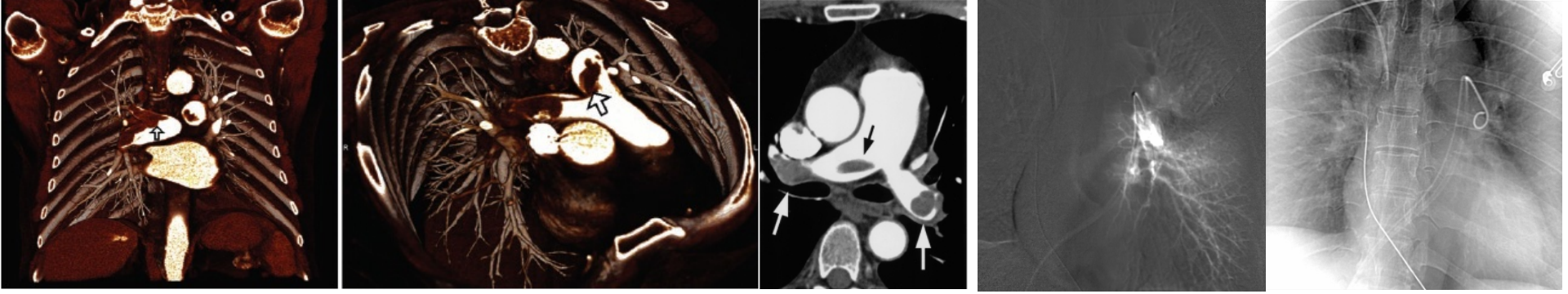
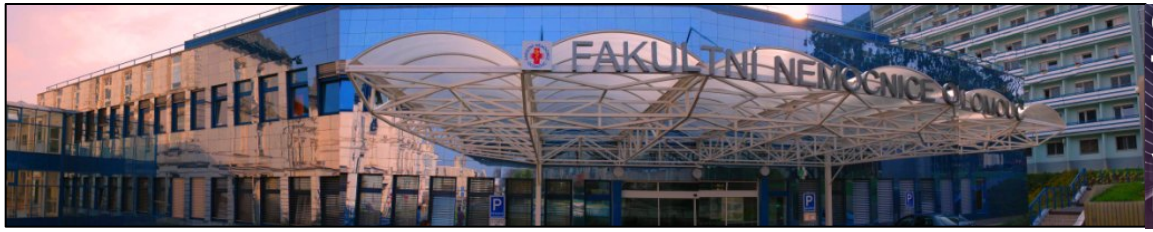


Od akutní plicní embolie k chronické tromboembolické plicní hypertenzi

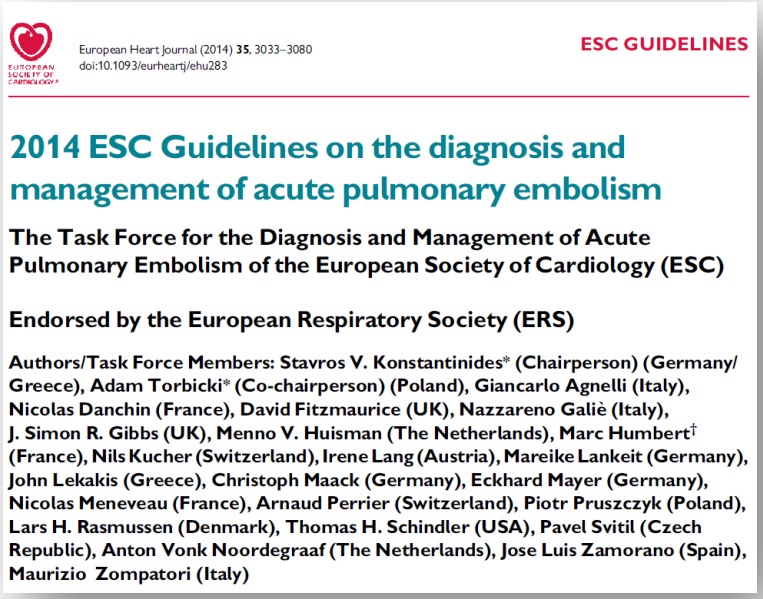
Martin Hutyra

1. interní klinika – kardiologická, Lékařská fakulta Univerzity Palackého a FN Olomouc



CHRONICKÁ TROMBOEMBOLICKÁ PLICNÍ HYPERTENZE – včasnou diagnostikou a léčbou k lepší prognóze pacientů

I. INTERNÍ KLINIKA KARDIOLOGIE
FAKULTNÍ NEMOCNICE OLOMOUC



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

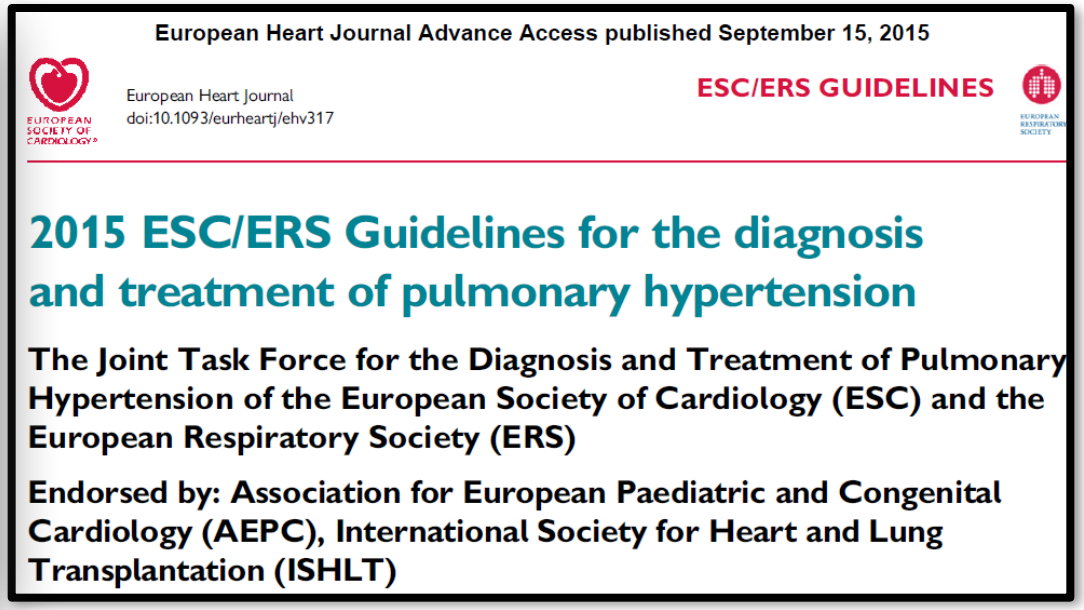
ESC GUIDELINES

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)



European Heart Journal Advance Access published September 15, 2015

European Heart Journal
doi:10.1093/eurheartj/ehv317

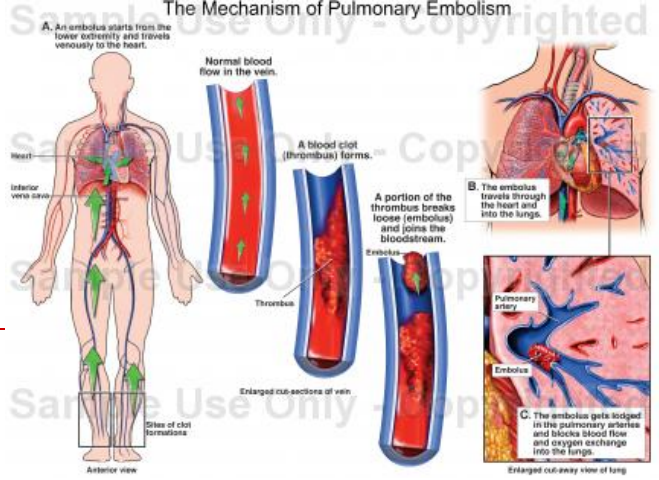
ESC/ERS GUIDELINES

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)

Epidemiologie



Prevalence 0,4% populace

Incidence 100-200/100 000/1 rok

Autopsie 2356 (79% všech zemřelých z populace 200 tis.) s nálezem PE u 25% a u 18% jako hlavní příčina smrti

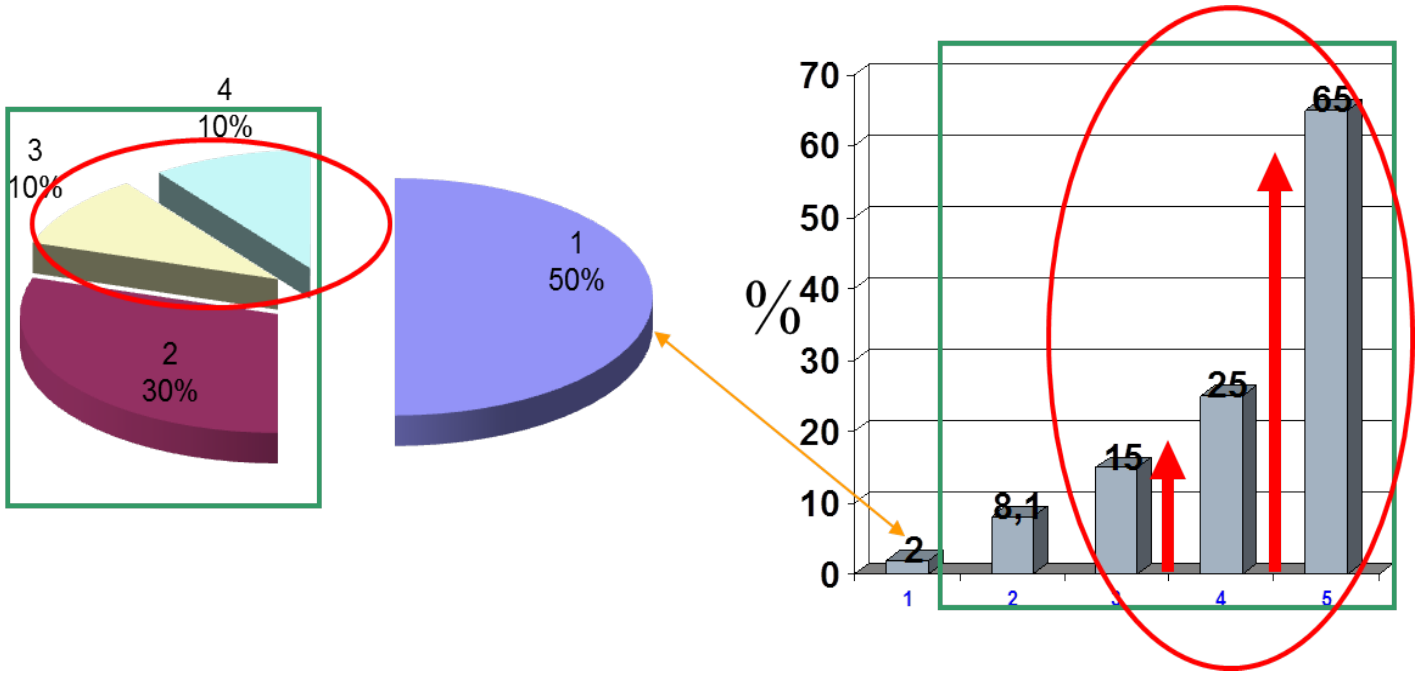
Závislost výskytu na věku a rizikových faktorech

Jen 30-45% pacientů, kteří zemřeli v důsledku plicní embolie bylo adekvátně léčeno

Až 80% pacientů s rizikovými faktory tromboembolie je špatně diagnostikováno

Noboa S, Mottier D, Oger E; on behalf of EPI-GETBO Study Group. Estimation of a potentially preventable fraction of venous thromboembolism: a community-based prospective study. J Thromb Haemost 2006; 4: 2720-2.
Oger E. Incidence of venous thromboembolism in a community-based study in western France. Thromb Haemost 2000;83:657-60
Modam B, Sharon E, Jelin W. Factors contributing to the incorrect diagnosis of pulmonary embolism. Chest 1972;62:388-93
Morpurgo M, Schmid C. Clinico-pathological correlations in pulmonary embolism. A prospective evaluation. Prog Respir Res 1980;13:8-15
Pineda LA, Hathwar VS, Grant BJ. Clinical suspicion of fatal pulmonary embolism. Chest 2001;120:791-5

