Zobrazovací metody CTEPH

Tromboembolická nemoc - od žilní trombózy po chronické komplikace plicní embolie

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XXVI. Výroční sjezd ČKS, Veletrhy Brno, 8. 5. 2018, sál Olomouc, pavilon E, 12.00-12.15 hod.

I. INTERNÍ KLINIKA
KARDIOLOGIE
FAKULTNÍ NEMOCNICE OLOMOUC

European Heart Journal (2014) **35**, 3033–3080
doi:10.1093/eurheartj/ehu283

ESC GUIDELINES

2014 ESC Guidelines on the diagnosis and management of acute pulmonary embolism

The Task Force for the Diagnosis and Management of Acute Pulmonary Embolism of the European Society of Cardiology (ESC)

Endorsed by the European Respiratory Society (ERS)

Authors/Task Force Members: Stavros V. Konstantinides* (Chairperson) (Germany/Greece), Adam Torbicki* (Co-chairperson) (Poland), Giancarlo Agnelli (Italy), Nicolas Danchin (France), David Fitzmaurice (UK), Nazzareno Galiè (Italy), J. Simon R. Gibbs (UK), Menno V. Huisman (The Netherlands), Marc Humbert† (France), Nils Kucher (Switzerland), Irene Lang (Austria), Mareike Lankeit (Germany), John Lekakis (Greece), Christoph Maack (Germany), Eckhard Mayer (Germany), Nicolas Meneveau (France), Arnaud Perrier (Switzerland), Piotr Pruszczyk (Poland), Lars H. Rasmussen (Denmark), Thomas H. Schindler (USA), Pavel Svitil (Czech Republic), Anton Vonk Noordegraaf (The Netherlands), Jose Luis Zamorano (Spain), Maurizio Zompatori (Italy)

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European Heart Journal
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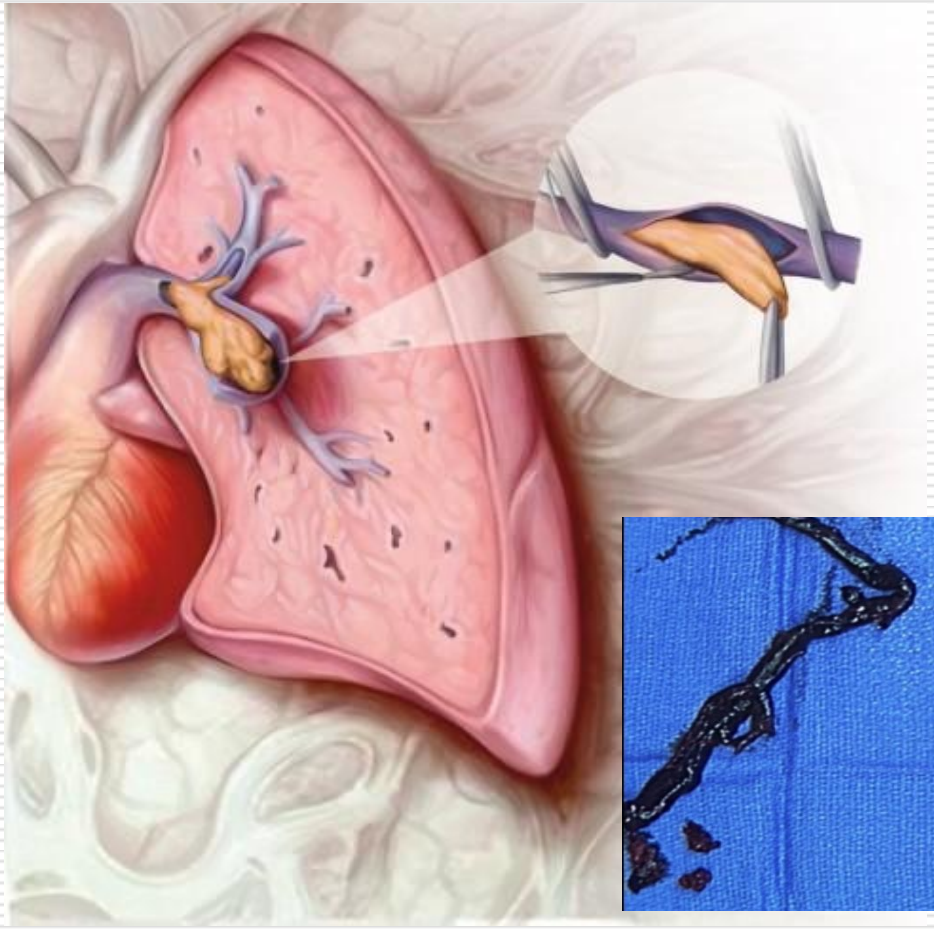
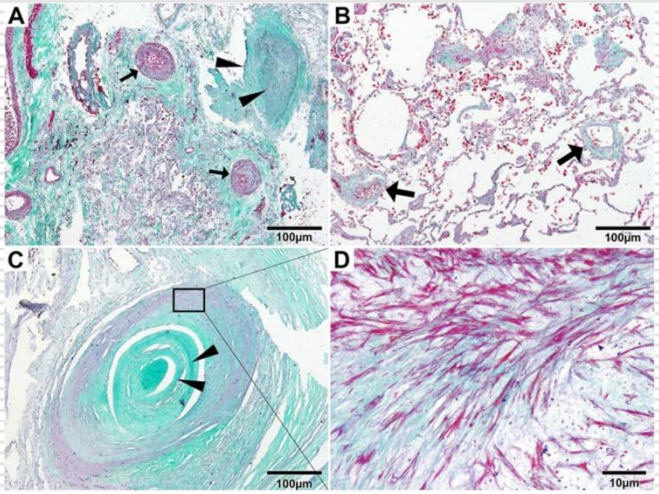
ESC/ERS GUIDELINES

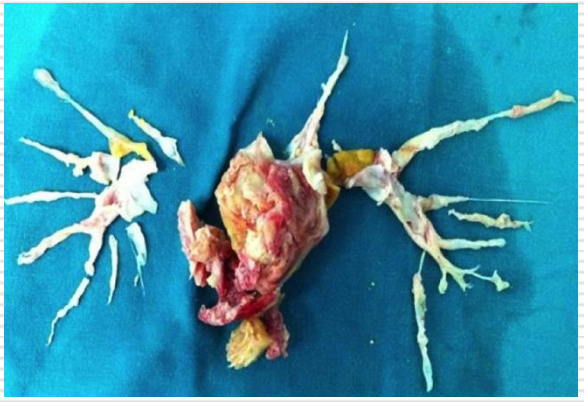
2015 ESC/ERS Guidelines for the diagnosis and treatment of pulmonary hypertension

The Joint Task Force for the Diagnosis and Treatment of Pulmonary Hypertension of the European Society of Cardiology (ESC) and the European Respiratory Society (ERS)

Endorsed by: Association for European Paediatric and Congenital Cardiology (AEPC), International Society for Heart and Lung Transplantation (ISHLT)

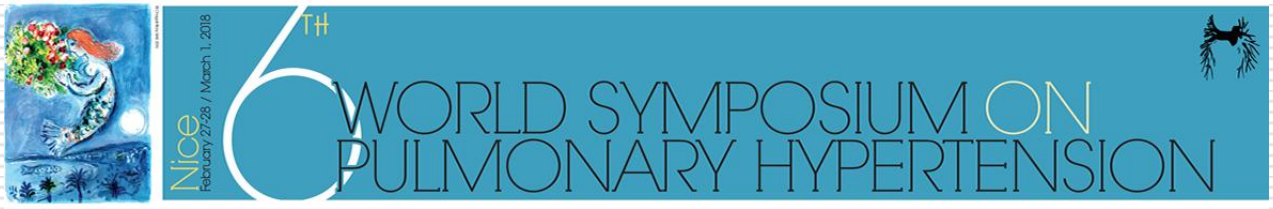






Irene Marthe Lang, and Michael Madani Circulation. 2014;130:508-518

Hemodynamická definice plicní hypertenze



Definice PH — **MPAP ≥20/25 mmHg**

Definice PAH — **MPAP ≥20/25 mmHg**; **PAWP ≤15 mmHg**; **PVR >3 WU**

PAP: pulmonary arterial pressure; PAWP: pulmonary artery wedge pressure; PVR: pulmonary vascular resistance

Hoeper MM, *et al. J Am Coll Cardiol* 2013; 62:D42-50.
6th World Symposium on Pulmonary Hypertension, Nice, February 27 to March 1, 2018

Plicní hypertenze - definice a klasifikace

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Updated Clinical Classification of Pulmonary Hypertension

Gerald Simonneau, MD,* Michael A. Gatzoulis, MD, PHD,† Ian Adatia, MD,‡ David Celermajer, MD, PHD,§ Chris Denton, MD, PHD,‖ Ardeschir Ghofrani, MD,¶ Miguel Angel Gomez Sanchez, MD,# R. Krishna Kumar, MD,** Michael Landzberg, MD,†† Roberto F. Machado, MD,‡‡ Horst Olschewski, MD,§§ Ivan M. Robbins, MD,‖‖ Rogiero Souza, MD, PHD¶¶

Definition	Characteristics	Clinical group(s)[b]
Pulmonary hypertension (PH)	Mean PAP ≥25 mmHg	All
Pre-capillary PH	Mean PAP ≥25 mmHg PWP ≤15 mmHg CO normal or reduced[c]	1. Pulmonary arterial hypertension 3. PH due to lung diseases 4. Chronic thromboembolic PH 5. PH with unclear and/or multifactorial mechanisms
Post-capillary PH	Mean PAP ≥25 mmHg PWP >15 mmHg CO normal or reduced[c]	2. PH due to left heart disease
Passive	TPG ≤12 mmHg	
Reactive (out of proportion)	TPG >12 mmHg	

Prevalence of PAH in the general population
15–50 cases per million (0.0015–0.0050%)

Prevalence of PAH in at risk populations
CHD: 4–15%
Systemic sclerosis: 8–10%
Portal hypertension: 0.5–10%
HIV: 0.5%
Sickle cell disease: 2%
BMPR2 mutation carriers: 20%

1. Pulmonary arterial hypertension
   1.1 Idiopathic PAH
   1.2 Heritable PAH
   1.2.1 BMPR2
   1.2.2 ALK-1, ENG, SMAD9, CAV1, KCNK3
   1.2.3 Unknown
   1.3 Drug and toxin induced
   1.4 Associated with:
   1.4.1 Connective tissue disease
   1.4.2 HIV infection
   1.4.3 Portal hypertension
   1.4.4 Congenital heart diseases
   1.4.5 Schistosomiasis

1′ Pulmonary veno-occlusive disease and/or pulmonary capillary hemangiomatosis
1″. Persistent pulmonary hypertension of the newborn (PPHN)

2. Pulmonary hypertension due to left heart disease
   2.1 Left ventricular systolic dysfunction
   2.2 Left ventricular diastolic dysfunction
   2.3 Valvular disease
   2.4 Congenital/acquired left heart inflow/outflow tract obstruction and congenital cardiomyopathies

3. Pulmonary hypertension due to lung diseases and/or hypoxia
   3.1 Chronic obstructive pulmonary disease
   3.2 Interstitial lung disease
   3.3 Other pulmonary diseases with mixed restrictive and obstructive pattern
   3.4 Sleep-disordered breathing
   3.5 Alveolar hypoventilation disorders
   3.6 Chronic exposure to high altitude
   3.7 Developmental lung diseases

4. Chronic thromboembolic pulmonary hypertension (CTEPH)

5. Pulmonary hypertension with unclear multifactorial mechanisms
   5.1 Hematologic disorders: chronic hemolytic anemia, myeloproliferative disorders, splenectomy
   5.2 Systemic disorders: sarcoidosis, pulmonary histiocytosis, lymphangioleiomyomatosis
   5.3 Metabolic disorders: glycogen storage disease, Gaucher disease, thyroid disorders
   5.4 Others: tumoral obstruction, fibrosing mediastinitis, chronic renal failure, segmental PH

Hoeper MM, *et al. J Am Coll Cardiol* 2013; 62:D42-50.

