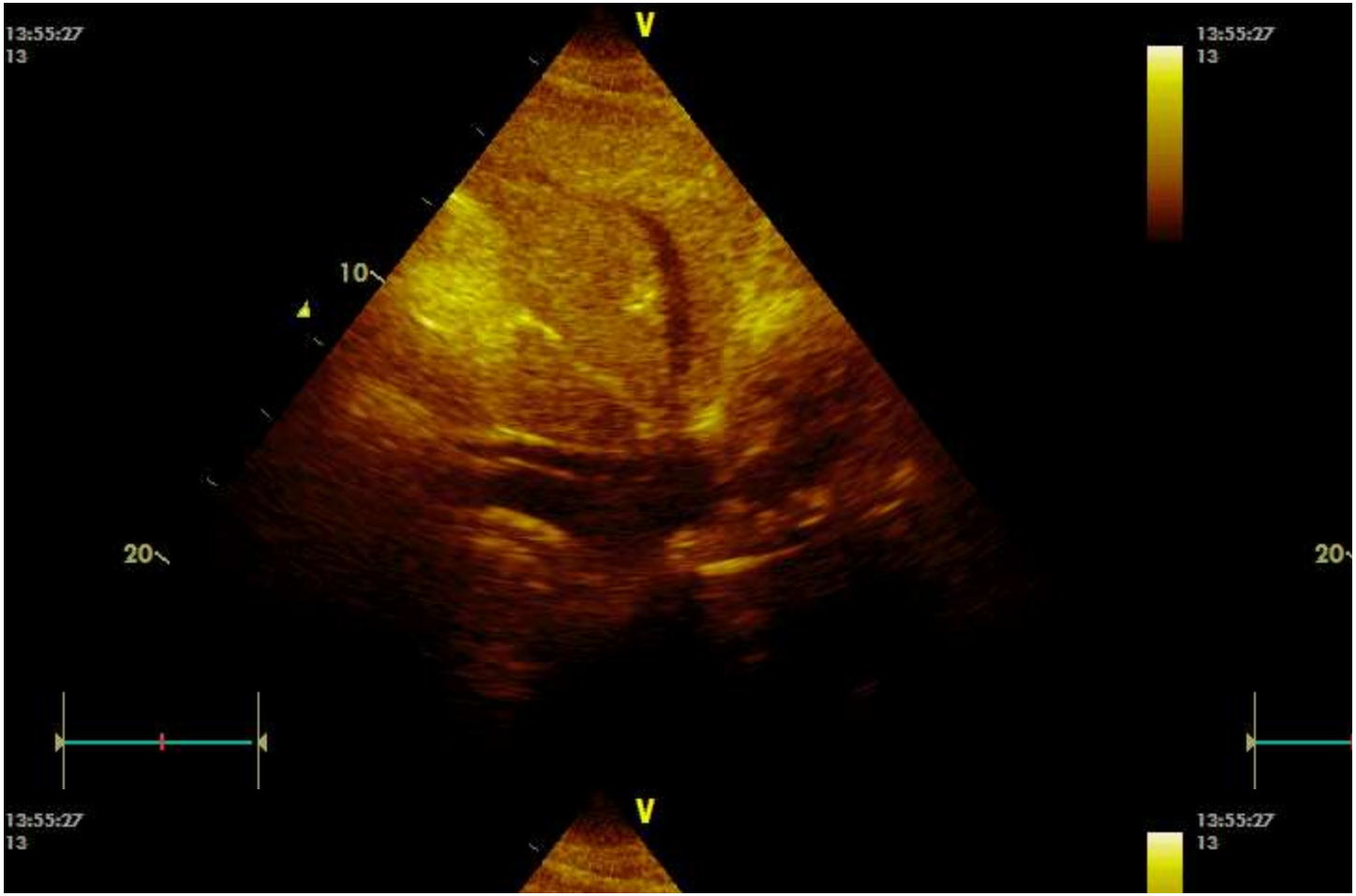





05:23:45
28
V
145
.53
-.53
5
Ao REG
AOD
10
Perik effusion
165
HR


14:31:35
40
V
0
.54
-.54
14:31:35
40
2
4
6
116
HR
14:31:35
40
V
0
.54
14:31:35
40


25/04/2013 15:14:44
29
V
2
4
vp dx
25/04/2013 15:14
29
25/04/2013 15:14:44
29
V
25/04/2013 15:14
29


13:55:27
13
V
13:55:27
13
10
20
20
13:55:27
13
V
13:55:27
13

Závěr

- (Ultra)Rychlý protokol (2-5min) umožňuje rychlou orientaci v emergentní situaci a rychlou diagnostiku
- Bedside
- Bez transportu a záření

- Vyžaduje zkušenost v interpretaci,
- Trénink a každodenní praxi

- Přístrojové vybavení

DESATERO UZ vyšetření v šoku a hypotenzi:

I. Srdce */pumpa/*

- A. Perikard **1**
- B. LK **2**
- C. PK **3**

I. Náplň oběhu – */nádrž/*

- *A. IVC* **4**
- *B. VJE* **5**
- *C. FAST* **6**
- *D. Útlak v hrudníku – PNO, fluidothorax* **7**

II. Cévy – */trubky/*

- *A. ASC Aorta + oblouk + desc. Aorta* **8**
- *B. Abdom. Aorta - AAA* **9**
- *C. Žíly (trombosa)* **10**

A B C D (of EE)

A. Awereness – bojuj proti rutině, mysli dále za zřejmou dg.

A. Be suspicious – vstupní Dg může být zavádějící, nikdy nevěř dokud se sám nepřesvědčíš.

A. Comprehensivness – as complete as possible, careful interpretation

A. Double R (**R**ecord and **R**eview + team work)