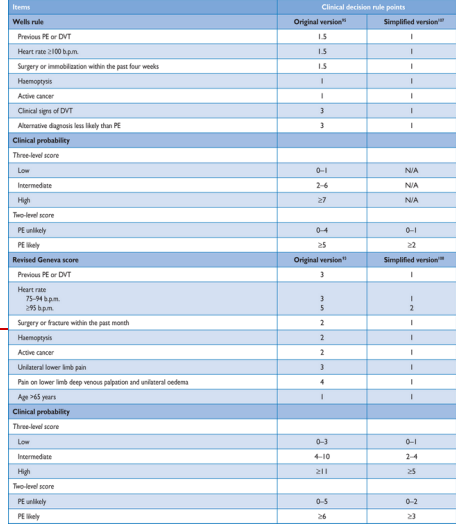
Prognóza



1. **Normotenze** bez dilatace a dysfunkce PK, bez elevace srdečních troponinů a BNP
2. **Normotenze s dilatací nebo dysfunkcí PK, plicní hypertenzí**, (elevace srdečních troponinů a BNP)
3. **Systémová hypotenze bez klinických známek šokové cirkulace** (pokles TKs<90 mmHg nebo pokles TKs>40 mmHg, bez nutnosti použití vazopresorů s výjimkou dobutaminu do maximální dávky 5 μg/kg/min)
4. **Kardiogenní obstrukční šok** s orgánovou hypoperfuzí a multiorgánovým selháním
5. Nutnost **iniciální kardiopulmonální resuscitace** a **náhlá srdeční smrt**

Kasper W, Konstantinides S, Greibel A, et al. Management strategies and determinants of outcome in acute pulmonary embolism: results of a multicenter registry. J Am Coll Cardiol 1997;30:1165–71
Goldhaber SZ, Visani L, DeRosa M. for ICOPER. Acute pulmonary embolism: clinical outcomes in the International Cooperative Pulmonary Embolism Registry (ICOPER). Lancet 1999; 353: 1386-9

Klinická pravděpodobnost



Items	Clinical decision rule points	
Wells rule	**Original version[45]**	**Simplified version[107]**
Previous PE or DVT	1.5	1
Heart rate ≥100 b.p.m.	1.5	1
Surgery or immobilization within the past four weeks	1.5	1
Haemoptysis	1	1
Active cancer	1	1
Clinical signs of DVT	3	1
Alternative diagnosis less likely than PE	3	1
Clinical probability		
Three-level score		
Low	0–1	N/A
Intermediate	2–6	N/A
High	≥7	N/A
Two-level score		
PE unlikely	0–4	0–1
PE likely	≥5	≥2
Revised Geneva score	**Original version[93]**	**Simplified version[108]**
Previous PE or DVT	3	1
Heart rate 75–94 b.p.m. ≥95 b.p.m.	3 5	1 2
Surgery or fracture within the past month	2	1
Haemoptysis	2	1
Active cancer	2	1
Unilateral lower limb pain	3	1
Pain on lower limb deep venous palpation and unilateral oedema	4	1
Age >65 years	1	1
Clinical probability		
Three-level score		
Low	0–3	0–1
Intermediate	4–10	2–4
High	≥11	≥5
Two-level score		
PE unlikely	0–5	0–2
PE likely	≥6	≥3

Geneva skóre:

klinická pravděpodobnost
nízká 0-3 body
střední 4-10
vysoká ≥ 11

Predisponující faktory	
Věk nad 65 let	+1
Předchozí TEN	+3
Chirurgický výkon nebo trauma do 1 měsíce	+2
Malignita	+2
Symptomy	
Bolesti končetiny	+3
Hemoptýza	+2
Fyzikální vyšetření	
Srdeční frekvence	
75-95/min.	+3
>95/min.	+2
Asymetrický otok nebo bolestivost končetiny	+4

Wellsovo skóre:

klinická pravděpodobnost
nízká 0-1 body
střední 2-6, vysoká ≥ 7
plicní embolie nepravděpodobná 0-4
pravděpodobná ≥ 5

Predisponující faktory	
Předchozí TEN	+1,5
Recentní chirurgický výkon nebo imobilizace	+1,5
Malignita	+1,0
Symptomy	
Hemoptýza	+1,0
Fyzikální vyšetření	
Tepová frekvence > 100/min.	+1,5
Klinické známky hluboké žilní trombózy	+3,0
Klinické hodnocení	
Jiná diagnóza je méně pravděpodobná než PE	+3,0

Annals of Internal Medicine
ESTABLISHED IN 1927 BY THE AMERICAN COLLEGE OF PHYSICIANS

Performance of 4 Clinical Decision Rules in the Diagnostic Management of Acute Pulmonary Embolism

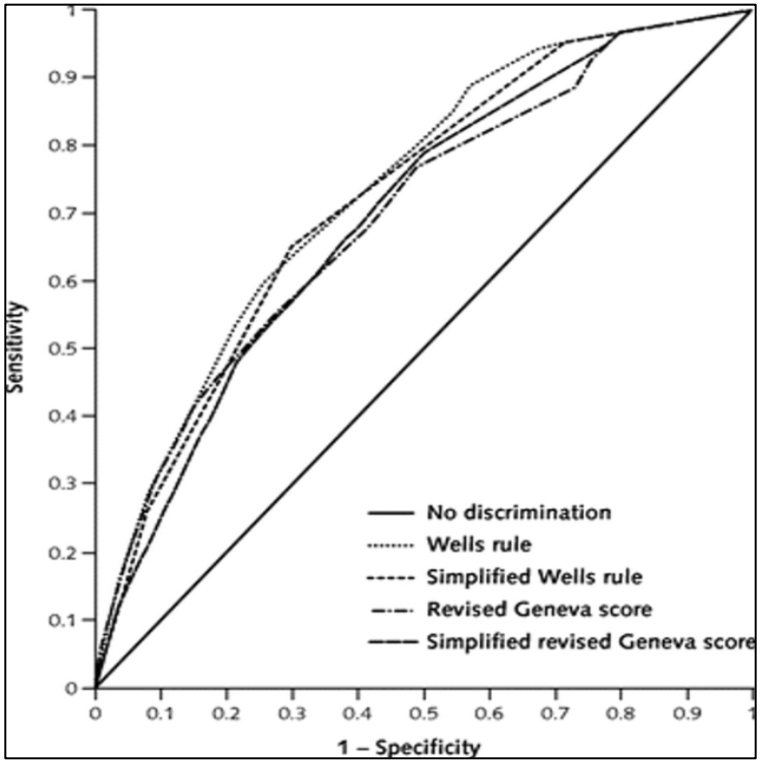
A Prospective Cohort Study from the Promethius Study Group

Ann Intern Med. 2011;154(11):709-718.

Table 4. Accuracy Indexes of the Clinical Decision Rules in Combination With a Normal D-Dimer Result in Patients With a Suspected Event*

Variable	Original Wells Rule (n = 796)	Simplified Wells Rule (n = 803)	RGS (n = 796)	Simplified RGS (n = 795)
Sensitivity†				
Number/number	190/191	191/192	188/189	187/188
Percentage (95% CI)	99.5 (97–100)	99.5 (97–100)	99.5 (97–100)	99.5 (97–100)
Specificity‡				
Number/number	183/605	177/611	184/607	189/607
Percentage (95% CI)	30 (27–34)	29 (25–33)	30 (27–34)	31 (28–34)
Negative predictive value§				
Number/number	183/184	177/178	184/185	189/190
Percentage (95% CI)	99.5 (97–100)	99.4 (97–100)	99.5 (97–100)	99.5 (97–100)

RGS = revised Geneva rule.
* Patients with a clinical decision rule indicating that PE was unlikely but in whom the D-dimer result was missing (protocol violation) were not included in this analysis; this number differed among the 4 clinical decision rules. Sensitivities did not differ among the 4 clinical decision rules in combination with D-dimer test. Specificity differed significantly between the Wells rule and the simplified Wells rule (P = 0.031) and the simplified Wells rule and the simplified RGS (P = 0.017). Other differences in specificity were not statistically significant.
† The number of patients correctly identified as having pulmonary embolism by the combination of clinical decision rules and D-dimer testing divided by the total number of patients with proven pulmonary embolism identified by computed tomography at the time of initial evaluation or venous thromboembolism at 3-mo follow-up.
‡ The number of patients correctly identified as not having pulmonary embolism by the combination of clinical decision rules and D-dimer testing divided by the total number of patients in whom pulmonary embolism was excluded by computed tomography at the time of initial evaluation or venous thromboembolism at 3-mo follow-up.
§ The number of patients correctly identified as not having pulmonary embolism by the combination of clinical decision rules and D-dimer testing divided by the total number of patients with the combination of clinical decision rule and D-dimer testing indicating that pulmonary embolism was excluded (i.e., pulmonary embolism and deep venous thrombosis).



Receiver-operating characteristic curves of the 4 clinical decision rules:
Area under the receiver-operating characteristic curves were 0.73 (95% CI, 0.69 to 0.77) for the Wells rule, 0.72 (CI, 0.68 to 0.76) for the simplified Wells rule, 0.70 (CI 0.65 to 0.74) for the revised Geneva score, and 0.69 (CI, 0.65 to 0.74) for the simplified revised Geneva score.

Ann Intern Med. 2011;154(11):709-718.

European Heart Journal Advance Access published August 29, 2014
European Heart Journal
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)

Terminologie

	Hemodynamická nestabilita [(a)]	Echokardiografické markery dilatace, dysfunkce PK a PH*	Kardiomarkery	Léčebná strategie
Masivní (high risk, mortalita >15%)	+	+	+	Trombolýza nebo embolektomie
Submasivní (medium risk)	-	+/-	+/-	Antikoagulace nebo trombolýza
Neriziková (mortalita <3%)	-	-	-	Antikoagulace

Early mortality risk		Risk parameters and scores			
		Shock or hypotension	PESI class III-V or sPESI >I[a]	Signs of RV dysfunction on an imaging test[b]	Cardiac laboratory biomarkers[c]
High		+	(+)[d]	+	(+)[d]
Intermediate	**Intermediate–high**	–	+	**Both positive**	
	Intermediate–low	–	+	**Either one (or none) positive[e]**	
Low		–	–	**Assessment optional; if assessed, both negative[e]**	

Task Force Members: Guidelines on the diagnosis and management. European Heart Journal (2008) 29, 2276–2315

Widimský J. et al. Doporučení diagnostiky, léčby a prevence plicní embolie. Verze 2007. Doporučení České kardiologické společnosti. Vnitř. lék. 2008, 54, Suppl. 1, S25-72

European Heart Journal Advance Access published August 29, 2014
European Heart Journal
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)

PESI – prognostická stratifikace

Parameter	Original version[214]	Simplified version[218]
Age	Age in years	1 point (if age >80 years)
Male sex	+10 points	–
Cancer	+30 points	1 point
Chronic heart failure	+10 points	1 point
Chronic pulmonary disease	+10 points	
Pulse rate ≥110 b.p.m.	+20 points	1 point
Systolic blood pressure <100 mm Hg	+30 points	1 point
Respiratory rate >30 breaths per minute	+20 points	–
Temperature <36 °C	+20 points	–
Altered mental status	+60 points	–
Arterial oxyhaemoglobin saturation <90%	+20 points	1 point
	Risk strata[a]	
	Class I:≤65 points very low 30-day mortality risk (0–1.6%) **Class II: 66–85 points** low mortality risk (1.7–3.5%) **Class III: 86–105 points** moderate mortality risk (3.2–7.1%) **Class IV: 106–125 points** high mortality risk (4.0–11.4%) **Class V: >125 points** very high mortality risk (10.0–24.5%)	**0 points**= 30-day mortality risk 1.0% (95% CI 0.0%–2.1%) **≥1 point(s)**= 30-day mortality risk 10.9% (95% CI 8.5%–13.2%)