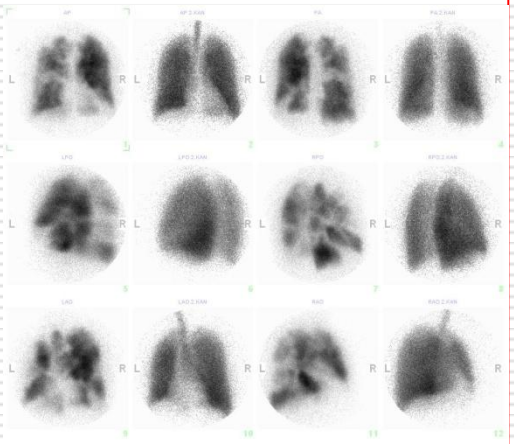
Plicní hypertenze - screening po plicní embolii

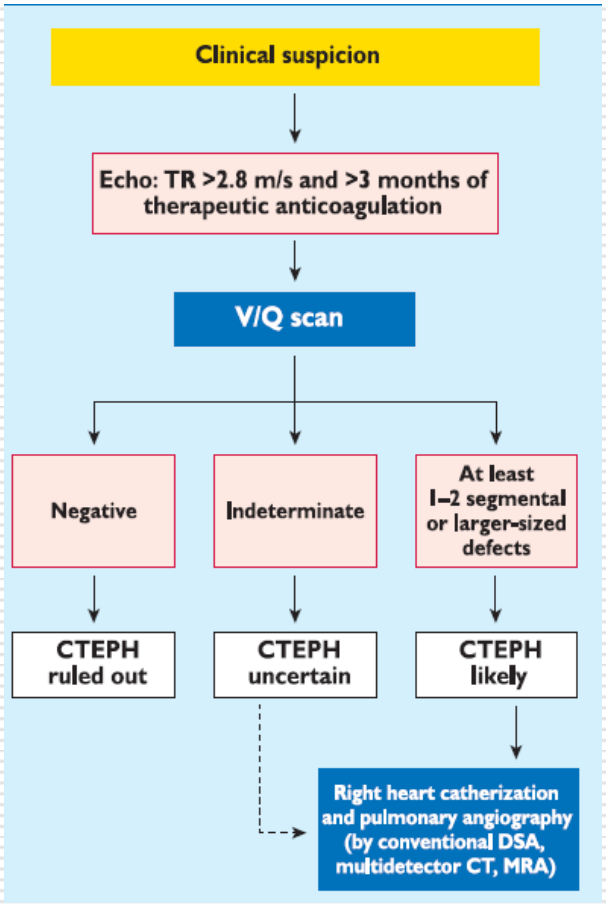
Recommendations	Class[a]	Level[b]	Ref.[c]
Interventional BPA may be considered in patients who are technically non-operable or carry an unfavourable risk:benefit ratio for PEA	IIb	C	57, 444–446, 448
Screening for CTEPH in asymptomatic survivors of PE is currently not recommended	III	C	417

1. SCREENING

- **Echokardiografie**

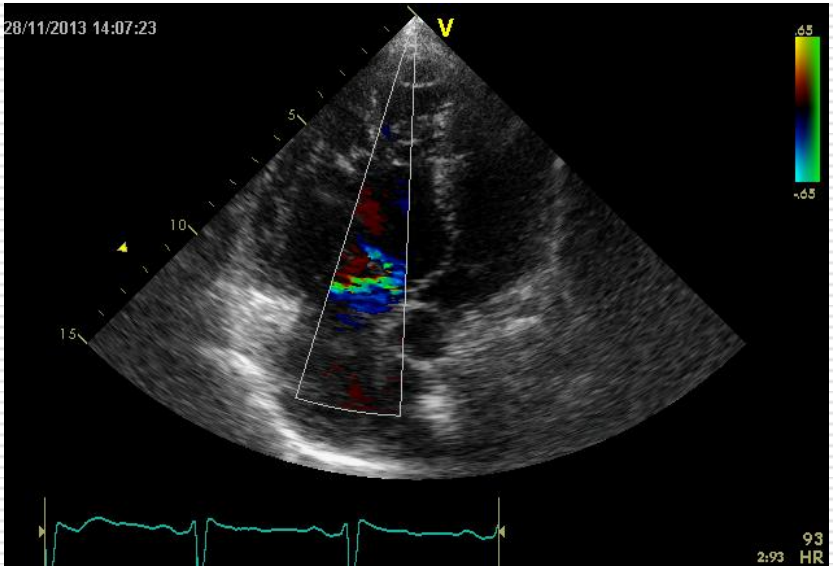
- **Scintigrafie plic**

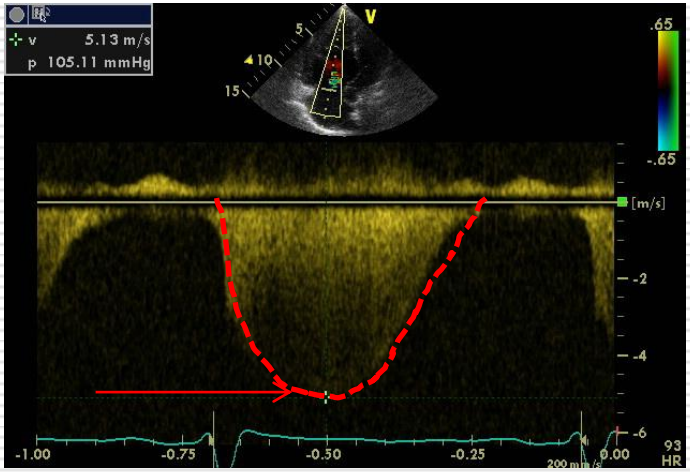




Obrázky poskytnuty laskavostí doc. Jansy

Echokardiografie – klíčový screeningový nástroj





CTEPH - screening

European Heart Journal
doi:10.1093/eurheartj/ehv317

ESC/ERS GUIDELINES

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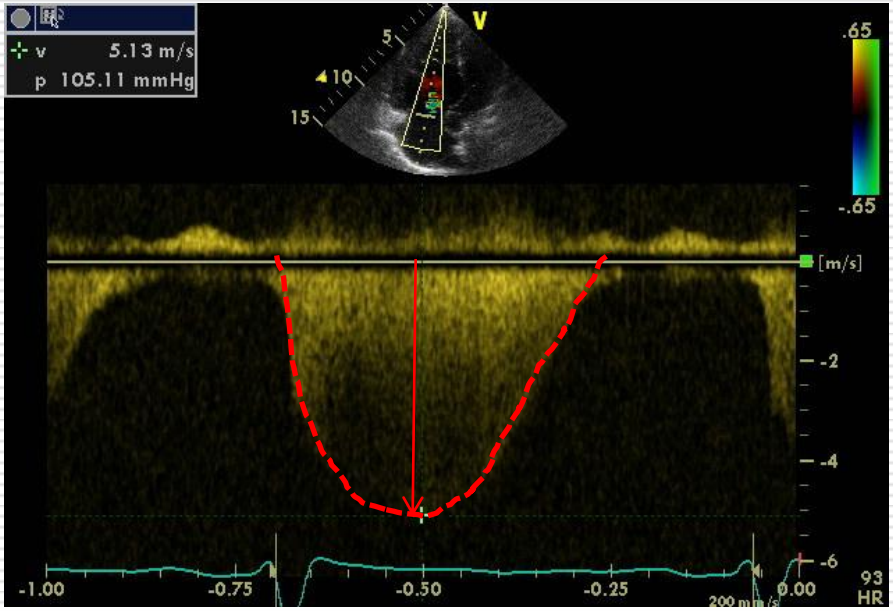

Peak tricuspid regurgitation velocity (m/s)	Presence of other echo 'PH signs'[a]	Echocardiographic probability of pulmonary hypertension
≤2.8 or not measurable	No	Low
≤2.8 or not measurable	Yes	Intermediate
2.9–3.4	No	
2.9–3.4	Yes	High
>3.4	Not required	

A: The ventricles[a]	B: Pulmonary artery[a]	C: Inferior vena cava and right atrium[a]
Right ventricle/ left ventricle basal diameter ratio >1.0	Right ventricular outflow Doppler acceleration time <105 msec and/or midsystolic notching	Inferior cava diameter >21 mm with decreased inspiratory collapse (<50 % with a sniff or <20 % with quiet inspiration)
Flattening of the interventricular septum (left ventricular eccentricity index >1.1 in systole and/or diastole)	Early diastolic pulmonary regurgitation velocity >2.2 m/sec	Right atrial area (end-systole) >18 cm^2
	PA diameter >25 mm.	

I. INTERNÍ KLINIKA
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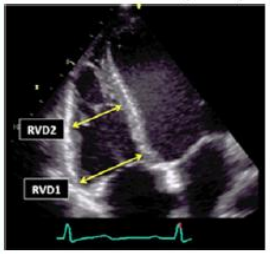
Morfologie a funkce pravé komory

European Heart Journal – Cardiovascular Imaging (2015) **16**, 233–271
doi:10.1093/ehjci/jev014

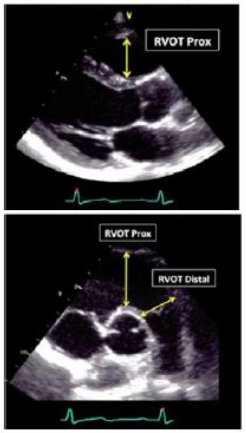
POSITION PAPER

Recommendations for Cardiac Chamber Quantification by Echocardiography in Adults: An Update from the American Society of Echocardiography and the European Association of Cardiovascular Imaging

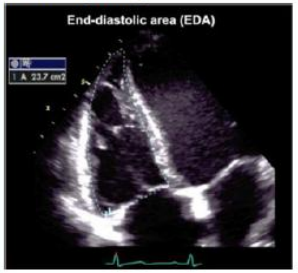
RV linear dimensions (inflow)*



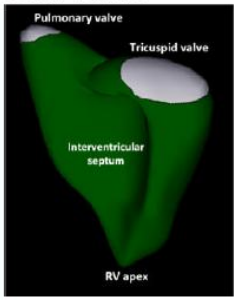
RV linear dimensions (outflow)*



RV areas (inflow)



3DE RV volumes



RV wall thickness

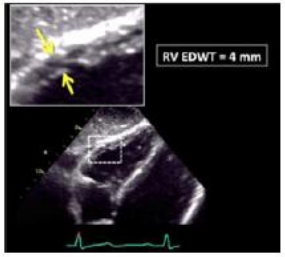
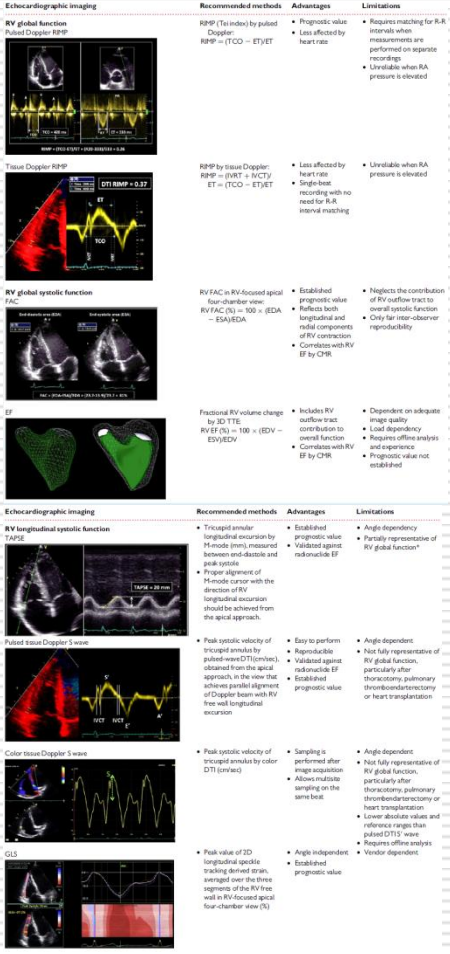


Table 8 Normal values for RV chamber size

Parameter	Mean ± SD	Normal range
RV basal diameter (mm)	33 ± 4	25–41
RV mid diameter (mm)	27 ± 4	19–35
RV longitudinal diameter (mm)	71 ± 6	59–83
RVOT PLAX diameter (mm)	25 ± 2.5	20–30
RVOT proximal diameter (mm)	28 ± 3.5	21–35
RVOT distal diameter (mm)	22 ± 2.5	17–27
RV wall thickness (mm)	3 ± 1	1–5
RVOT EDA (cm^2)		
Men	17 ± 3.5	10–24
Women	14 ± 3	8–20
RV EDA indexed to BSA (cm^2/m^2)		
Men	8.8 ± 1.9	5–12.6
Women	8.0 ± 1.75	4.5–11.5
RV ESA (cm^2)		
Men	9 ± 3	3–15
Women	7 ± 2	3–11
RV ESA indexed to BSA (cm^2/m^2)		
Men	4.7 ± 1.35	2.0–7.4
Women	4.0 ± 1.2	1.6–6.4
RV EDV indexed to BSA (mL/m^2)		
Men	61 ± 13	35–87
Women	53 ± 10.5	32–74
RV ESV indexed to BSA (mL/m^2)		
Men	27 ± 8.5	10–44
Women	22 ± 7	8–36



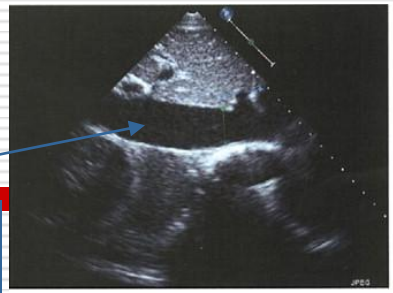
Maximální gradient regurgitace na pulmonální chlopni (PR) predikuje střední tlak v plicnici **(MAP)** .
Endiastolický gradient pulmonální regurgitace predikuje diastolický tlak v plicnici **(DAP)** .

Dolní dutá žíla **(IVC)** , její rozměr a stupeň inspiračního kolapsu predikují tlak v pravé síni **(RAP resp. CVT)**:
IVC <1.2 cm a kolaps 100% = RAP 0 mmHg

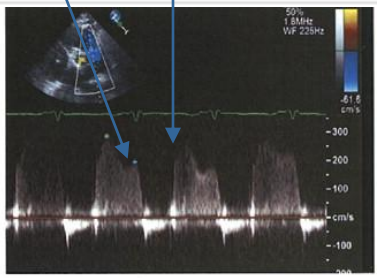
IVC 1.2-1.7 cm s >50% kolapsem = RAP 0-5 mmHg

IVC >1.7 cm s >50% kolapsem = RAP 6-10 mmHg; <50% kolapsem = RAP 10-15 mmHg

IVC >1.7 cm s 0% kolapsem = RAP >15 mmHg

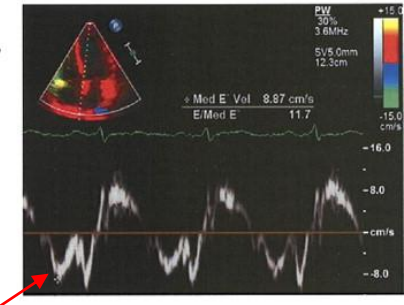


A. IVCCI--RAP

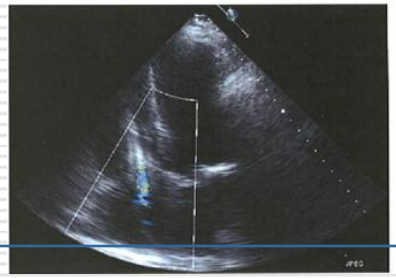


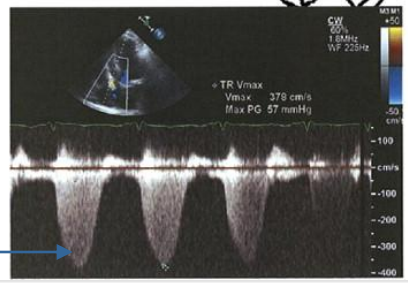
C. PR Vel.--PAPm, PAPd

B. TR Vel.--RVSP



D. E/E'--PCWP





Vrcholová systolická rychlost jetu trikuspidální regurgitace **(TR)** predikuje systolický tlak v plicnici **(SAP)**:

Poměr vrcholové systolické rychlosti časného mitrálního toku (E)/časná diastolická rychlost mitrálního anulu Em **(E/Em)** <8 nebo >15 přesně predikuje **PCWP** <15 mmHg resp. >15 mm Hg.

Kirkpatrick JN et al. Echocardiography in Heart Failure: Applications, Utility, and New Horizons. J Am Coll Cardiol 2007;50:381–96

I. INTERNÍ KLINIKA
KARDIOLOGIE
FAKULTNÍ NEMOCNICE OLOMOUC

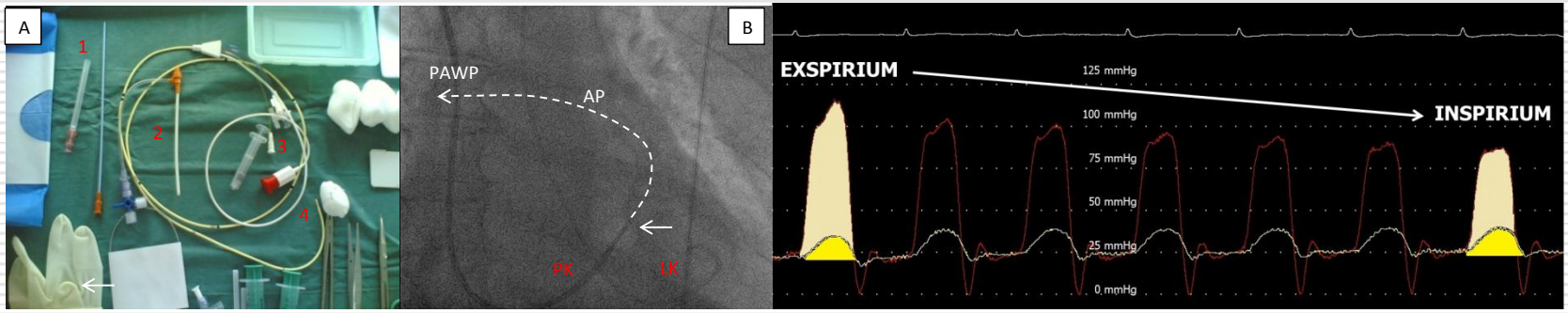
PAWP – LAP - LVED

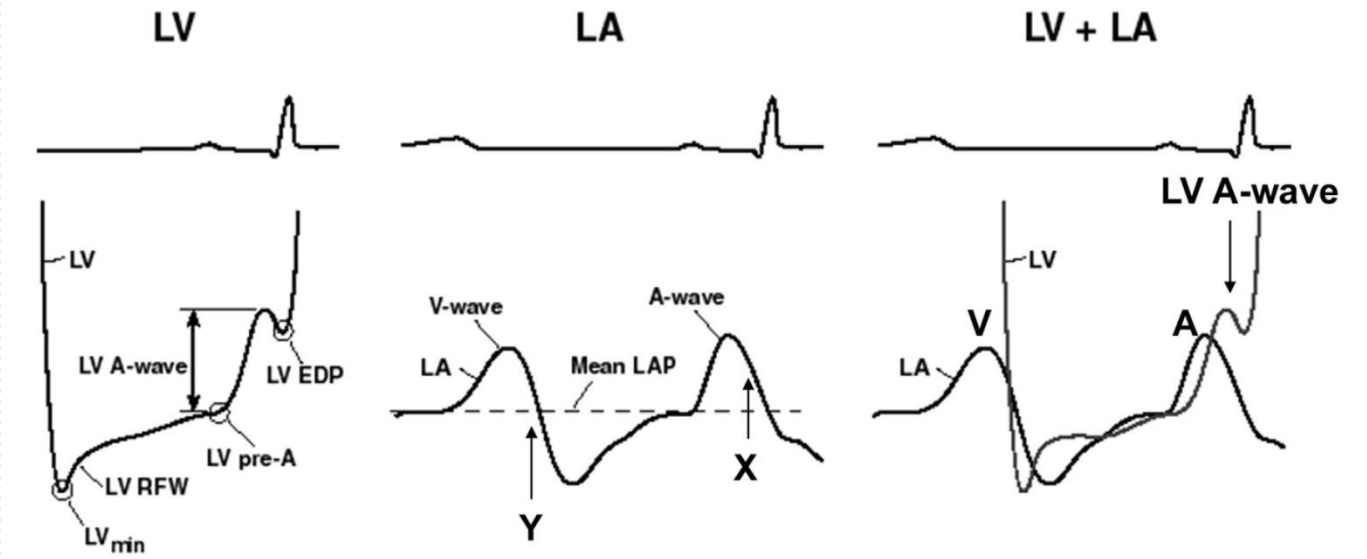
ASE/EACVI GUIDELINES AND STANDARDS

Recommendations for the Evaluation of Left Ventricular Diastolic Function by Echocardiography: An Update from the American Society of Echocardiography and the European Association of Cardiovascular Imaging

Sherif F. Nagueh, Chair, MD, FASE,[1] Otto A. Smiseth, Co-Chair, MD, PhD,[2] Christopher P. Appleton, MD,[1] Benjamin F. Byrd, III, MD, FASE,[1] Hisham Dokainish, MD, FASE,[1] Thor Edvardsen, MD, PhD,[2] Frank A. Flachskampf, MD, PhD, FESC,[2] Thierry C. Gillebert, MD, PhD, FESC,[2] Allan L. Klein, MD, FASE,[1] Patrizio Lancellotti, MD, PhD, FESC,[2] Paolo Marino, MD, FESC,[2] Jae K. Oh, MD,[1] Bogdan Alexandru Popescu, MD, PhD, FESC, FASE,[2] and Alan D. Waggoner, MHS, RDCS[1], *Houston, Texas; Oslo, Norway; Phoenix, Arizona; Nashville, Tennessee; Hamilton, Ontario, Canada; Uppsala, Sweden; Ghent and Liège, Belgium; Cleveland, Ohio; Novara, Italy; Rochester, Minnesota; Bucharest, Romania; and St. Louis, Missouri*

(J Am Soc Echocardiogr 2016;29:277-314.)





Odhad PAWP – LAP - LVED

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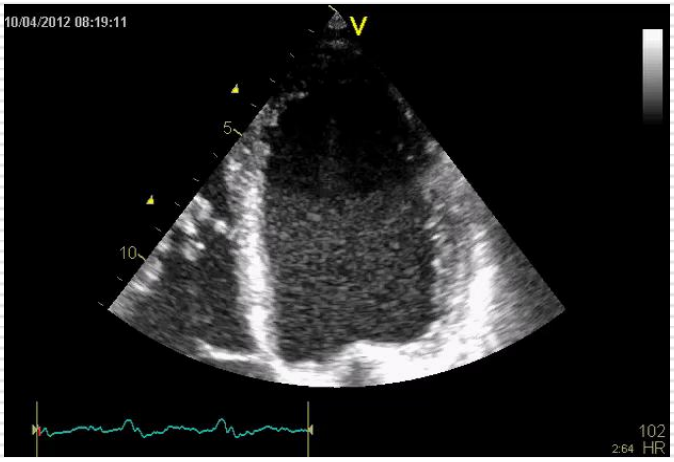

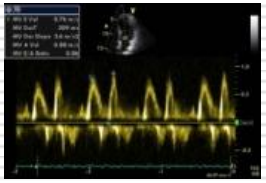

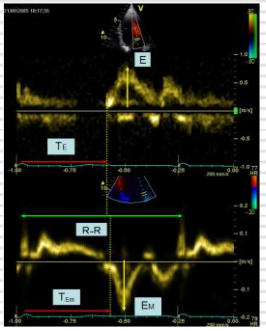

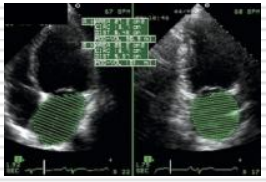

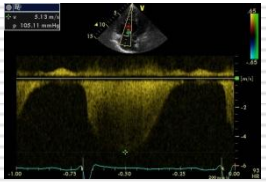

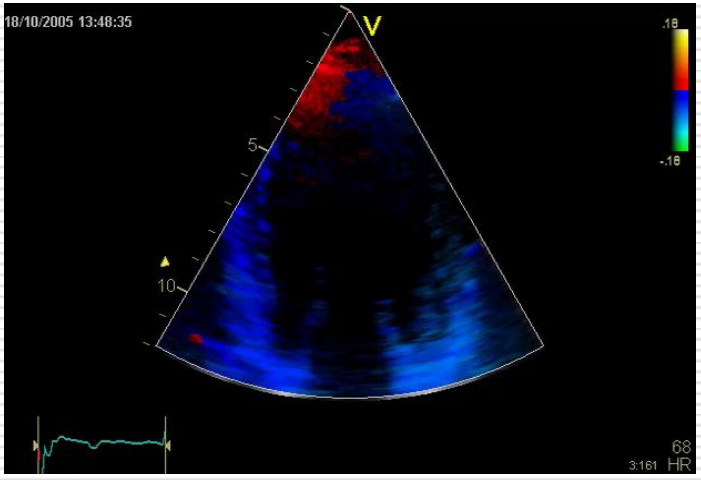

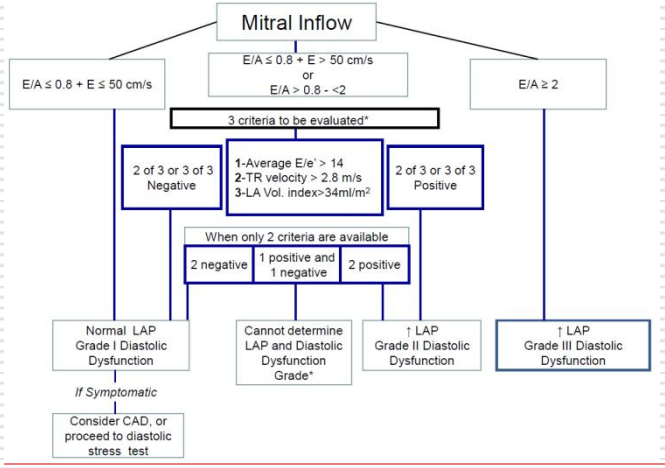

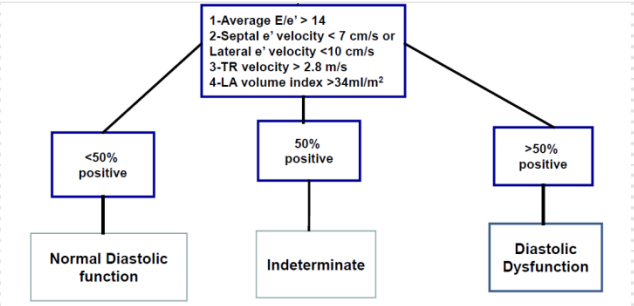

Snížená EF LK

Normální EF LK

I. INTERNÍ KLINIKA KARDIOLOGIE
FAKULTNÍ NEMOCNICE OLOMOUC

GUIDELINES AND STANDARDS

Guidelines for the Echocardiographic Assessment of the Right Heart in Adults: A Report from the American Society of Echocardiography

Endorsed by the European Association of Echocardiography, a registered branch of the European Society of Cardiology, and the Canadian Society of Echocardiography