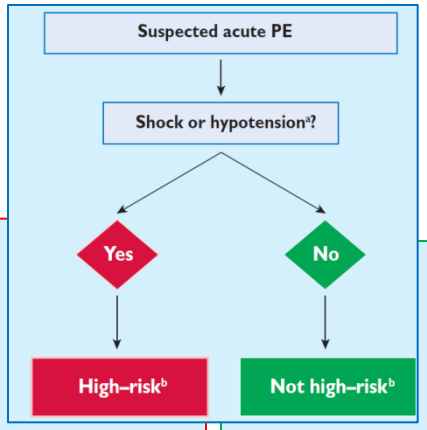
Diagnostika a riziková stratifikace

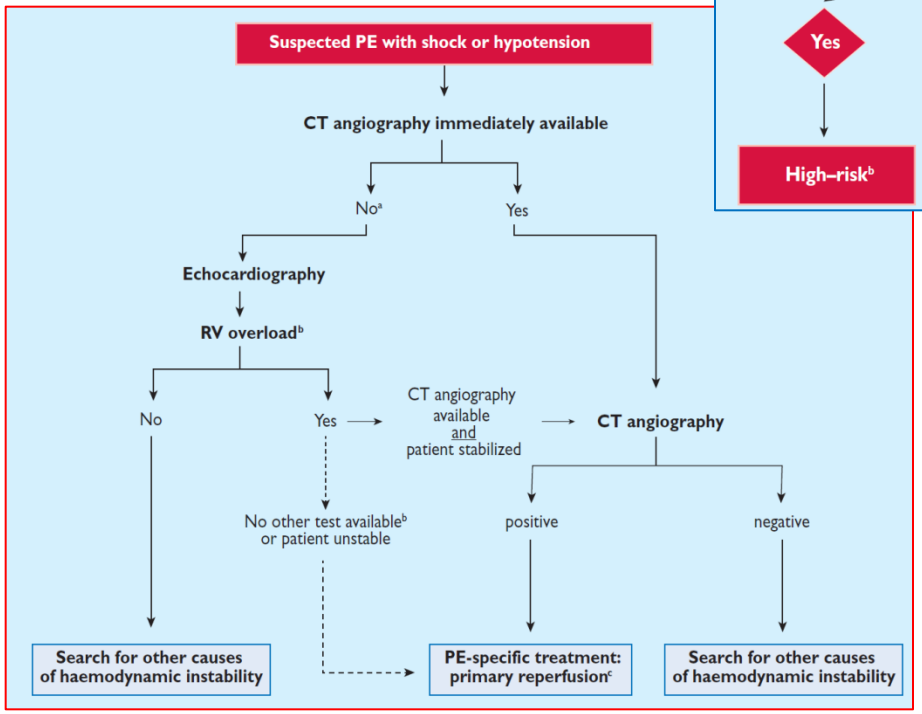
European Heart Journal Advance Access published August 29, 2014
European Heart Journal
doi:10.1093/eurheartj/ehu283
ESC GUIDELINES

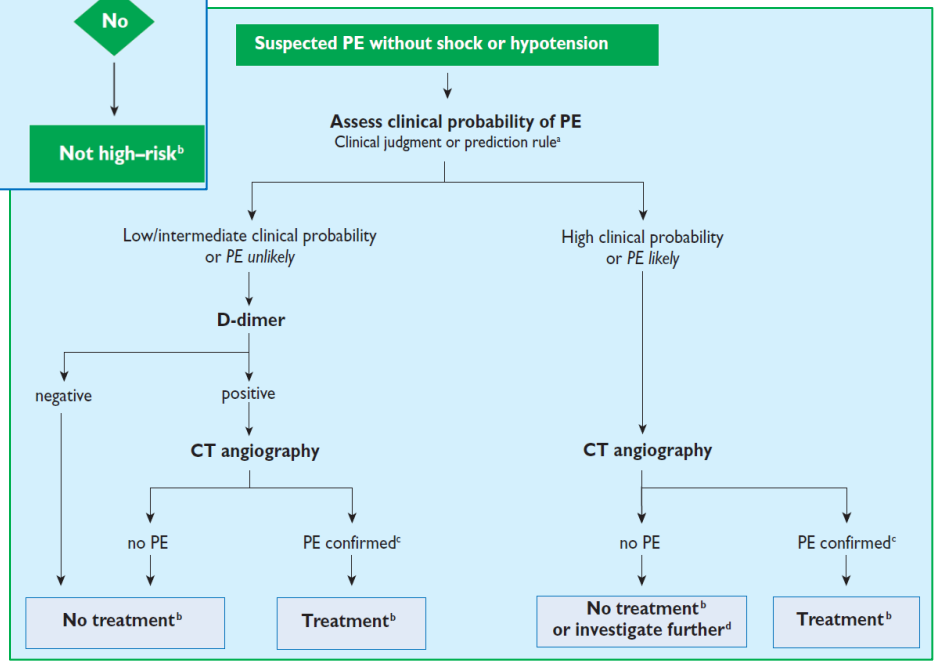
2014 ESC Guidelines on the diagnosis and management of acute pulmonary embolism

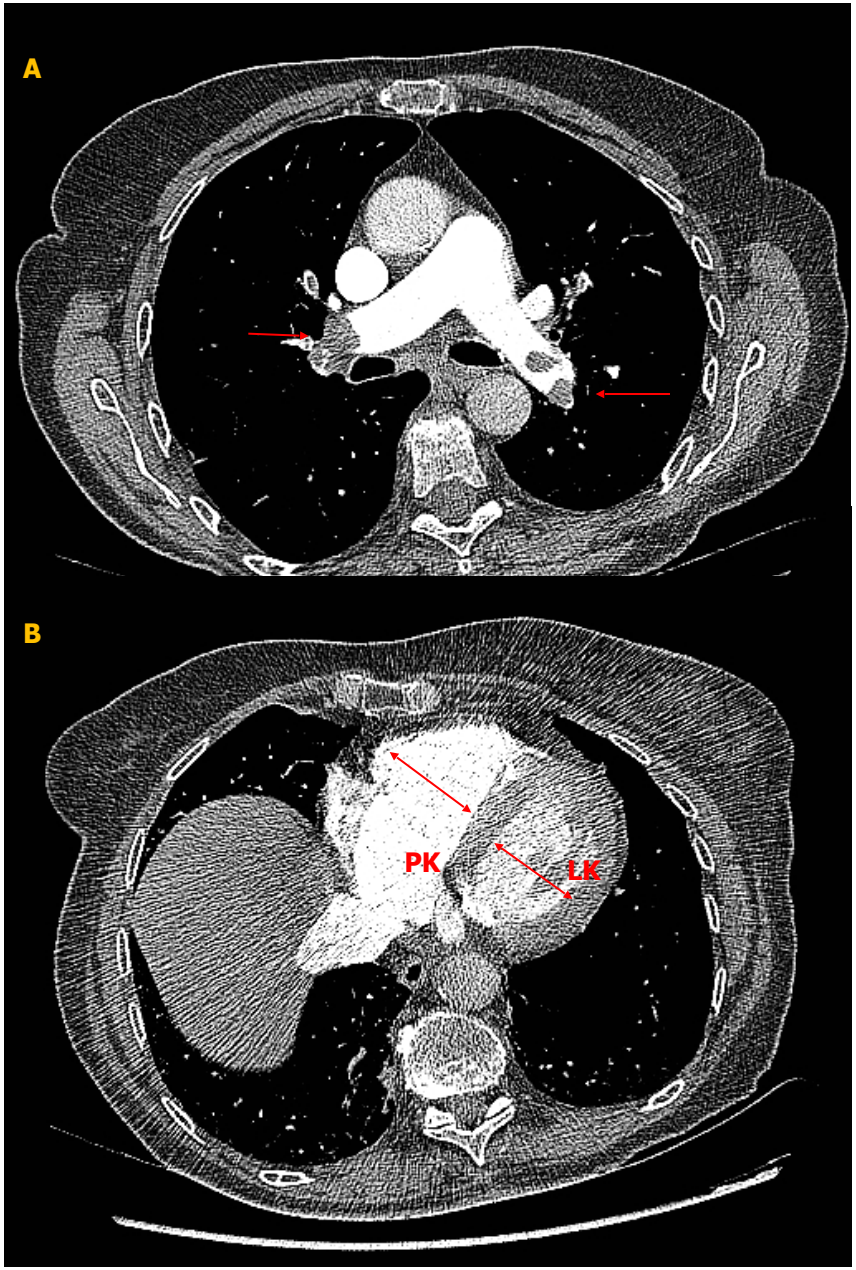
The Task Force for the Diagnosis and Management of Acute Pulmonary Embolism of the European Society of Cardiology (ESC)

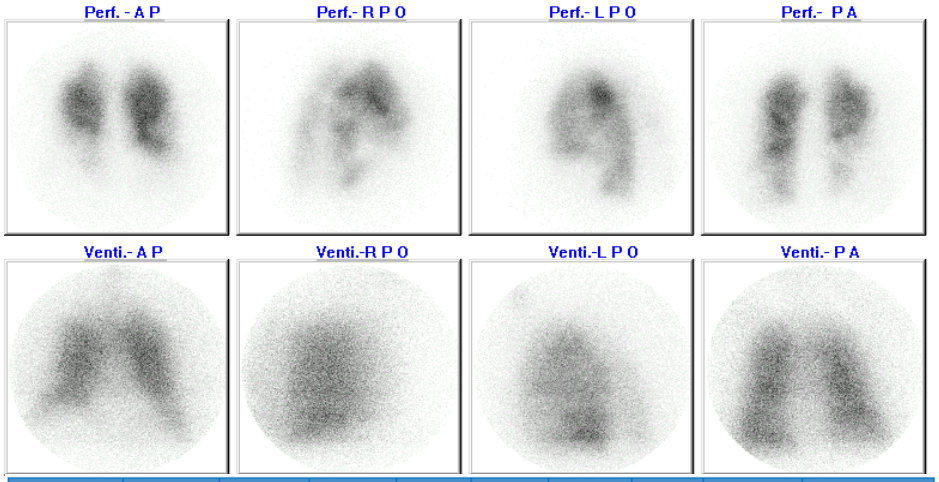
Endorsed by the European Respiratory Society (ERS)





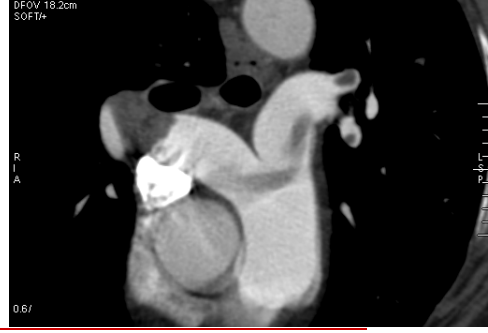


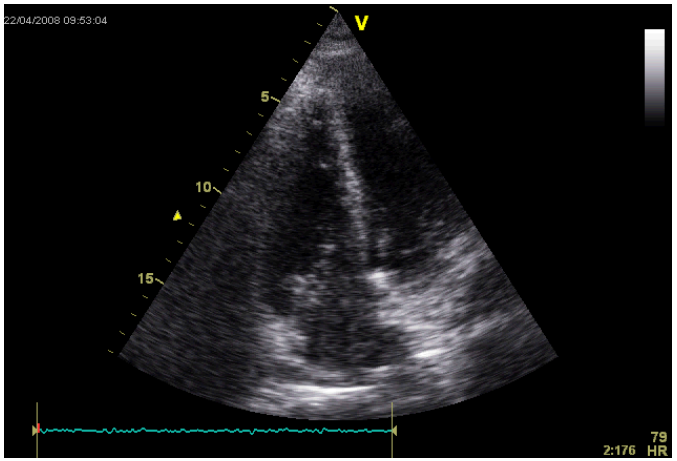


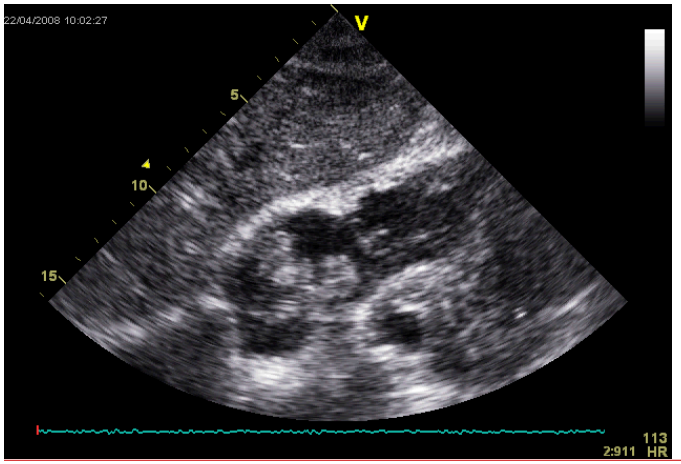


Test or biomarker	Cut-off value	Sensitivity, % (95% CI)	Specificity, % (95% CI)	NPV, % (95% CI)	PPV, % (95% CI)	OR or HR (95% CI)	No. patients	Study design (reference)	Remarks
Echocardiography	Various criteria of RV dysfunction	74 (61–84)	54 (51–56)	98 (96–99)	8 (6–10)	2.4 (1.3–4.3)	1249	Meta-analysis[226]	RV dysfunction on echocardiography or CT was one of the inclusion criteria in two randomized trials investigating thrombolysis in normotensive patients with PE.[252, 253]
CT angiography	RV/LV ≥1.0	46 (27–66)	59 (54–64)	93 (89–96)	8 (5–14)	1.5 (0.7–3.4)	383	Meta-analysis[226]	
	RV/LV ≥0.9	84 (65–94)	35 (30–39)	97 (94–99)	7 (5–10)	2.8 (0.9–8.2)	457	Prospective cohort[228]	
BNP	75–100 pg/mL	85 (64–95)	56 (50–62)	98 (94–99)	14 (9–21)	6.5 (2.0–21)	261	Meta-analysis[232]	The optimal cut-off value for PE has not been defined.
NT-proBNP	600 pg/mL	86 (69–95)	50 (46–54)	99 (97–100)	7 (5–19)	6.3 (2.2–18.3)	688	Prospective cohort[234e]	NT-proBNP <500 pg/mL was one of the inclusion criteria in a single-armed management trial investigating home treatment of PE.[237]
Troponin I	Different assays/ cut-off values[c]	NR	NR	NR	NR	4.0 (2.2–7.2)	1303	Meta-analysis[239]	A positive cardiac troponin test was one of the inclusion criteria in a randomized trial investigating thrombolysis in normotensive patients with PE.[253]
Troponin T	Different assays/cut-off values[c]	NR	NR	NR	NR		682	Meta-analysis[239]	
	14 pg/mL[d]	87 (71–95)	42 (38–47)	98 (95–99)	9 (6–12)	5.0 (1.7–14.4)	526	Prospective cohort[76e]	
H-FABP	6 ng/mL	89 (52–99)	82 (74–89)	99 (94–99)	28 (13–47)	36.6 (4.3–304)	126	Prospective cohort[244e]	