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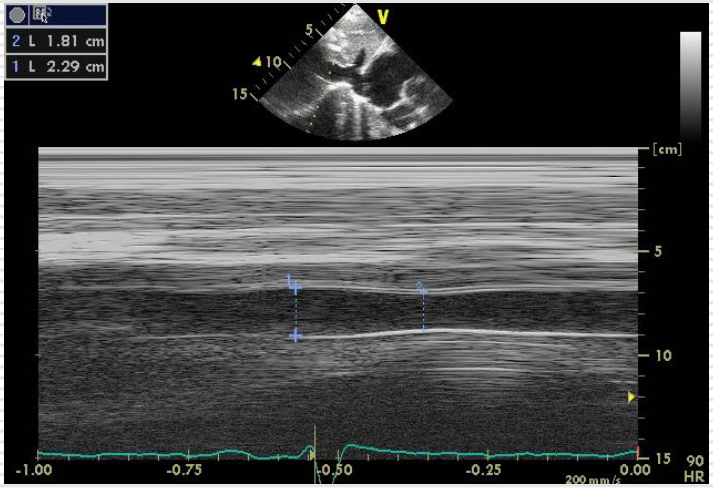
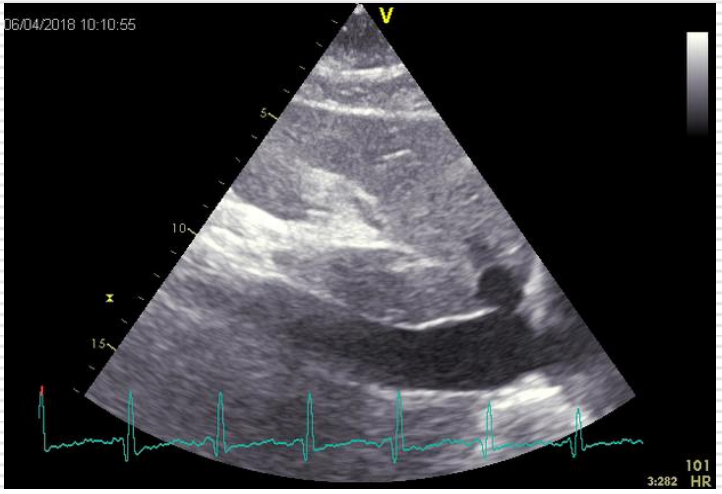
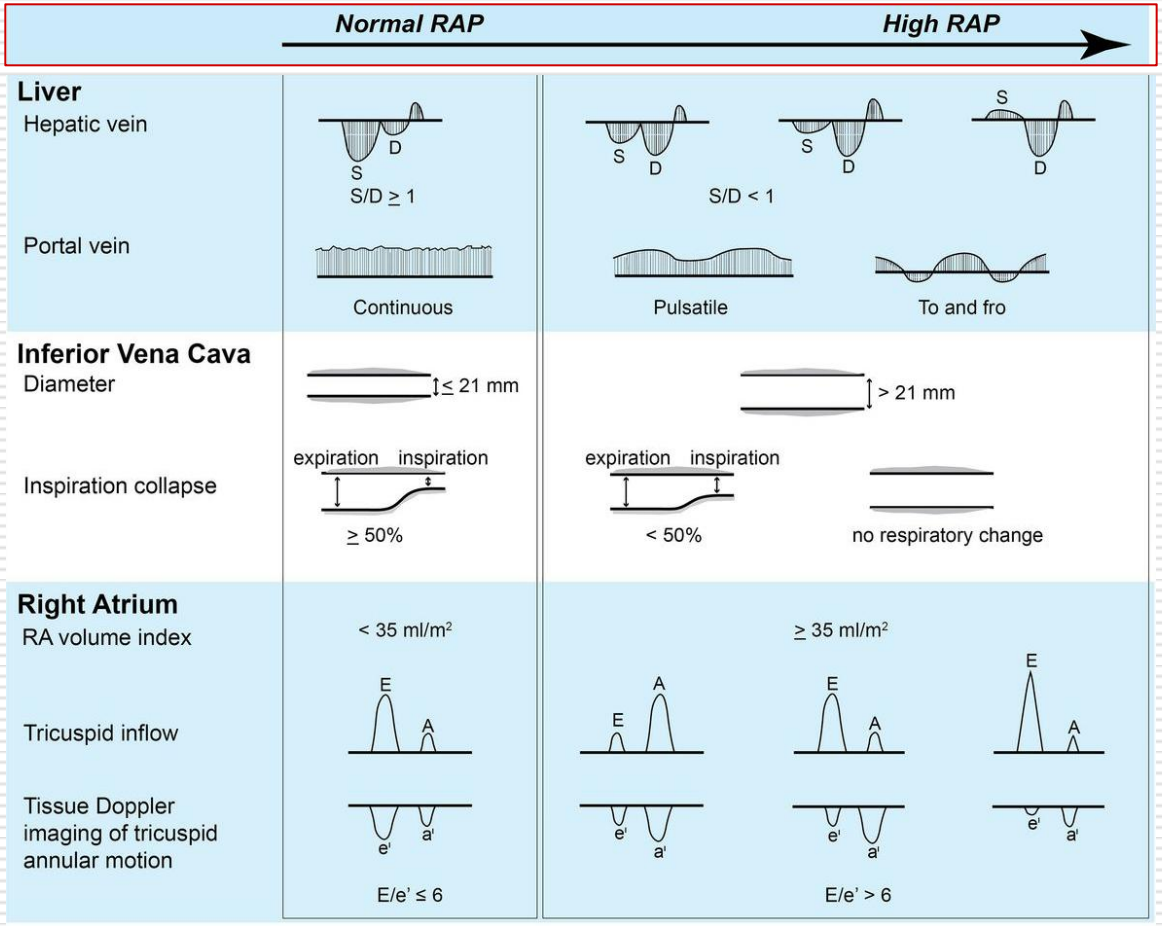
(J Am Soc Echocardiogr 2010;23:685-713.)

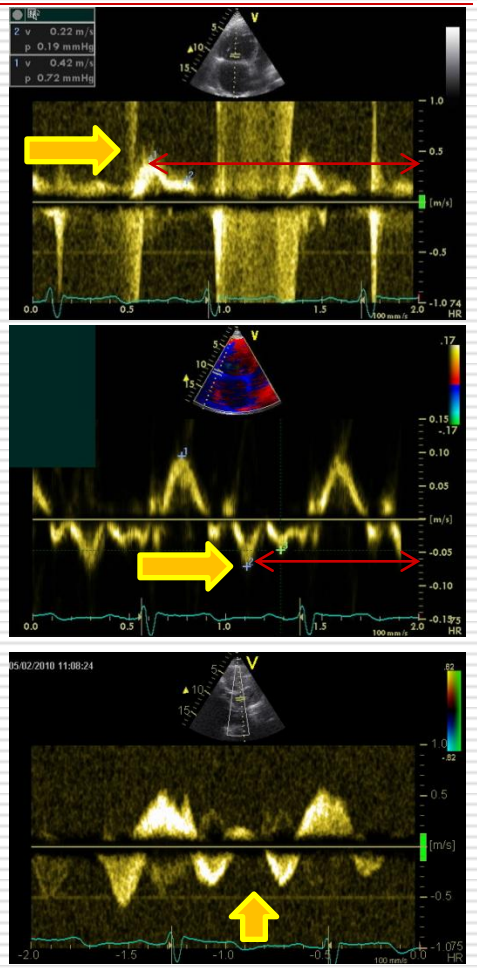
Odhad tlaku v pravé síni





- IVC diameter ≤2.1 cm that collapses >50% with a sniff suggests **normal RA pressure** of 3 mmHg (range, 0-5 mm Hg).
- IVC diameter 2.1 cm that collapses <50% with a sniff suggests **high RA pressure** of 15 mmHg (range, 10-20 mm Hg).
- IVC diameter and collapse do not fit this paradigm, an **intermediate value** of 8 mm Hg (range, 5-10 mm Hg) may be used.
- TV E/E_T >6 suggests **high RA pressure**





W.H. Wilson Tang, and Takeshi Kitai JCHF 2016;4:683-686

GUIDELINES AND STANDARDS

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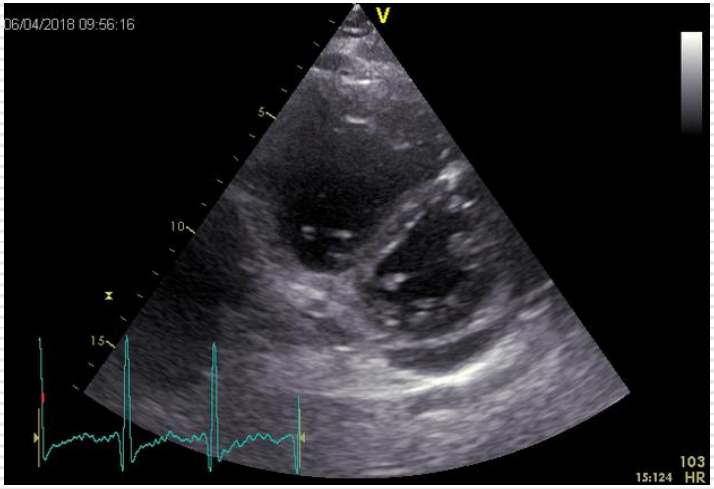
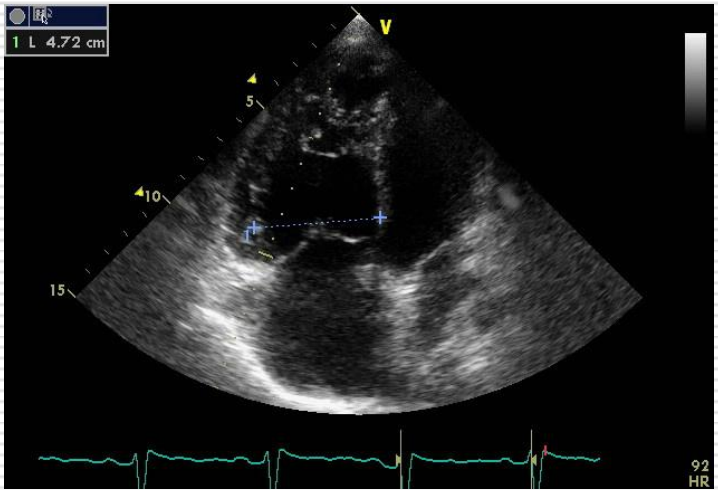
(J Am Soc Echocardiogr 2010;23:685-713.)

Geometrie a morfologie PK





- Visual assessment of ventricular septal curvature looking for a D-shaped pattern in systole and diastole should be used to help in the **diagnosis of RV volume and/or pressure overload**.
- Although a D-shaped septum is not diagnostic in RV overload, with its presence, additional emphasis should be placed on the confirmation, as well as determination, of the etiology and severity of right-sided pressure and/or volume overload.

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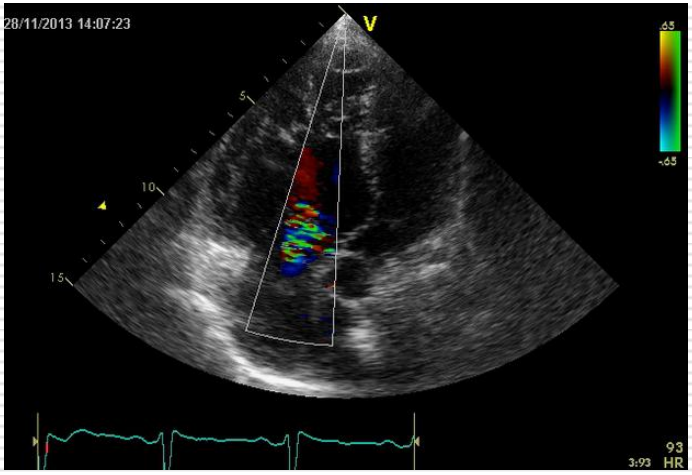
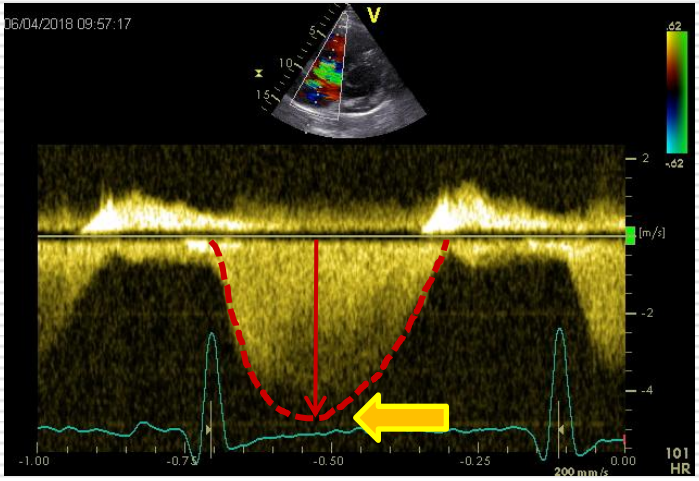
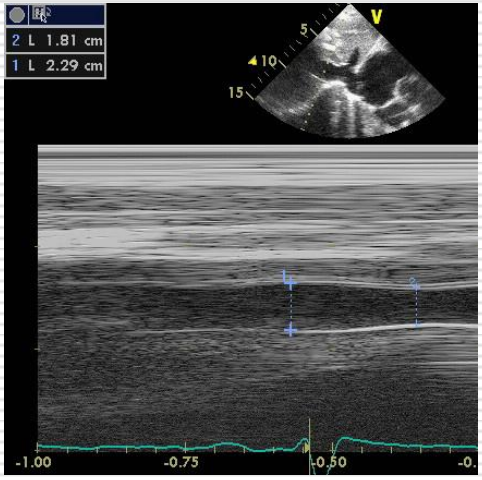
Odhad systolického tlaku v AP







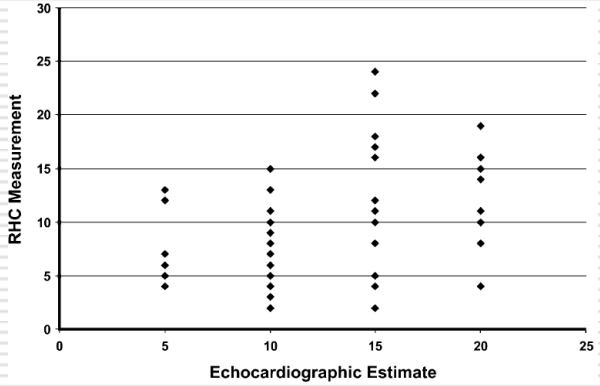
- The normal cutoff value for invasively measured **mean PA pressure** is 25 mmHg. In the echolab, SPAP is more commonly measured and reported. **RVSP** can be determined from peak TR jet velocity, using Bernoulli equation and combining this value with an estimate of the RA pressure: RVSP = $4V^2$ + RAP.
- In cases in which RVSP is elevated, **obstruction at RVOT or PV should be excluded**, especially in patients with congenital heart disease.
- **Normal resting values** are usually defined as a peak TR gradient of 2.8-2.9 m/s or a peak systolic pressure of 35/36 mm Hg, assuming an RA pressure of 3-5 mm Hg. This value may increase with age and increasing BSA.