Tranzientní tromby







Přítomny až u 4 (18)% nemocných s plicní embolií

Závažný nález indikující trombolýzu

Při kontraindikaci (při PFO z rizikem vzniku paradoxní embolizace) k embolektomii

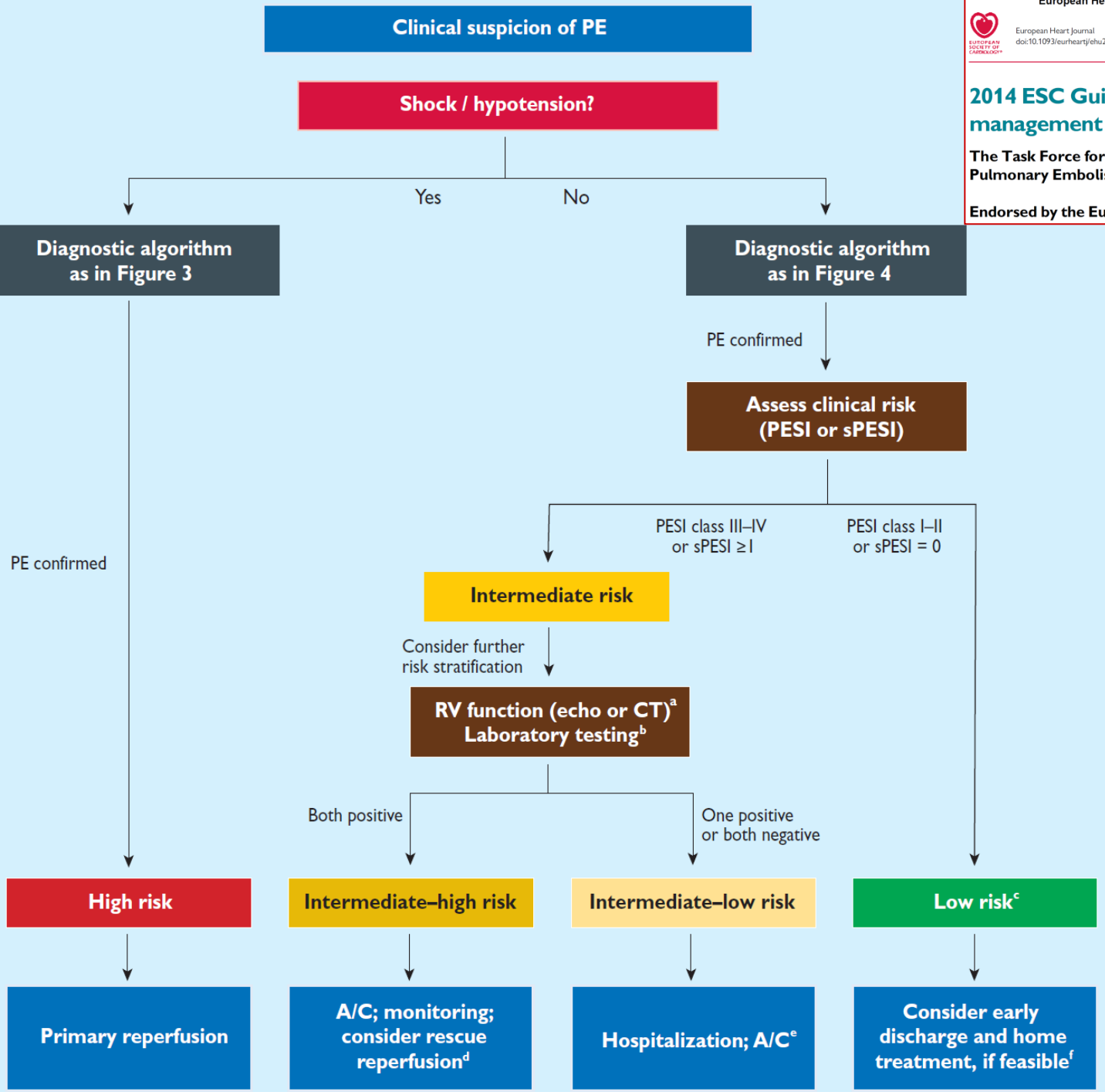
Casazza F, Bongarzoni A. Prevalence and prognostic significance of right-sided cardiac mobile thrombi in acute massive pulmonary embolism. Am J Cardiol 1997; 79:1433-5
Chartier L, Bera J. et al. Free-Floating Thrombi in the right Heart: Diagnosis, management and prognostic indexes in 38 consecutive patients. Circulation 1999; 99: 2779-83

European Heart Journal Advance Access published August 29, 2014
European Heart Journal
doi:10.1093/eurheartj/ehu283
ESC GUIDELINES

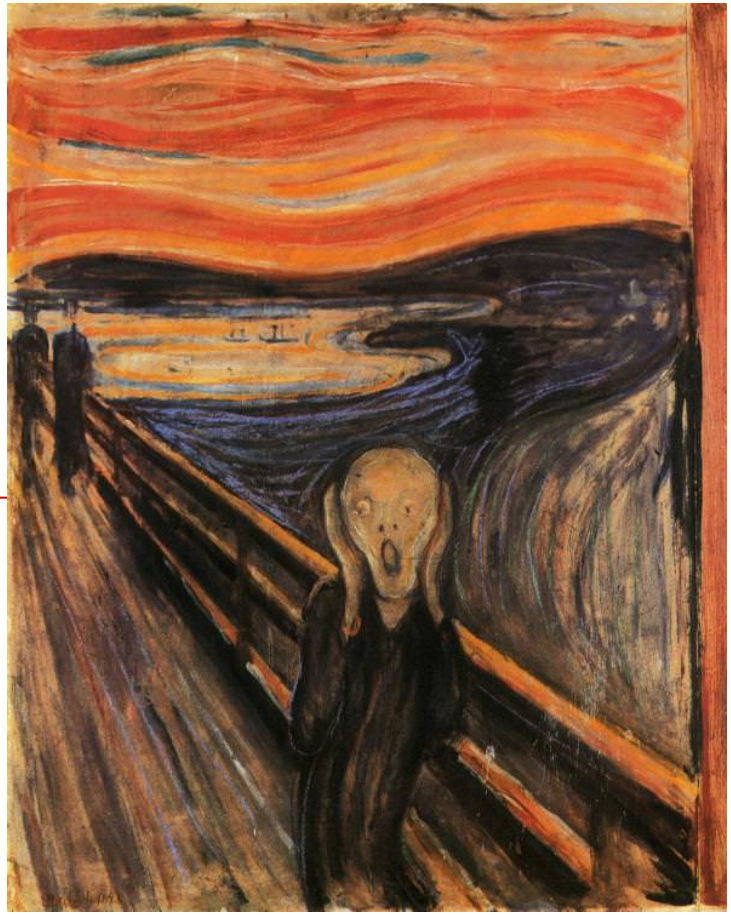
2014 ESC Guidelines on the diagnosis and management of acute pulmonary embolism

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)



I. INTERNÍ KLINIKA KARDIOLOGIE
FAKULTNÍ NEMOCNICE OLOMOUC

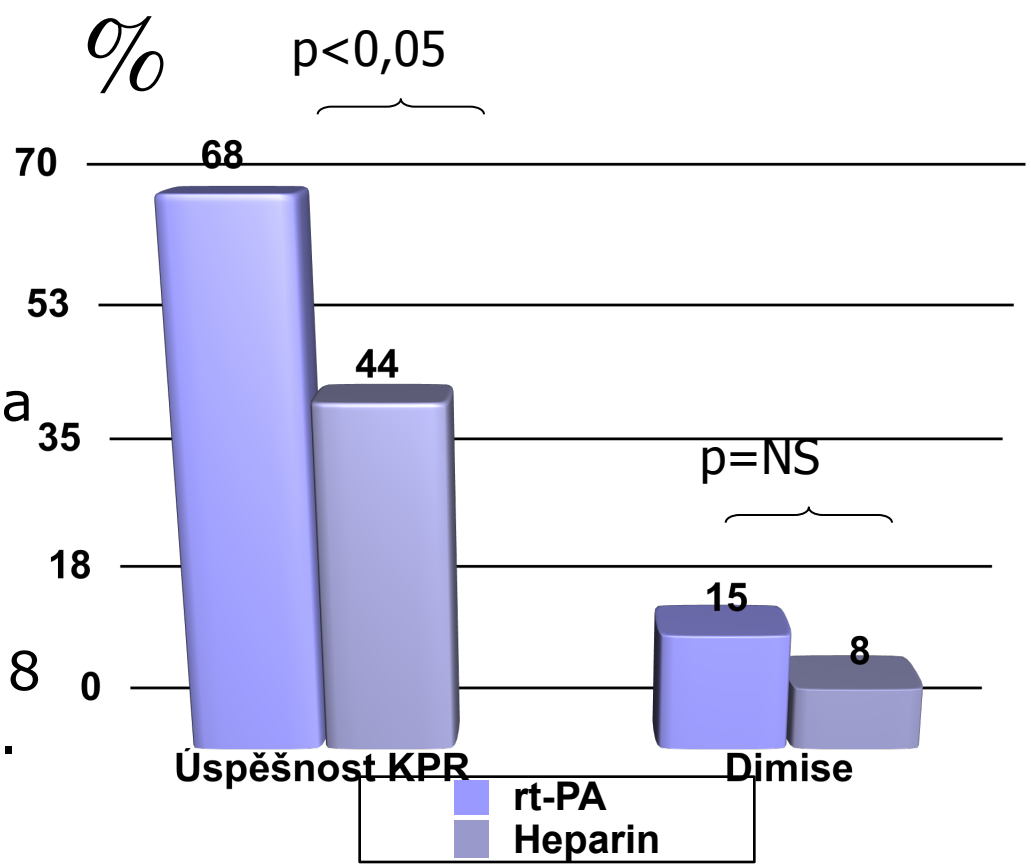


Masivní (high-risk) plicní embolie se zástavou oběhu a KPR

I. INTERNÍ KLINIKA
KARDIOLOGIE
FAKULTNÍ NEMOCNICE OLOMOUC

Trombolýza při zástavě oběhu způsobené plicní embolií

- Prospektivní studie srovnávající **rt-PA** 50 mg/2 min. (n=40) + heparin i.v. s **konvenčním postupem** (n=50) u pacientů s masivní PE a >15 min. trvající oběhovou zástavou s nutností KPR
- 1 zachráněný život na 8 trombolyzovaných pac.