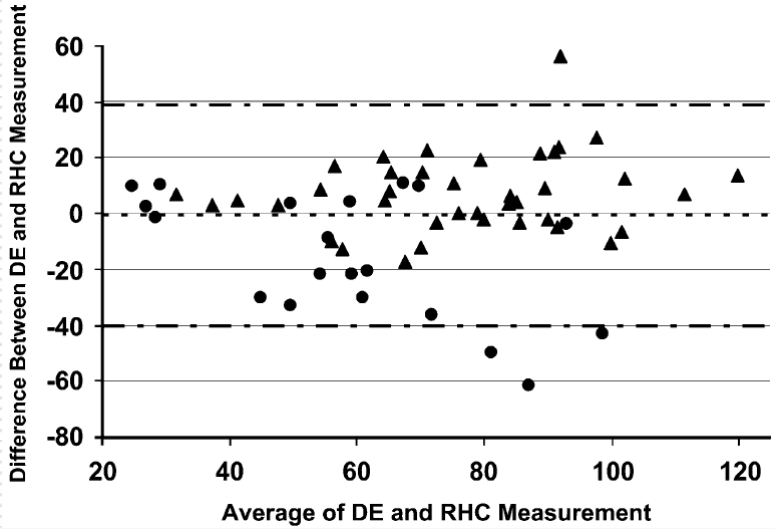
Accuracy of Doppler Echocardiography in the Hemodynamic Assessment of Pulmonary Hypertension

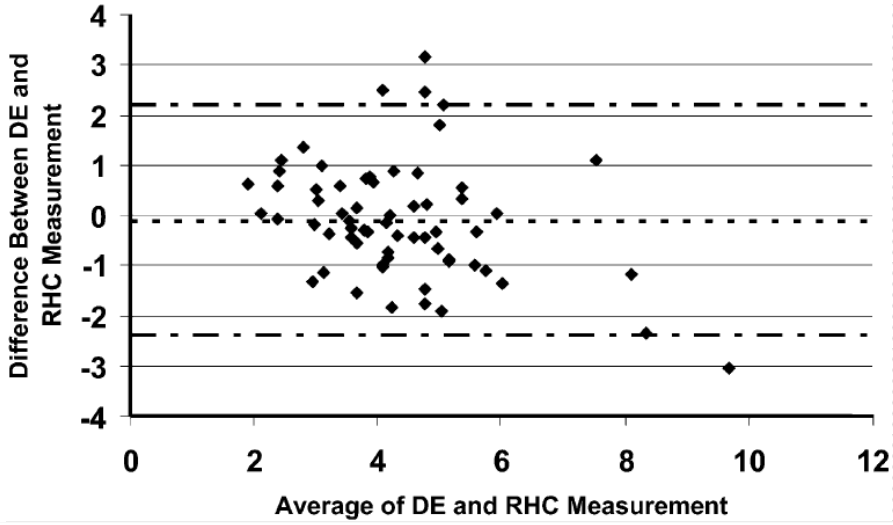
Micah R. Fisher[1]*, Paul R. Forfia[2†], Elzbieta Chamera[2], Traci Housten-Harris[1], Hunter C. Champion[2], Reda E. Girgis[1], Mary C. Corretti[2], and Paul M. Hassoun[1]

[1]Division of Pulmonary and Critical Care Medicine; [2]Division of Cardiology, Department of Medicine, Johns Hopkins University, Baltimore, Maryland

Right-Heart Catheterization	n	Mean	SD
RAP, mm Hg	65	9.4	5.0
PASP, mm Hg	65	68.5	23.9
mPAP, mm Hg	65	41.4	14.6
CO, L/min	65	4.4	1.7
Echocardiogram			
RAP, mm Hg	65	12.4	4.7
RVSP, mm Hg	59	70.2	25.1
CO, L/min	64	4.3	1.4







Micah R. Fisher et al. Am J Respir Crit Care 2009, Med Vol 179. pp 615–621,

I. INTERNÍ KLINIKA
KARDIOLOGIE
FAKULTNÍ NEMOCNICE OLOMOUC

GUIDELINES AND STANDARDS

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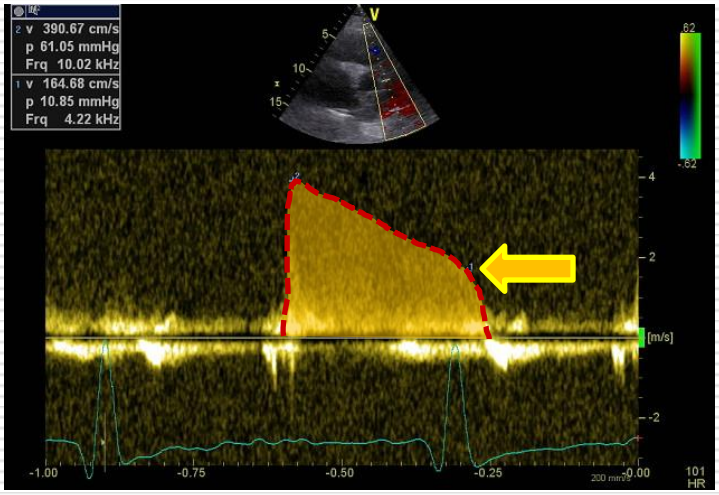
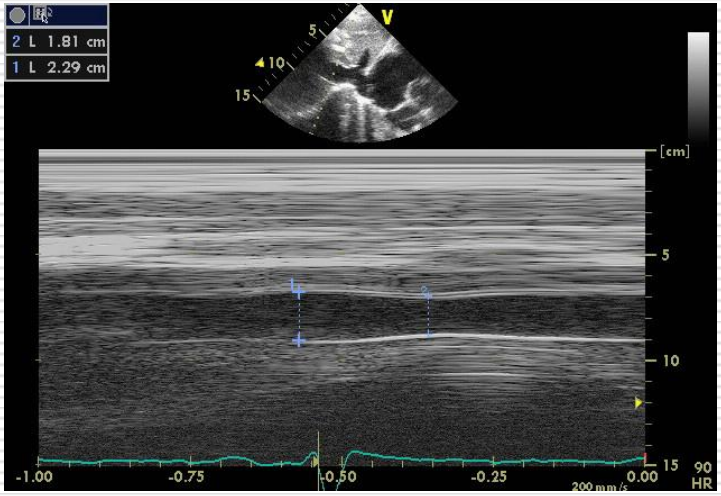
(J Am Soc Echocardiogr 2010;23:685-713.)

Odhad diastolického tlaku v AP





- PADP can be estimated from the velocity of the end-diastolic pulmonary regurgitant jet using the modified Bernoulli equation: [PADP = 4 (end-diastolic pulmonary regurgitant velocity)2 + RA pressure].

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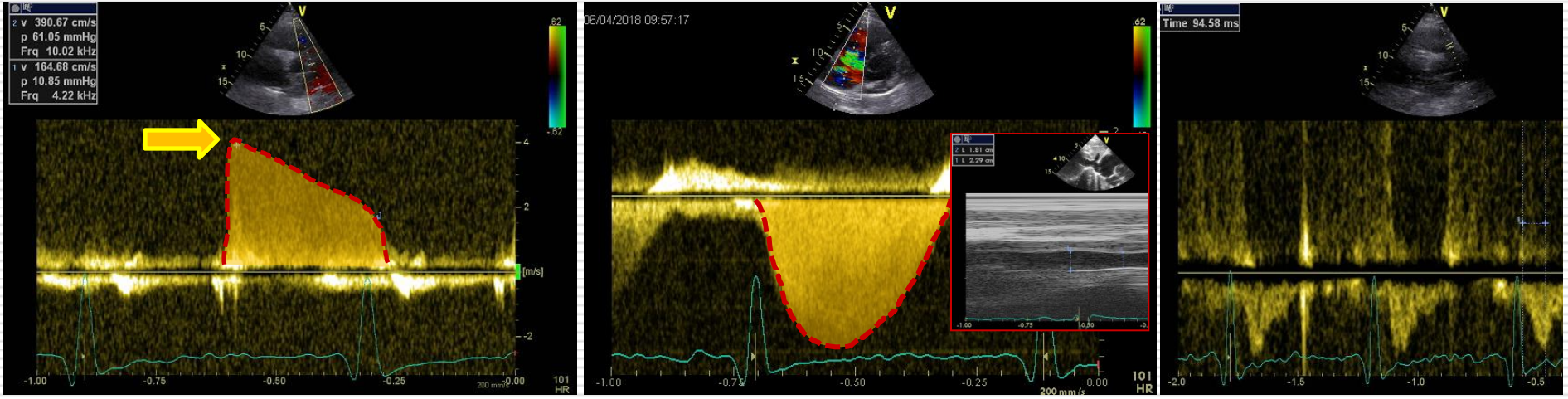
(J Am Soc Echocardiogr 2010;23:685-713.)

Odhad středního tlaku v AP



- **Standard formula mean PA pressure** = 1/3(SPAP) + 2/3(PADP).

- Mean PA pressure may also be estimated by using **PAT measured by pulsed Doppler of the pulmonary artery** in systole, whereby mean PAP = 79 x (0.45 AT). In patients with PAT <120 ms, the formula for mean PAP is 90 x (0.62 AT) performed better.
- The mean PA pressure can be estimated as 4 x (early **PR velocity**) 2+ estimated RAP.

- An additional recently described method adds estimated RA pressure to the **velocity-time integral of the TR jet** to calculate a mean systolic pressure.

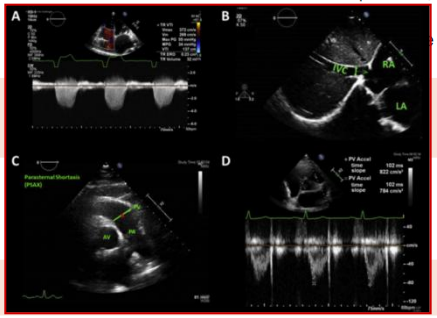
Echocardiographic Estimation of Mean Pulmonary Artery Pressure: A Comparison of Different Approaches to Assign the Likelihood of Pulmonary Hypertension

Kristian Hellenkamp, MD, Bernhard Unsöld, MD, Sitali Mushemi-Blake, PhD, Ajay M. Shah, MD, Tim Friede, PhD, Msc, Gerd Hasenfuß, MD, and Tim Seidler, MD, *Göttingen and Regensburg, Germany; and London, United Kingdom*

J Am Soc Echocardiogr 2018;31:89-98

Srovnání metod

Method	Publication	Number of patients included in this study (*n*)	Maximal time frame between RHC and echocardiography	Study design	Formula/abbreviation
Methods for estimating PAPm					
TR-derived methods					
RA-RV mean gradient (TR Pmean) + RAP* (obtained by tracing the TR time-velocity integral added to the estimated RAP)	Aduen *et al*[4]	102	Simultaneously	Prospective	PAPm = TR Pmean + RAP
	Er *et al*[5]	164	Within 120 min	Prospective	
Empirical; using PAPsys	Chemla *et al*[6,†]	31	—[‡]	Prospective	PAPm = 0.61 × PAPsys + 2
	Steckelberg *et al*[9,†]	307 (RHC), 109 (echocardiography)	Within 1 mo	Retrospective	PAPm = 0.61 × PAPsys + 1.95
	Amsallem *et al*[10,†]	307	Within 5 d	Retrospective	PAPm = 0.60 × PAPsys + 2.1
	Friedberg *et al*[8]	17	Within 30 d	Retrospective	PAPm = 0.69 × PAPsys − 0.22
	Syyed *et al*[7]	65	—[#]	Retrospective	PAPm = 0.65 × PAPsys + 0.55
PAT-derived method					
Empirical; using PAT	Dabestani *et al*[11]	39	Within 6 d	Not specified,	PAT ≥120 msec: PAPm = 79 − (0.45 × PAT) PAT <120 msec: PAPm = 90 − (0.62 × PAT)
Other echocardiographic parameters that may correlate with invasive PAPm					
RA-RV maximal velocity (TR Vmax) (obtained by tracing the TR time-velocity integral without addition of RAP)	ESC[1]	No study specified within the guideline			TR Vmax
RA-RV maximal gradient (TR Pmax) added to estimated RAP	Rudski *et al*[3]	No study specified			PAPsys = TR Pmax + RAP
PAT (without empirical calculation of PAPm)	Dabestani *et al*[11]	39	Within 6 d	Prospective	PAT
	Granstam *et al*[12]	29	Within 2 d	Retrospective	
	Yared *et al*[14]	371	—[§]	Retrospective and prospective (*n* = 100)	
	Kitabatake *et al*[15]	33	Within 1 wk	Not specified, probably prospective	



J Am Soc Echocardiogr 2018;31:89-98.