Bottiger BW. Efficacy and safety of thrombolytic therapy after initially unsuccessful cardiopulmonary resuscitation: a prospective clinical trial. Lancet 2001;357:1583–5

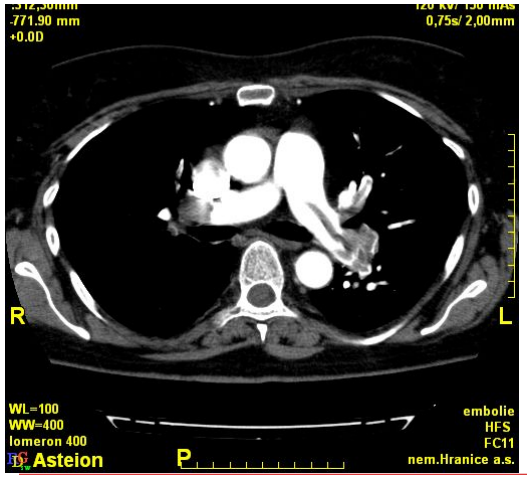
Masivní high-risk plicní embolie s hypotenzí a kardiogenním šokem

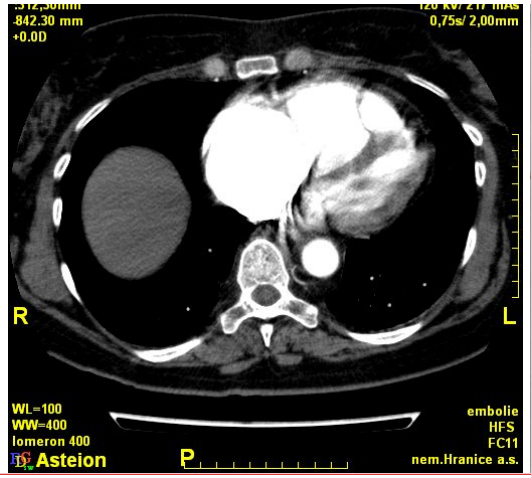
I. INTERNÍ KLINIKA
KARDIOLOGIE
FAKULTNÍ NEMOCNICE OLOMOUC

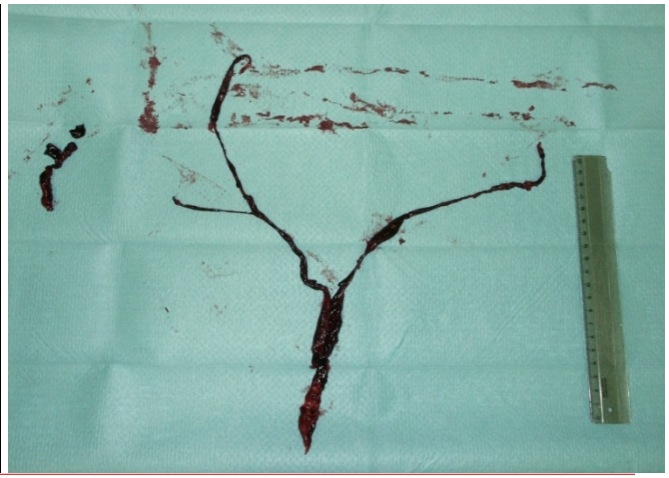
Trombolýza vs. heparin u „high-risk“ plicní embolie

- Jerjez-Sanchez, J Thromb Thrombolysis 1995;2:227–9

Study	Treatment regimens	No. of patients	Mortality, n (%)	Recurrence n (%)	Major haemorrhage,* n (%)	Comments
Jerjes-Sanchez et al.	**STREPROKINÁZA vs. HEPARIN**	**4** **4**	**0 (0%)** **4 (100%)**	**0** **NA**	**2 (4,3%)** **0**	







Jerjes-Sanchez C, Ramirez-Rivera A, Garcia M de L, et al. Streptokinase and heparin versus heparin alone in massive pulmonary embolism; a randomized controlled trial. J Thromb Thrombolysis 1995;2:227–9

Kontraindikace trombolýzy

Absolute contraindications[a]

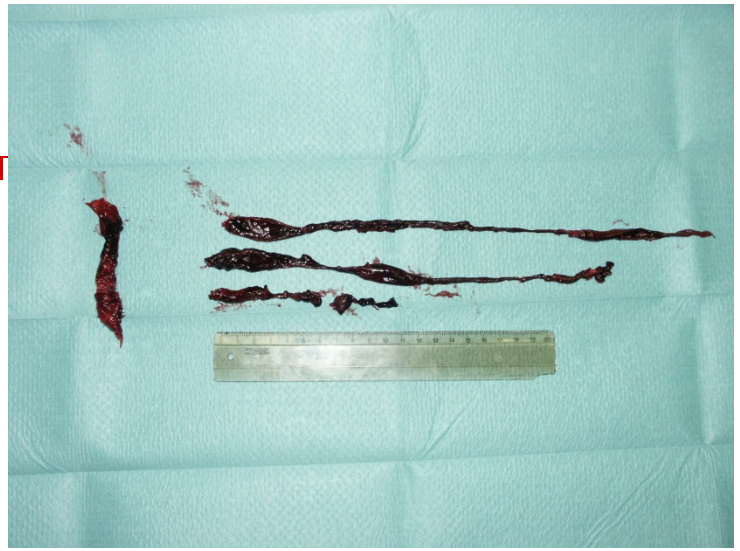
- Haemorrhagic stroke or stroke of unknown origin at any time
- Ischaemic stroke in preceding 6 months
- Central nervous system damage or neoplasms
- Recent major trauma/surgery/head injury (within preceding 3 weeks)
- Gastrointestinal bleeding within the last month
- Known bleeding

Relative contraindications

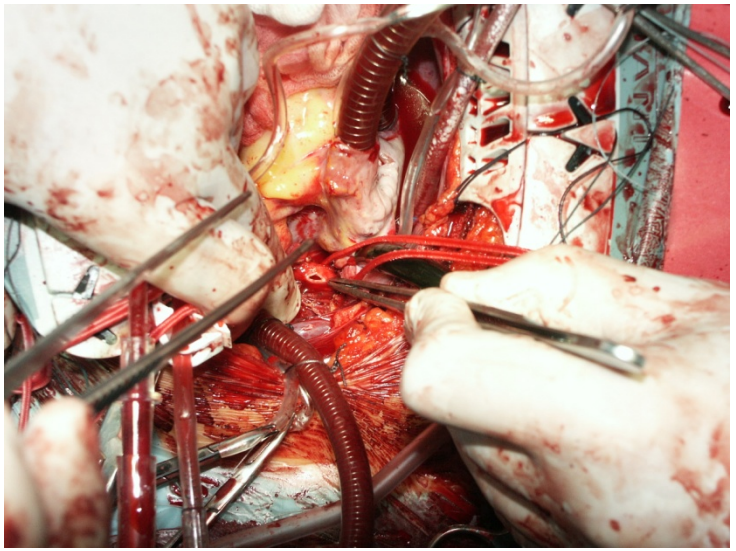
- Transient ischaemic attack in preceding 6 months
- Oral anticoagulant therapy
- Pregnancy or within 1 week post partum
- Non-compressible punctures
- Traumatic resuscitation
- Refractory hypertension (systolic blood pressure >180 mmHg)
- Advanced liver disease
- Infective endocarditis
- Active peptic ulcer

Embolektomie

- „Reperfuzní – emboly odstraňující“ alternativa trombolýzy při kontraindikaci podání

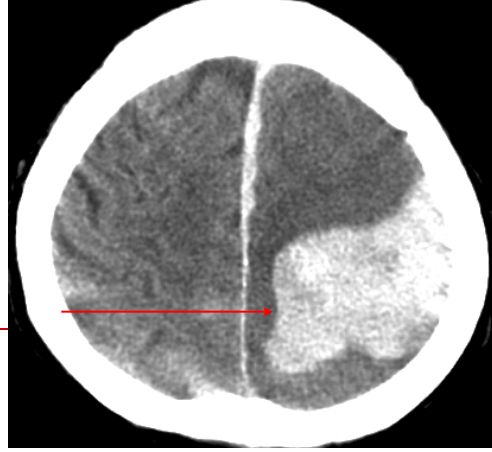


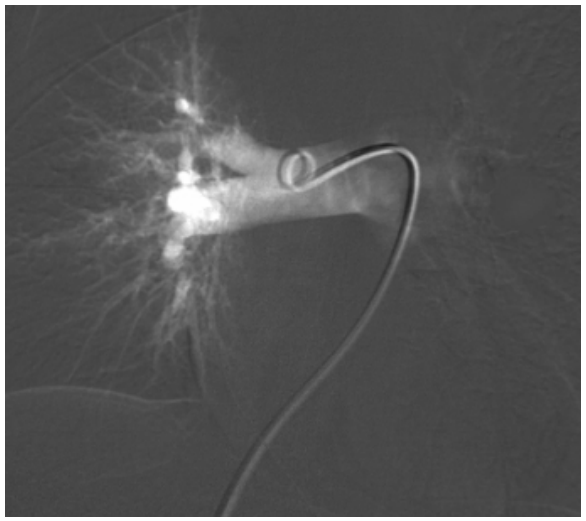
- Srovnávací studie 23 pacientů v kardiogenním šoku léčených embolektomií a 24 léčených farmakologicky (TL) prokázala přežívaní 77% proti 67% v konzervativně léčené skupině.

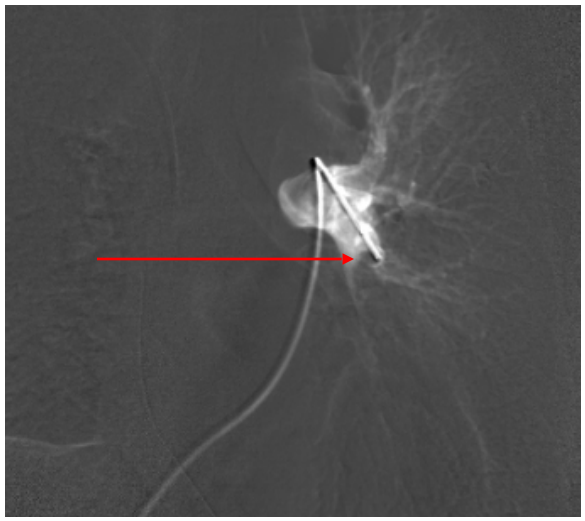


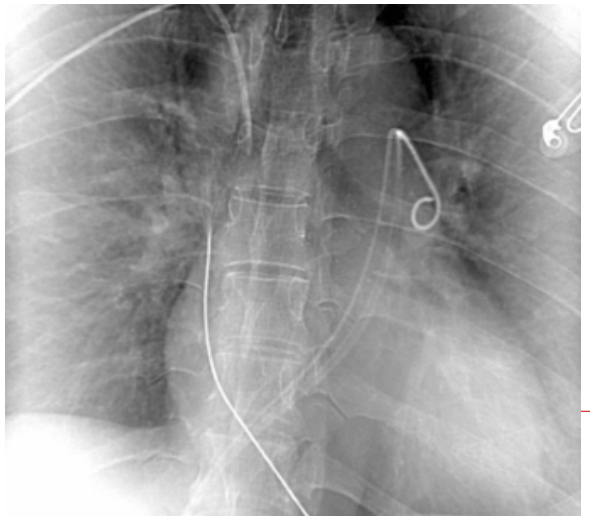
Clark D, Abrams L. Pulmonary embolectomy. A 25-year experience. J Thorac Cardiovasc Surg 1986;92:442–5.
Doerge H, Schoendole T, Voss M, et al. Surgical therapy for fulminant pulmonary embolism: early and late results. Thorac Cardiovasc Surg1999;47:9–13.
Gulba D, Schmid C, Borst H, et al. Medical compared to surgical treatment ofmassive pulmonary embolism. Lancet 1994;343:576–7.

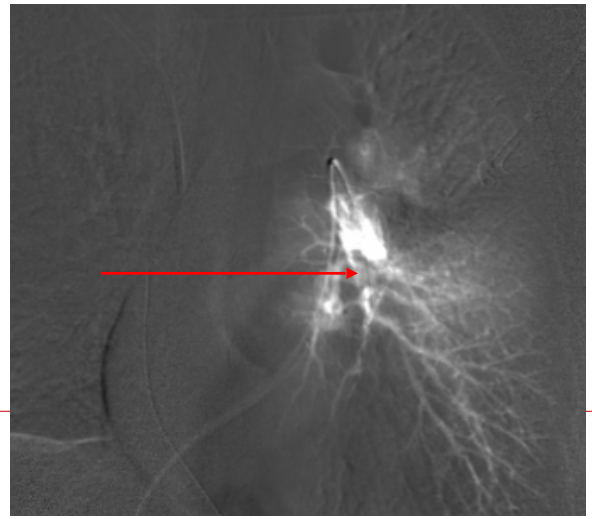
Katetrová fragmentace PE





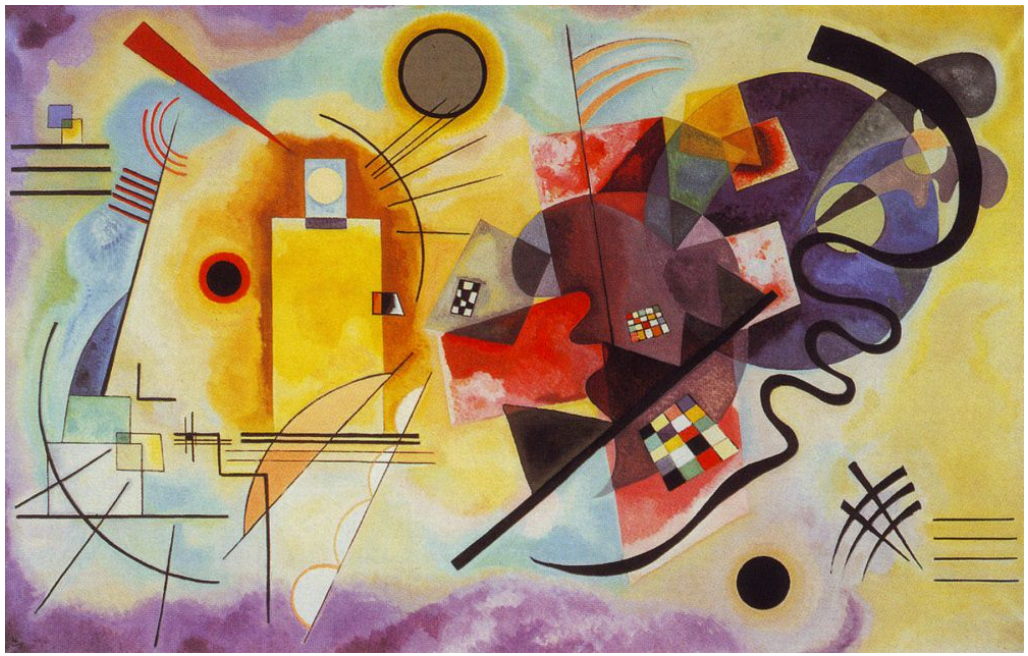


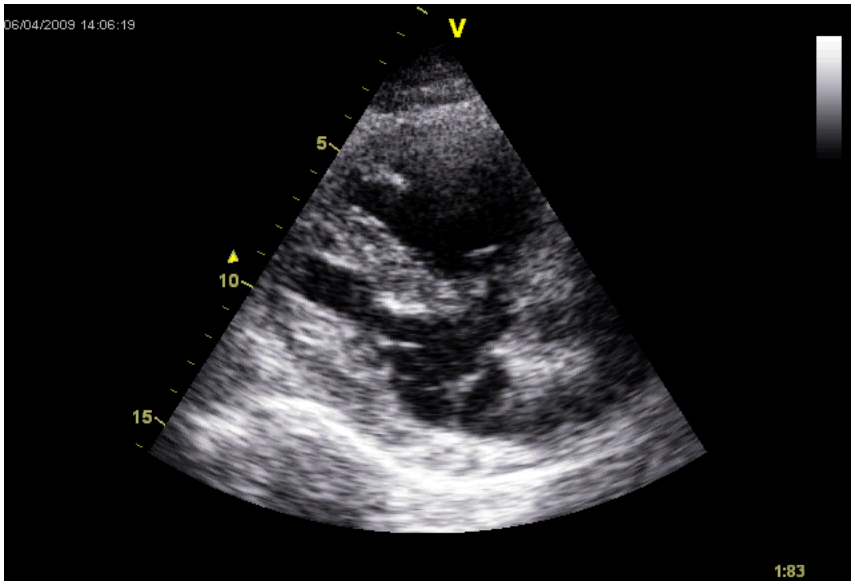


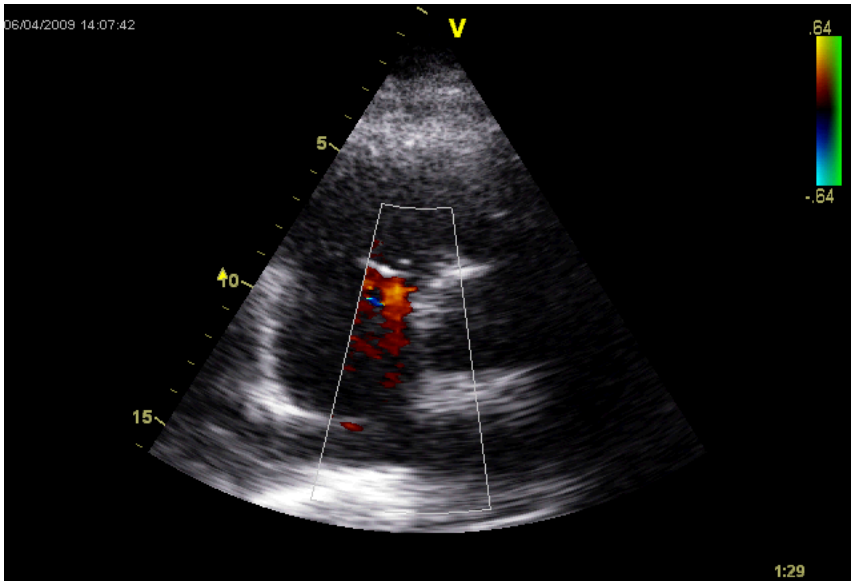


- Při vysokém riziku závažné hemoragie
- Prospektivní studie konsekutivních pacientů s dysfunkcí PK bez kardiogenního šoku: **mortalita** 11% a **zvýšení srdečního výdeje** u 91%
- Rescue metoda bez žádné srovnávací studie

Submasivní - středně riziková plicní embolie







Normální systémový tlak, anamnéza synkopy (!), narůstající dušnost při léčbě LMWH, troponin T 0,24 μg/l, NT-proBNP 11375 ng/l, snížený srdeční výdej

MAPPET-2

Registr 1001 pacientů, 719 normotenzních pacientů s dysfunkcí pravé komory

	Trombolýza (n=169)	**Heparin** (n=550)	Sign.
Mortalita	4,7%	11,1%	0,016
Recidiva	7,7%	18,7%	<0,001
Větší hemoragie	21,9%	7,8%	<0,001
Mozková hemoragie	1,2%	0,4%	NS

W Kasper, S Konstantinides, A Geibel et al.: Management strategies and determinants of outcome in acute major pulmonary embolism: results of a multicenter registry J Am Coll Cardiol 1997 30: 1165-1171

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Fibrinolysis for Patients with Intermediate-Risk Pulmonary Embolism

Guy Meyer, M.D., Eric Vicaut, M.D., Thierry Danays, M.D., Giancarlo Agnelli, M.D., Cecilia Becattini, M.D., Jan Beyer-Westendorf, M.D., Erich Bluhmki, M.D., Ph.D., Helene Bouvaist, M.D., Benjamin Brenner, M.D., Francis Couturaud, M.D., Ph.D., Claudia Dellas, M.D., Klaus Empen, M.D., Ana Franca, M.D., Nazzareno Galiè, M.D., Annette Geibel, M.D., Samuel Z. Goldhaber, M.D., David Jimenez, M.D., Ph.D., Matija Kozak, M.D., Christian Kupatt, M.D., Nils Kucher, M.D., Irene M. Lang, M.D., Mareike Lankeit, M.D., Nicolas Meneveau, M.D., Ph.D., Gerard Pacouret, M.D., Massimiliano Palazzini, M.D., Antoniu Petris, M.D., Ph.D., Piotr Pruszczyk, M.D., Matteo Rugolotto, M.D., Aldo Salvi, M.D., Sebastian Schellong, M.D., Mustapha Sebbane, M.D., Bozena Sobkowicz, M.D., Branislav S. Stefanovic, M.D., Ph.D., Holger Thiele, M.D., Adam Torbicki, M.D., Franck Verschuren, M.D., Ph.D., and Stavros V. Konstantinides, M.D., for the PEITHO Investigators*

ORIGINAL ARTICLE

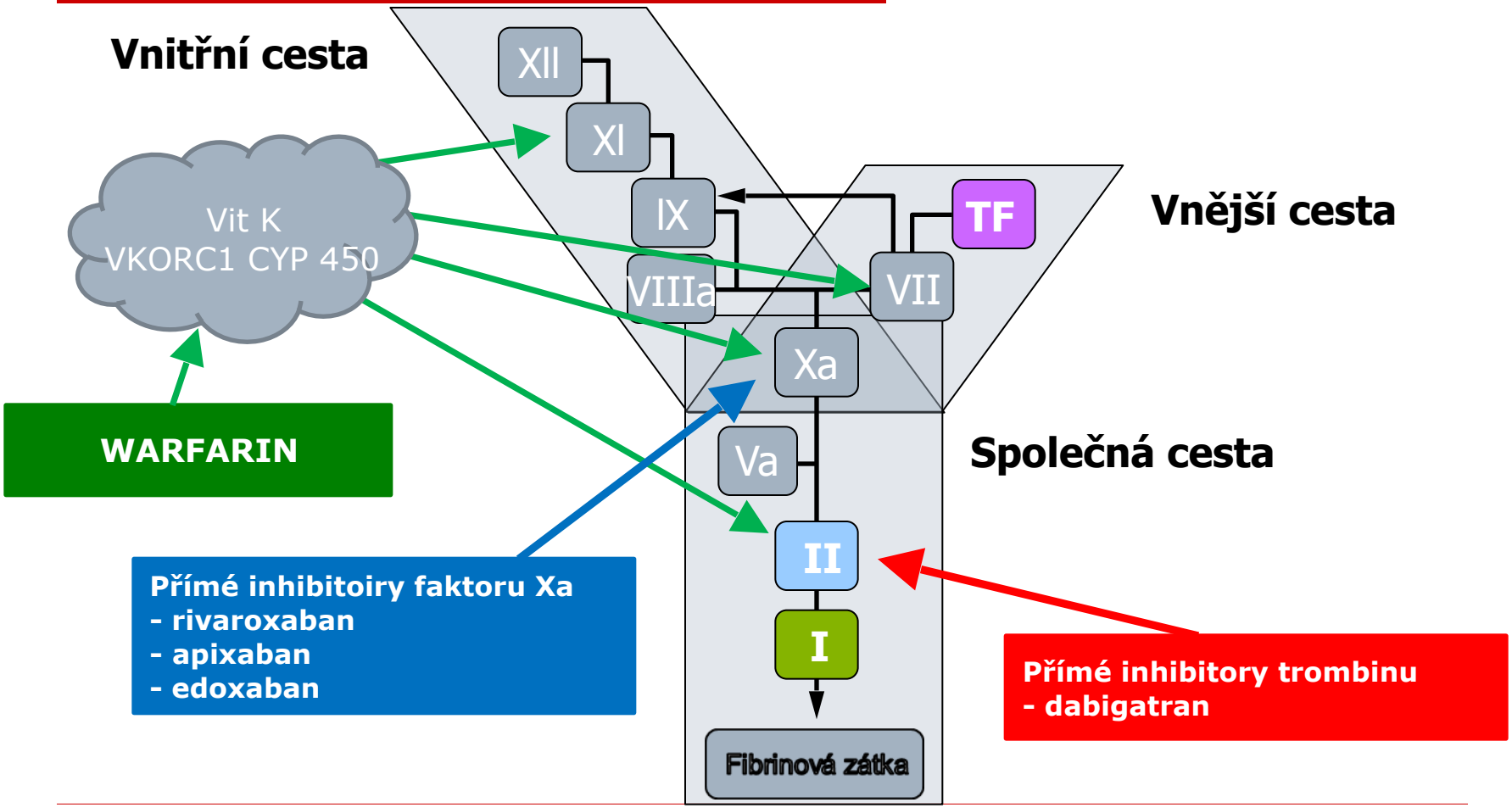
Fibrinolysis for Patients with Intermediate-Risk Pulmonary Embolism

Outcome	Tenecteplase (N=506)	Placebo (N=499)	Odds Ratio (95% CI)	P Value
Primary outcome — no. (%)	13 (2.6)	28 (5.6)	0.44 (0.23–0.87)	0.02
Death from any cause	6 (1.2)	9 (1.8)	0.65 (0.23–1.85)	0.42
Hemodynamic decompensation	8 (1.6)	25 (5.0)	0.30 (0.14–0.68)	0.002
Time between randomization and primary efficacy outcome — days	1.54±1.71	1.79±1.60		
Recurrent pulmonary embolism between randomization and day 7 — no. (%)	1 (0.2)	5 (1.0)	0.20 (0.02–1.68)	0.12
Fatal	0	3 (0.6)		
Nonfatal	1 (0.2)	2 (0.4)		
Other in-hospital complications and procedures — no. (%)				
Mechanical ventilation	8 (1.6)	15 (3.0)		
Surgical embolectomy	1 (0.2)	2 (0.4)		
Catheter thrombus fragmentation	1 (0.2)	0 (0.0)		
Vena cava interruption	5 (1.0)	1 (0.2)		
Thrombolytic treatment other than study medication	4 (0.8)	23 (4.6)		
Death from any cause between randomization and day 30 — no. (%)	12 (2.4)	16 (3.2)	0.73 (0.34–1.57)	0.42
Patient still hospitalized at day 30 — no. (%)	59 (11.7)	50 (10.0)		
Rehospitalization between randomization and day 30 — no. (%)	22 (4.4)	15 (3.0)		