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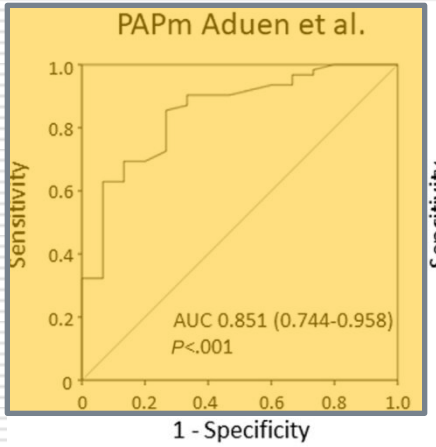
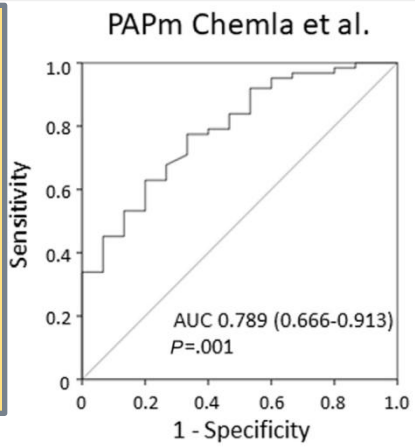
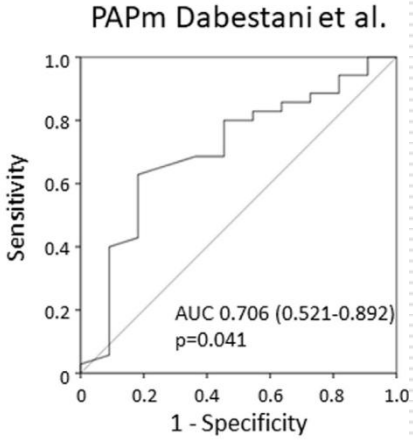
Srovnání přesnosti



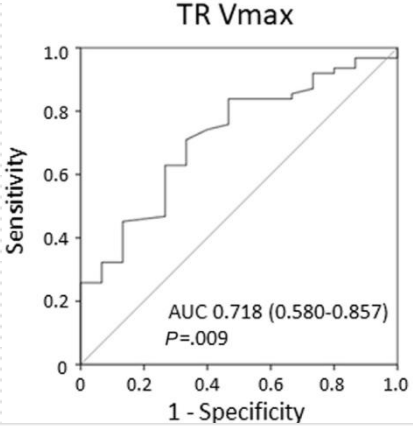
PAPm = TR Pmean + RAP

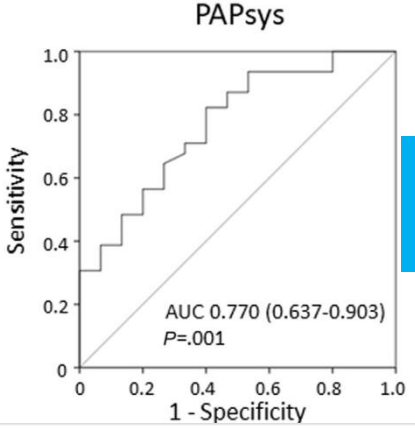


PAPm = 0.61 x PAPsys + 2



PAT ≥120 ms: PAPm = 79 (0.45 x PAT)
PAT <120 ms: PAPm = 90 (0.62 x PAT)

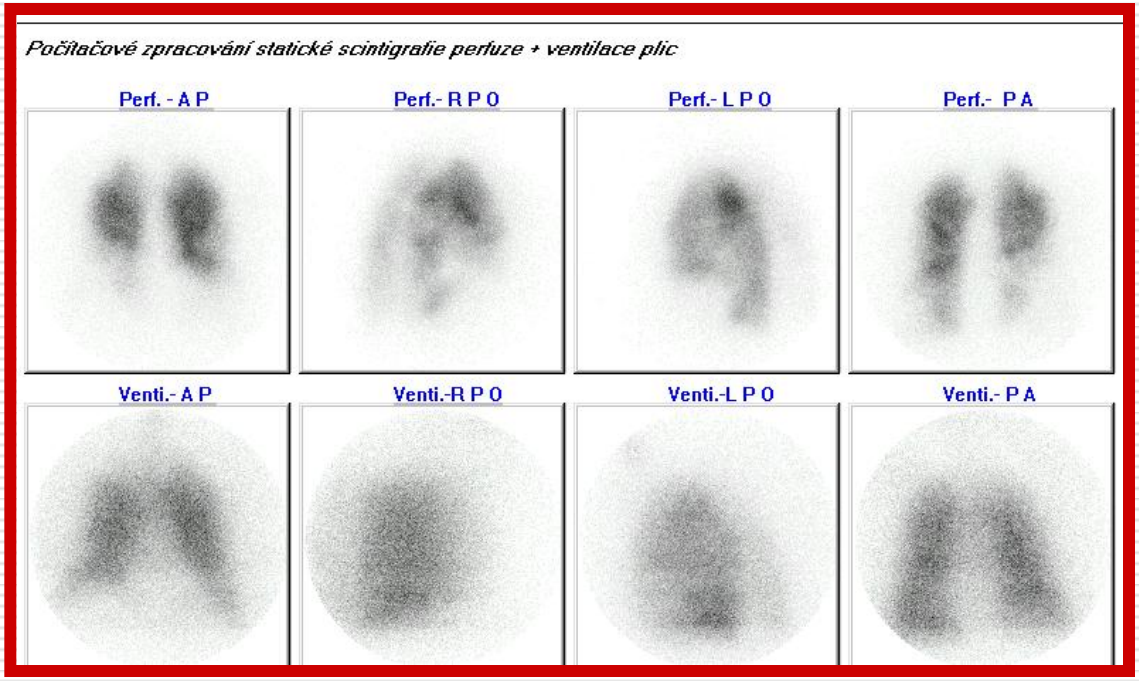


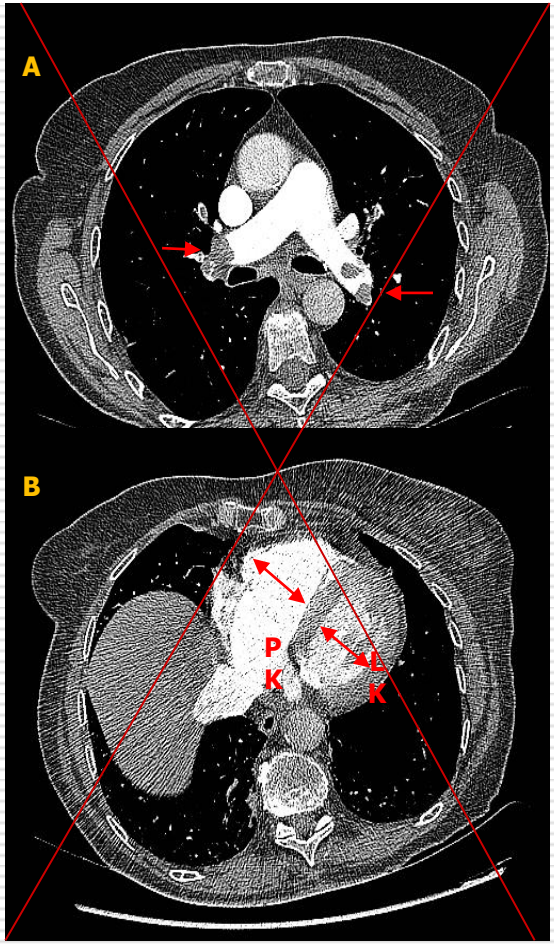


TR Vmax: sensitivity 0.81; specificity 0.53
PAPm: sensitivity 0.87; specificity 0.67

J Am Soc Echocardiogr 2018;31:89-98.

Scintigrafie plic – screeningová zobrazovací metoda





Ventilation–Perfusion Scintigraphy Is More Sensitive than Multidetector CTPA in Detecting Chronic Thromboembolic Pulmonary Disease as a Treatable Cause of Pulmonary Hypertension

Nina Tunariu[1], Simon J.R. Gibbs[2,3], Zarni Win[4], Wendy Gin-Sing[2], Alison Graham[1], Philip Gishen[1], and Adil AL-Nahhas[3,4]

[1]Department of Radiology, Hammersmith Hospital, London, United Kingdom; [2]Department of Cardiology, Hammersmith Hospital, London, United Kingdom; [3]Imperial College, London, United Kingdom; and [4]Department of Nuclear Medicine, Hammersmith Hospital, London, United Kingdom

J Nucl Med 2007; 48:680–684

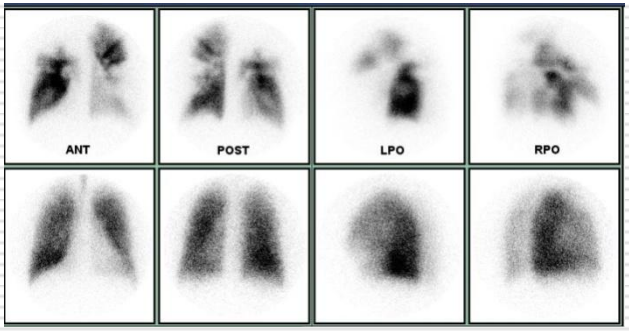
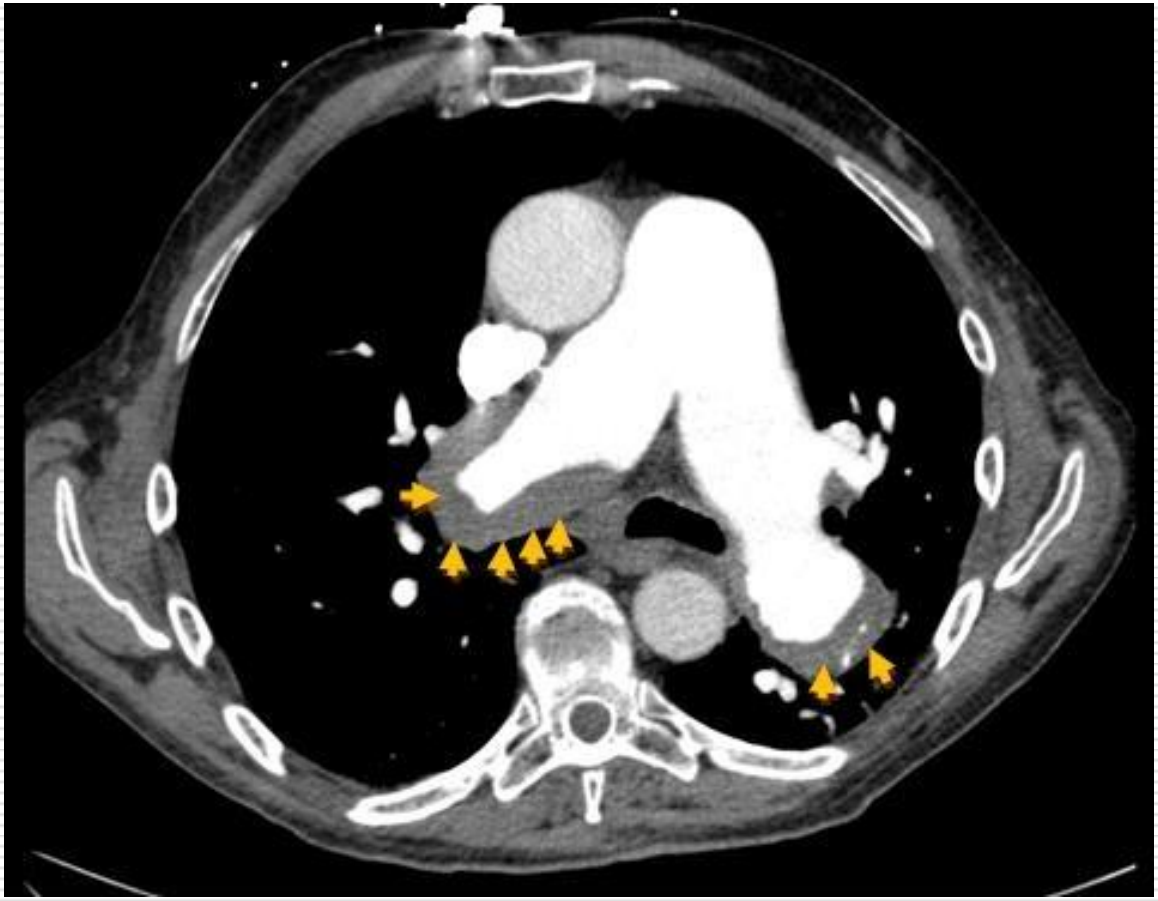
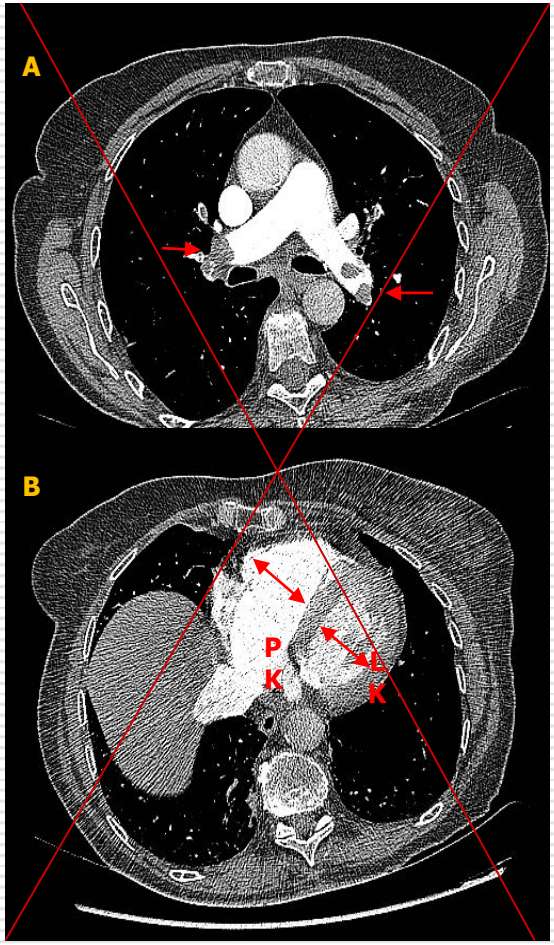