Table 4. Safety Outcomes in the Intention-to-Treat Population.*

Outcome	Tenecteplase (N=506)	Placebo (N=499)	Odds Ratio (95% CI)	P Value
	no. (%)			
Bleeding between randomization and day 7				
Major extracranial bleeding	32 (6.3)	6 (1.2)	5.55 (2.3–13.39)	<0.001
Minor bleeding	165 (32.6)	43 (8.6)		
Major bleeding†	58 (11.5)	12 (2.4)		
Stroke between randomization and day 7	12 (2.4)	1 (0.2)	12.10 (1.57–93.39)	0.003
Ischemic stroke	2 (0.4)	0		
Hemorrhagic stroke‡	10 (2.0)	1 (0.2)		
Serious adverse events between randomization and day 30	55 (10.9)	59 (11.8)	0.91 (0.62–1.34)	0.63

Koagulační kaskáda

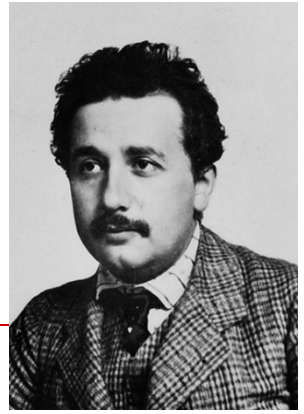


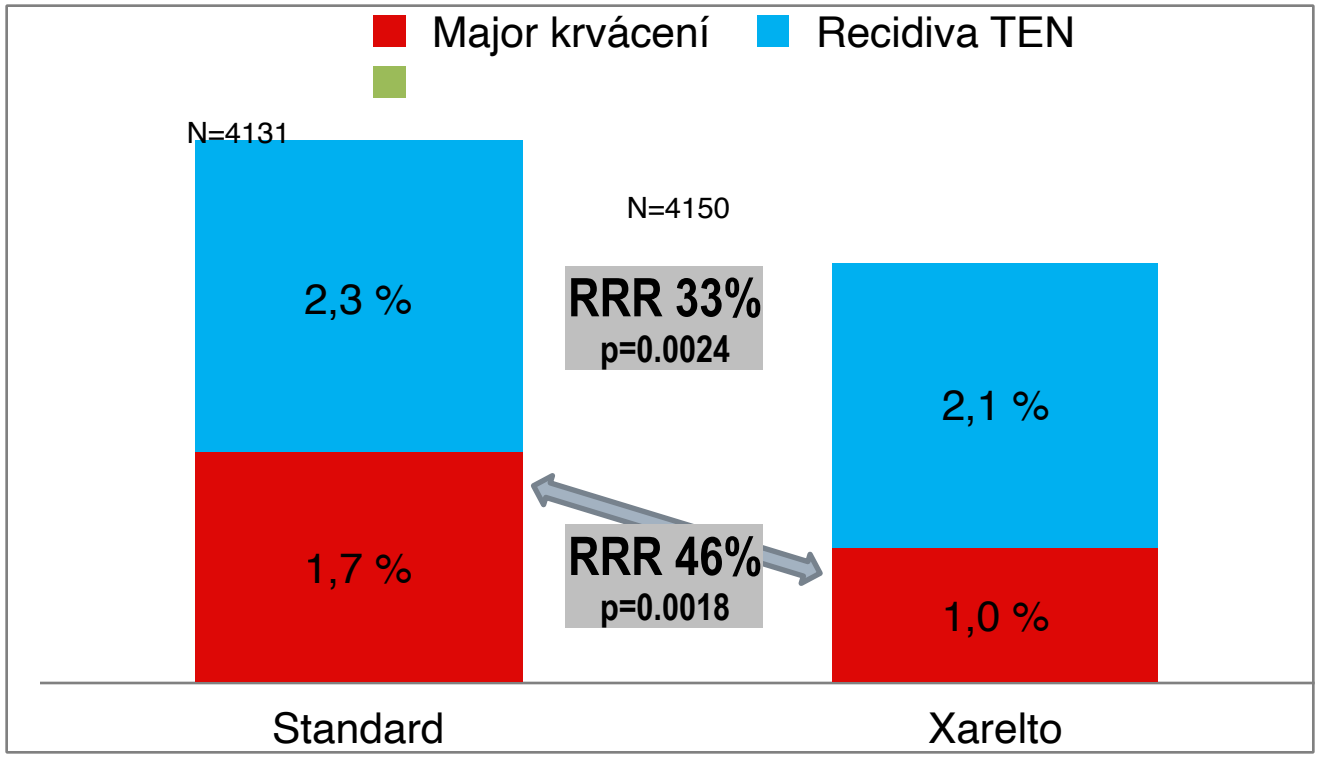
Převzato z Ansell J. J Thromb Haemost. 2007;5(suppl1):60-64.
Guyton AC, Hall JE. Hemostasis and blood coagulation. In: Textbook of Medical Physiology. 10th ed. Philadelphia, PA: WB Saunders Co; 2000:419-429.
Moake JL. Hemostasis. In: Porter RS, Kaplan JL, Homeier BP, eds. The Merck Manual Online

NOAC/DVT a PE - přehled

	Rivaroxaban	Dabigatran	Apixaban	Edoxaban
klin. studie	EINSTEIN (-PE, -DVT, -Ext)	RE-COVER	AMPLIFY	HOKUSAI-VTE
dávkování	15 mg 2x denně (první 3T), 20 mg 1x denně	LMWH 5dní, poté 150 mg 2x denně	10 mg 2x denně (prvních 7D), poté 5mg 2x denně	LMWH 5dní, poté 60 mg 1x denně
rekurence TEN	NI (HR 1,12)	NI (2,4% vs. 2,1%)	NI (2,3% vs. 2,7%)	NI (3,2% vs. 3,5%)
„major" krvácení	NI (10,3% vs. 11,4%)	NI (1,6 vs. 1,9%)	**SUP (0,6% vs. 1,8%)**	**SUP (8,5% vs. 10,3%)**
„major" krvácení + klin. relevantní krvácení	**SUP (1,1 % vs 2,2%)**	NI	**SUP (4,3% vs. 9,7%)**	-

EINSTEIN DVT a PE - výsledky



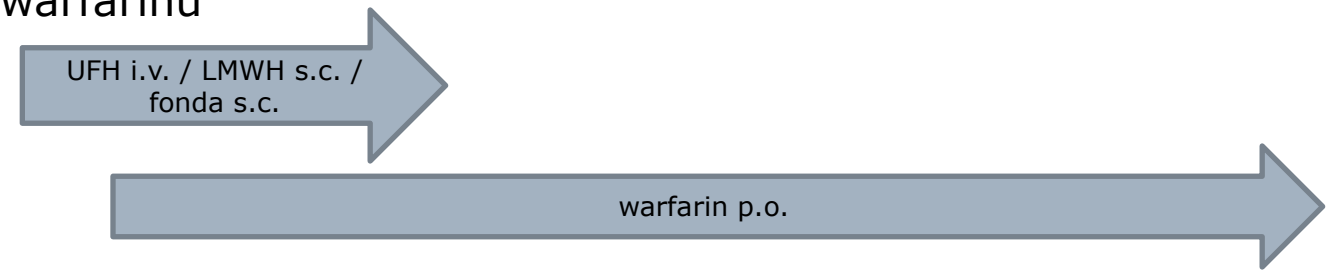


Recidiva TEN: Kompozit symptomatické rekurentní HŽT, symptomatické PE (fatální nebo nefatální), úmrtí asociovaného s TEN a progrese trombózy

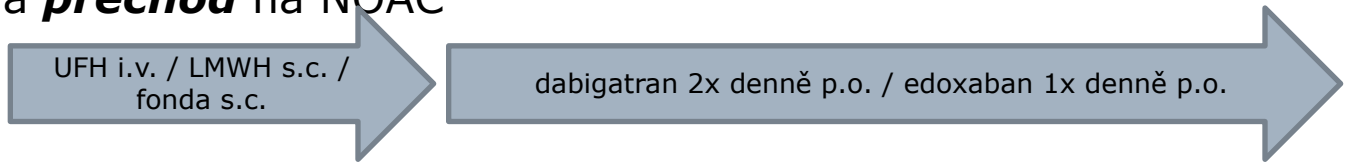
Buller H, Oral Rivaroxaban for the Treatment of Symptomatic Venous Thromboembolism: A Pooled Analysis of the EINSTEIN DVT and EINSTEIN PE Studies, ASH 2012, https://ash.confex.com/ash/2012/webprogram/Paper51556.html

Terapeutické schémata

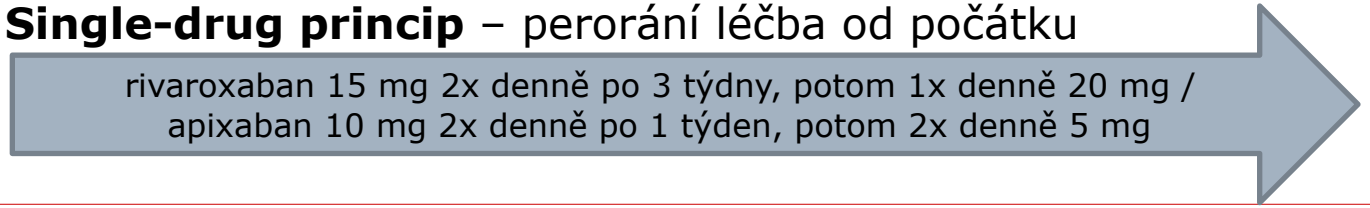
- **Klasické schéma** – ***překrytí*** parenterálního antikoagulancia a warfarinu



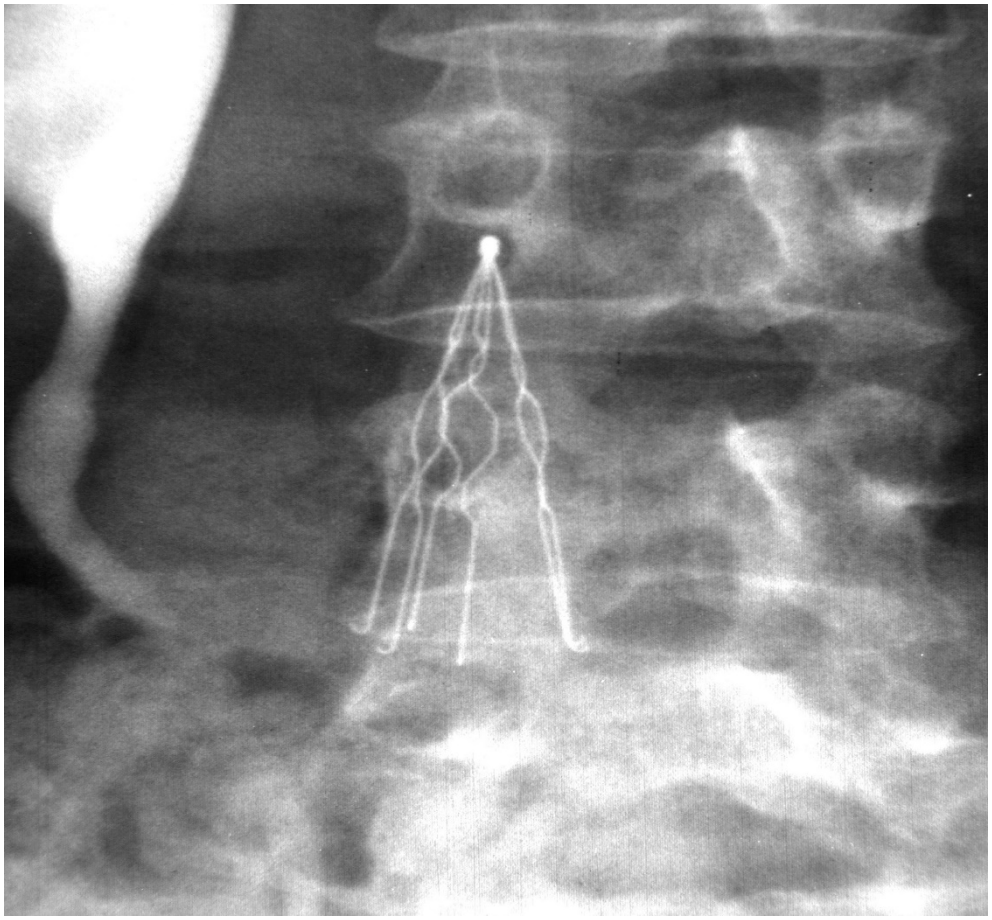
- **Sekvenční podávání** – zahájení léčby parenterálním antikoagulanciem a ***přechod*** na NOAC