TABLE 1
Summary of V/Q Scans and CTPA Results

	V/Q			CTPA	
Group	Low probability	Intermediate probability	High probability	Negative	Positive
A (*n* = 78)	2	1	75	38	40
B (*n* = 149)	134	7	8	148	1

CTA plicnice –
alternativa



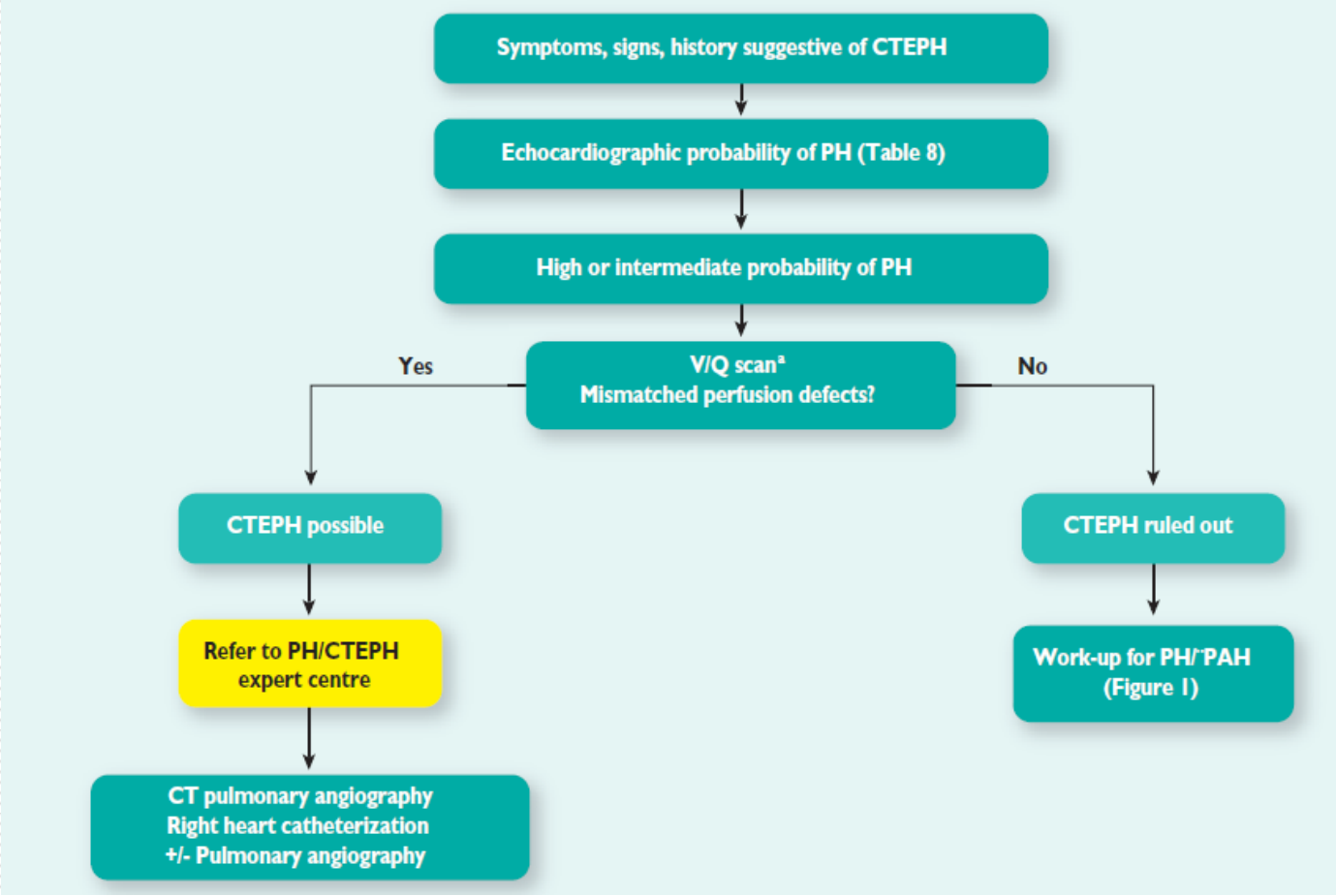


European Heart Journal Advance Access published September 15, 2015
European Heart Journal
doi:10.1093/eurheartj/ehv317
ESC/ERS GUIDELINES

2015 ESC/ERS Guidelines for the diagnosis and treatment of pulmonary hypertension

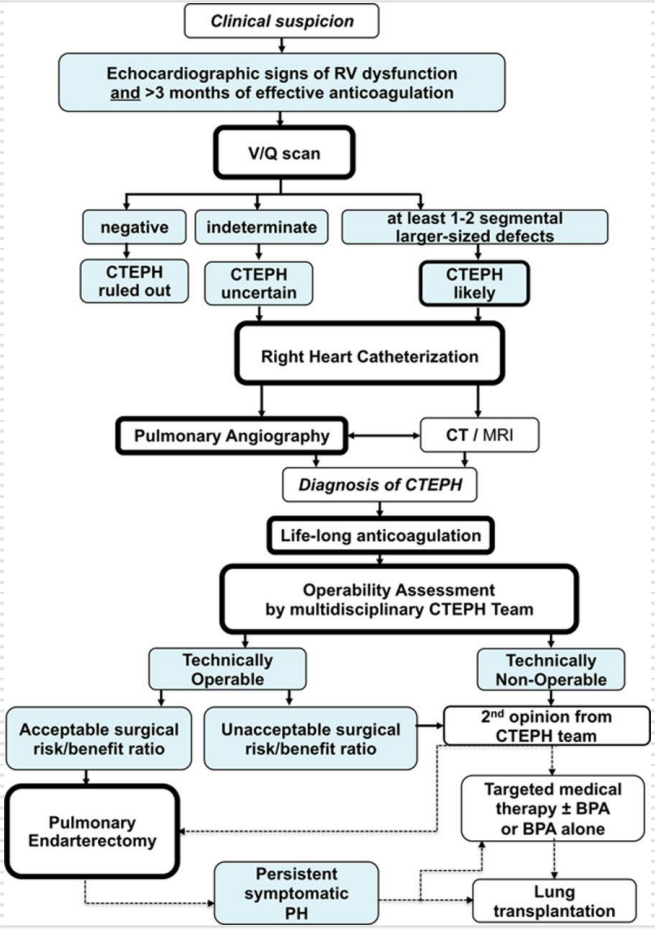
The Joint Task Force for the Diagnosis and Treatment of Pulmonary Hypertension of the European Society of Cardiology (ESC) and the European Respiratory Society (ERS)

Endorsed by: Association for European Paediatric and Congenital Cardiology (AEPC), International Society for Heart and Lung Transplantation (ISHLT)

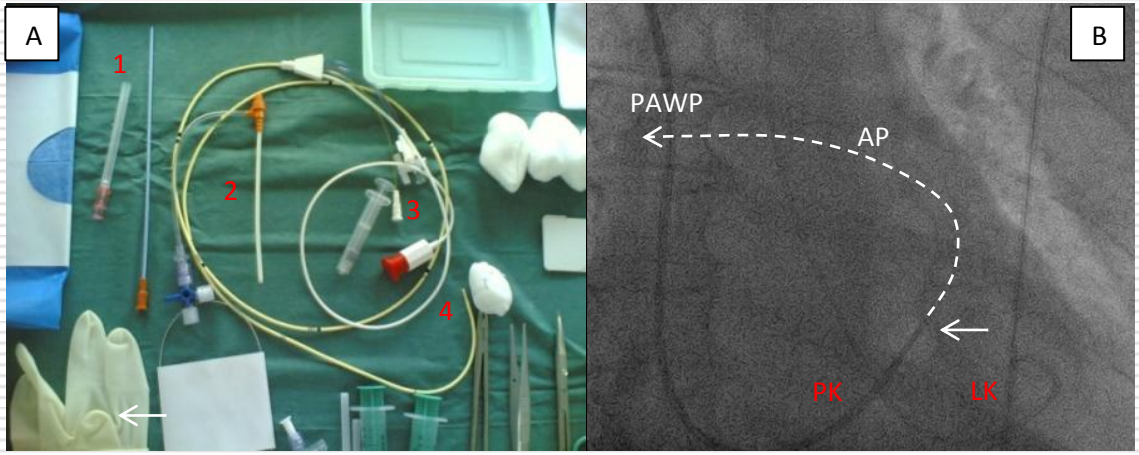


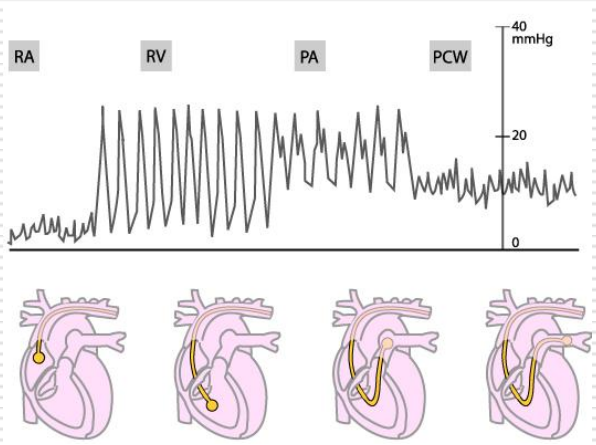
2. KONFIRMACE A EVALUACE

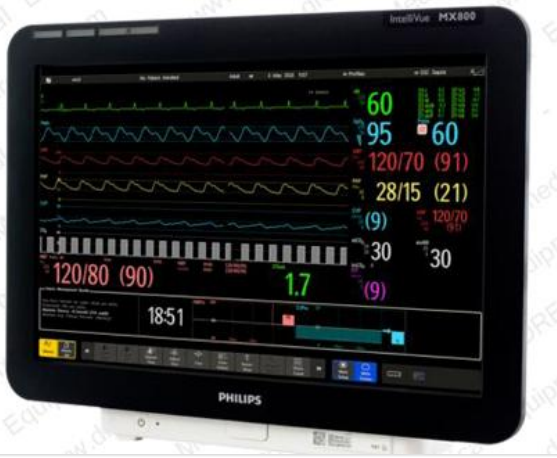
- CTA, (MRI)
- PSK + hemodynamické vyšetření
- Angiografie plicnice
- Angiografie B-P kolaterál
- Identifikace periferní remodelace



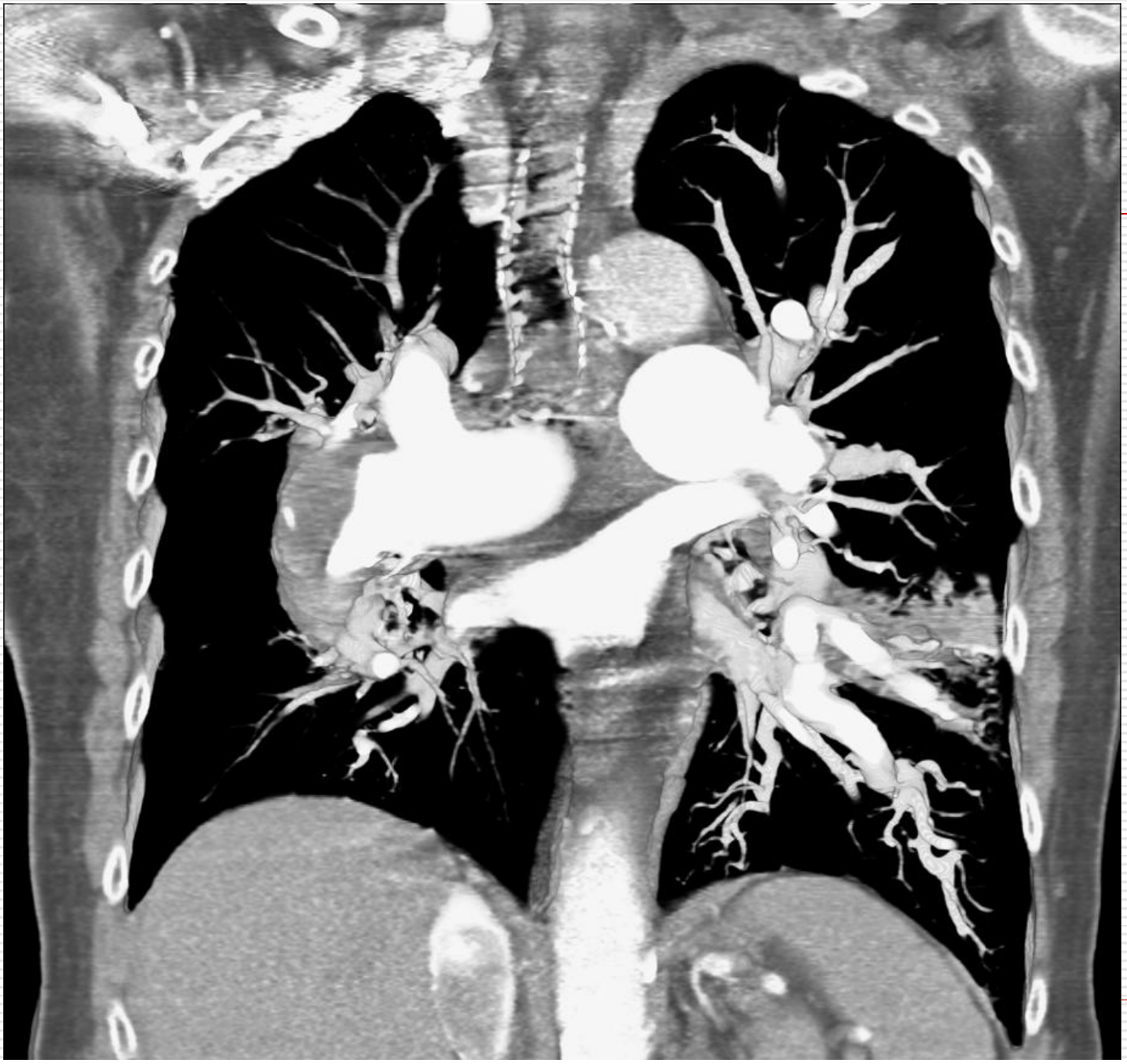
Pravostranná katetrizace – „zlatý standard“



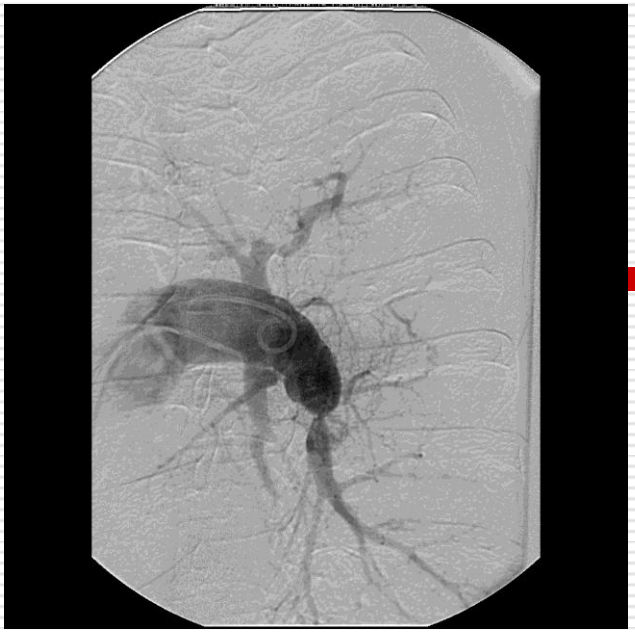


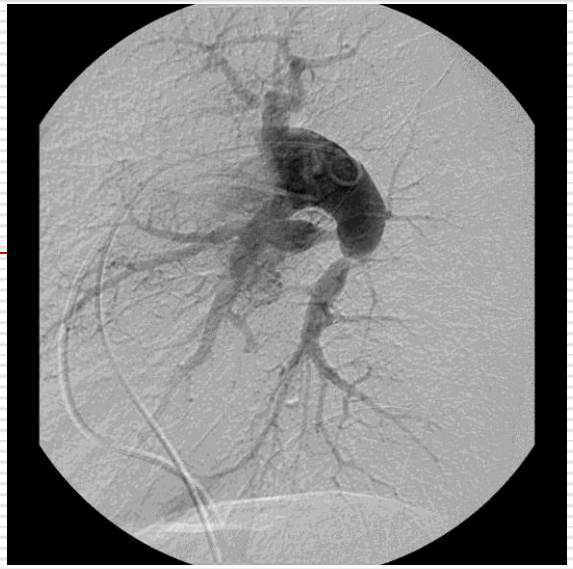


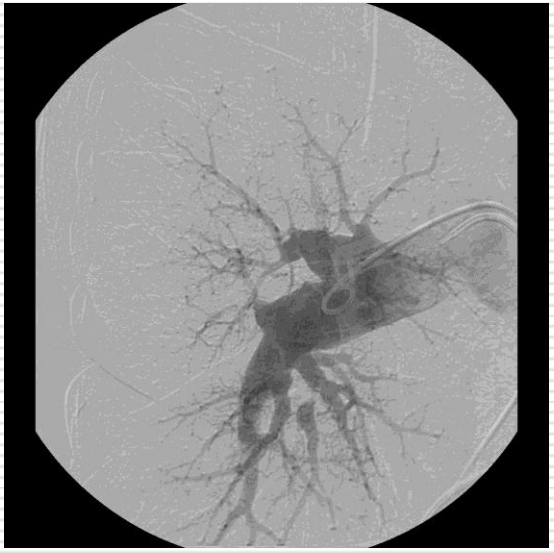
ESC guidelines. Eur Heart J 2009;30:2493-2537
Jansa P. Chronicka plicni hypertenze. Cor Vasa 2011;53(3)



Obrázky poskytnuty laskavostí doc. Jansy



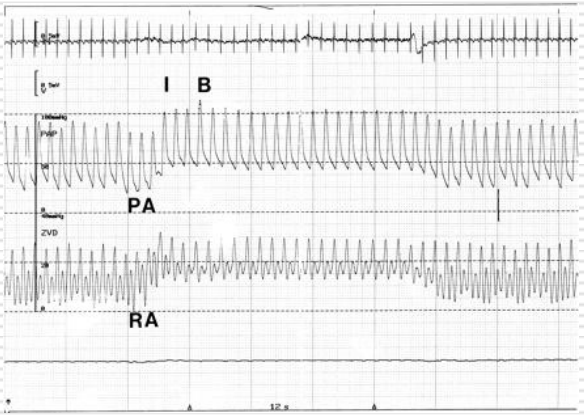


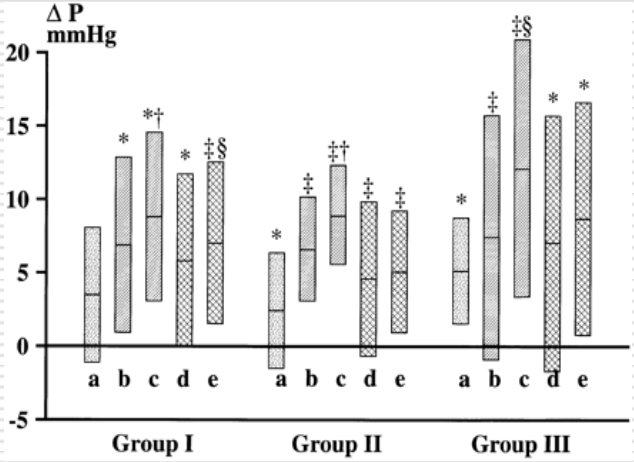


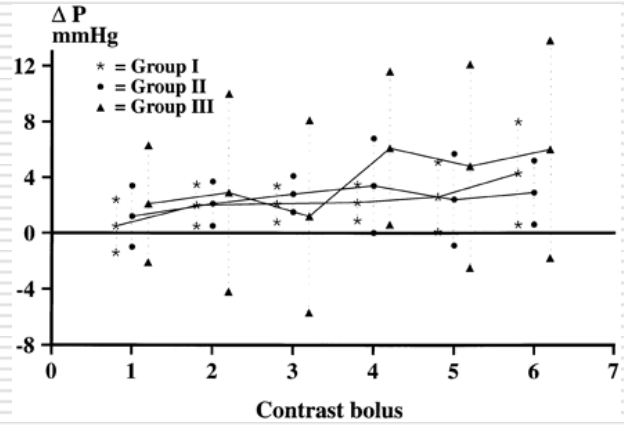

Obrázky poskytnuty laskavostí doc. Jansy

Plicní angiografie

- morbidita 2-5 %
- mortalita 0.2 %
- nárůst rizika při PAMP > 60 mmHg







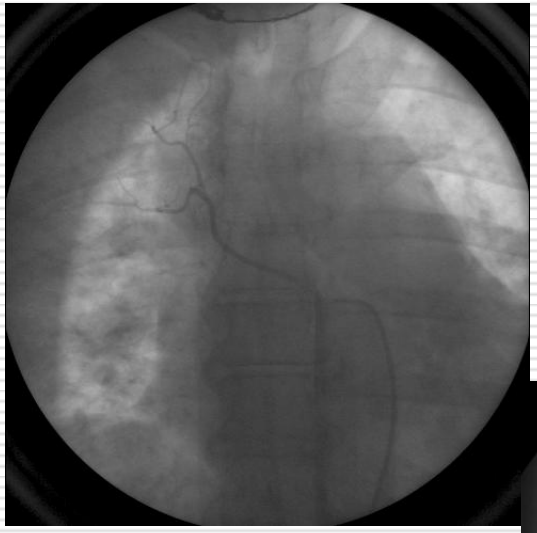
- kontinuální hemodynamické monitorování
- neionický kontrast
- inhalace O_2 během celého vyšetření

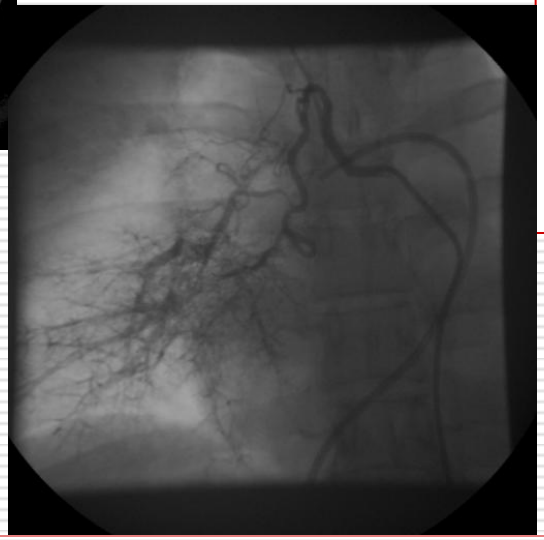
Pitton MB et al., *Circulation* 1996, 94: 2485-91

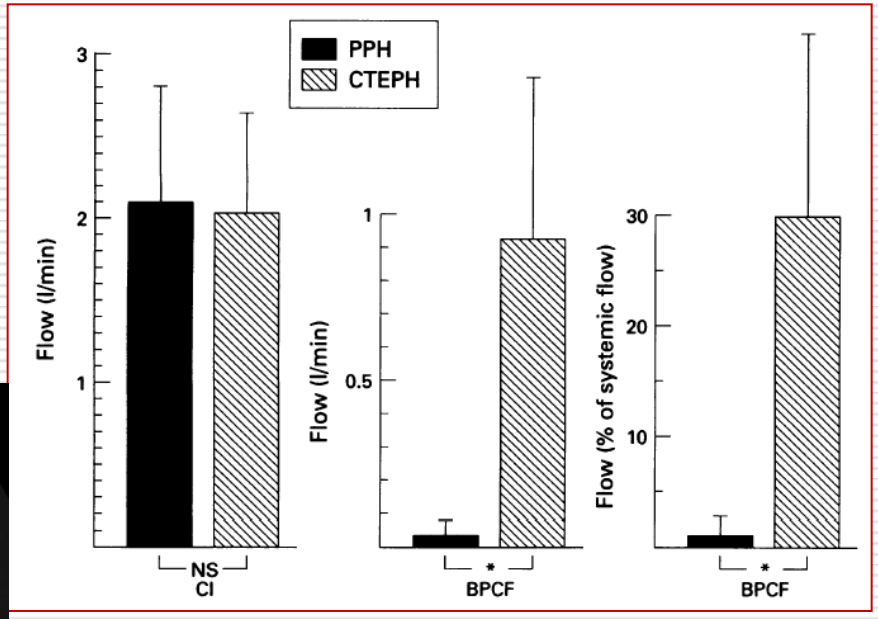
B-P kolaterály

Comparison of bronchopulmonary collaterals and collateral blood flow in patients with chronic thromboembolic and primary pulmonary hypertension

Jiri Endrys, Nasser Hayat, George Cherian



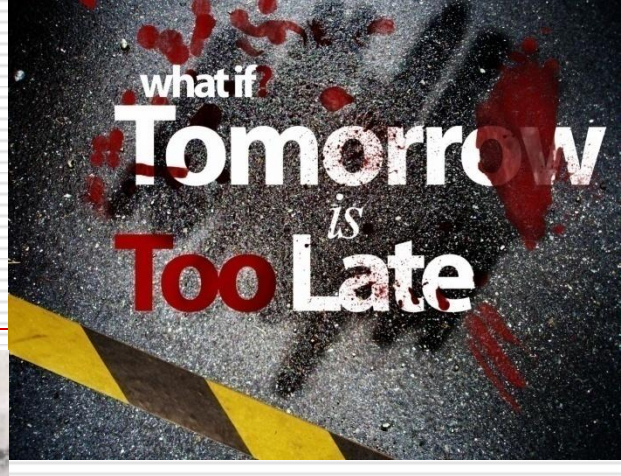




Endrys J. et al. *Heart* 1997, 78: 171-6

Závěry

- Echokardiograficky stanovené odhady tlakových poměrů v plicnici/LAP jsou standardem **screeningových** aktivit CTEPH
- Klíčové je **kvalitativní** stanovení pravděpodobnosti PH a její etiologie (prekapilární vs. postkapilární)
- K odlišení PAH od CTEPH se provádí **scintigrafie plic**, která má excelentní negativní prediktivní hodnotu ve vztahu k CTEPH
- Jako **konfirmační** hemodynamické a zobrazovací metody jsou realizovány pravostranná katetrizace, CTA plicnice a angiografie plicnice


what if
Tomorrow
is
Too Late


MAJESTIC