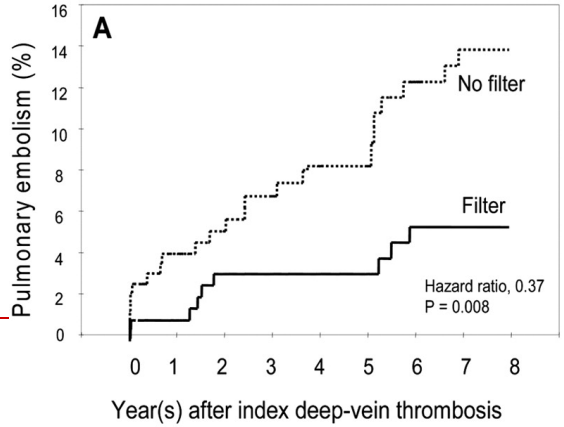


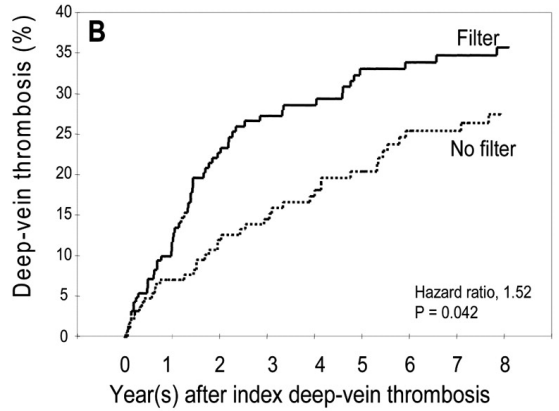
- **Single-drug princip** – perorání léčba od počátku

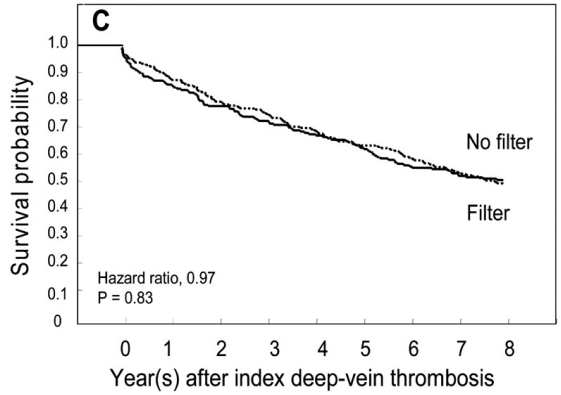


Kavální filtry?









The PREPIC Study Group, Circulation 2005

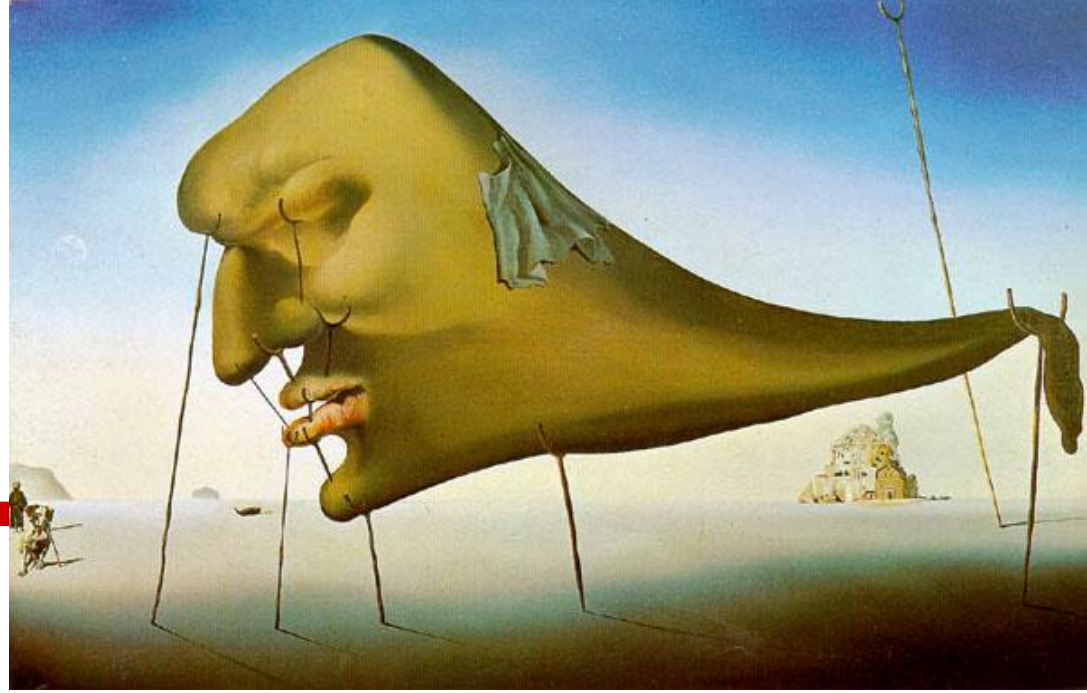
I. INTERNÍ KLINIKA
KARDIOLOGIE
FAKULTNÍ NEMOCNICE OLOMOUC

Recommendations	Class[a]	Level[b]	Ref[c]
PE with shock or hypotension (high-risk)			
It is recommended that intravenous anticoagulation with UFH be initiated without delay in patients with high-risk PE.	I	C	
Thrombolytic therapy is recommended.	I	B	168
Surgical pulmonary embolectomy is recommended for patients in whom thrombolysis is contraindicated or has failed.[d]	I	C	313
Percutaneous catheter-directed treatment should be considered as an alternative to surgical pulmonary embolectomy for patients in whom full-dose systemic thrombolysis is contraindicated or has failed.[d]	IIa	C	

Recommendations	Class[a]	Level[b]	Ref[c]
PE without shock or hypotension (intermediate-or low-risk)[d]			
Anticoagulation: combination of parenteral treatment with VKA			
Initiation of parenteral anticoagulation is recommended without delay in patients with high or intermediate clinical probability of PE while diagnostic work-up is in progress.	I	C	352
LMWH or fondaparinux is the recommended form of acute phase parenteral anticoagulation for most patients.	I	A	273, 274, 281, 353
In parallel to parenteral anticoagulation, treatment with a VKA is recommended, targeting an INR of 2.5 (range 2.0–3.0).	I	B	352, 354
Anticoagulation: new oral anticoagulants			
As an alternative to the combination of parenteral anticoagulation with a VKA, anticoagulation with rivaroxaban (15 mg twice daily for 3 weeks, followed by 20 mg once daily) is recommended.	I	B	296
As an alternative to the combination of parenteral anticoagulation with a VKA, anticoagulation with apixaban (10 mg twice daily for 7 days, followed by 5 mg twice daily) is recommended.	I	B	
As an alternative to VKA treatment, administration of dabigatran (150 mg twice daily, or 110 mg twice daily for patients ≥80 years of age or those under concomitant verapamil treatment) is recommended following acute-phase parenteral anticoagulation.	I	B[e]	
As an alternative to VKA treatment, administration of edoxaban* is recommended following acute-phase parenteral anticoagulation.	I	B	
New oral anticoagulants (rivaroxaban, apixaban, dabigatran, edoxaban) are not recommended in patients with severe renal impairment.[f]	III	A	

Recommendations	Class[a]	Level[b]
Reperfusion treatment		
Routine use of primary systemic thrombolysis is not recommended in patients not suffering from shock or hypotension.	III	B
Close monitoring is recommended in patients with intermediate-high risk PE to permit early detection of haemodynamic decompensation and timely initiation of 'rescue' reperfusion therapy.	I	B
Thrombolytic therapy should be considered for patients with intermediate-high-risk PE and clinical signs of haemodynamic decompensation.	IIa	B
Surgical pulmonary embolectomy may be considered in intermediate-high-risk patients if the anticipated risk of bleeding under thrombolytic treatment is high.[g]	IIb	C
Percutaneous catheter-directed treatment may be considered in intermediate-high-risk patients if the anticipated risk of bleeding under thrombolytic treatment is high.[g]	IIb	B
Early discharge and home treatment		
Patients with acute low-risk PE should be considered for early discharge and continuation of treatment at home if proper outpatient care and anticoagulant treatment can be provided.	IIa	B

I. INTERNÍ KLINIKA
KARDIOLOGIE
FAKULTNÍ NEMOCNICE OLOMOUC



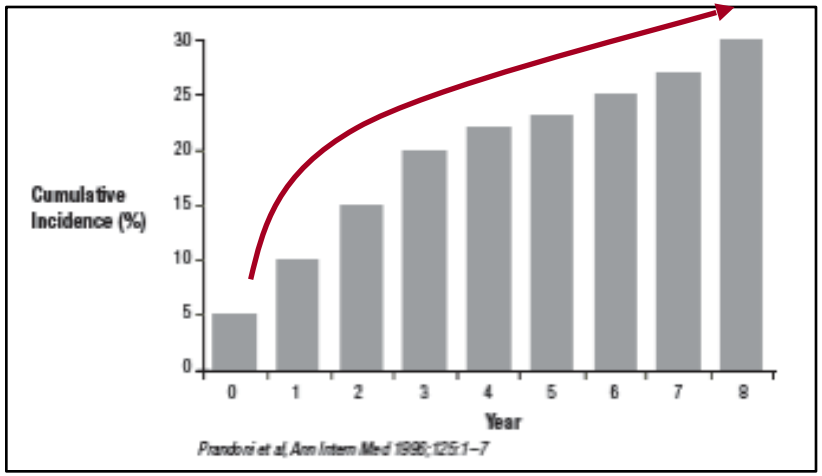
Plicní embolie:

Co nastává po akutní fázi onemocnění?

I. INTERNÍ KLINIKA
KARDIOLOGIE
FAKULTNÍ NEMOCNICE OLOMOUC

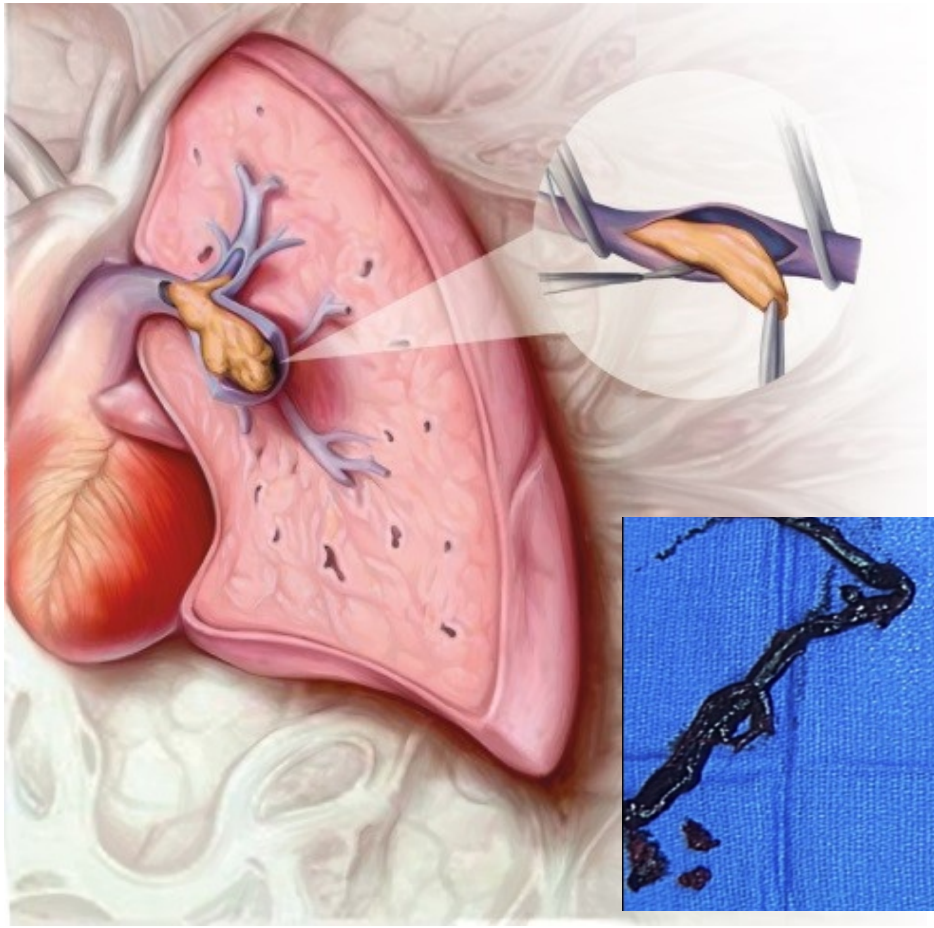
Rekurence

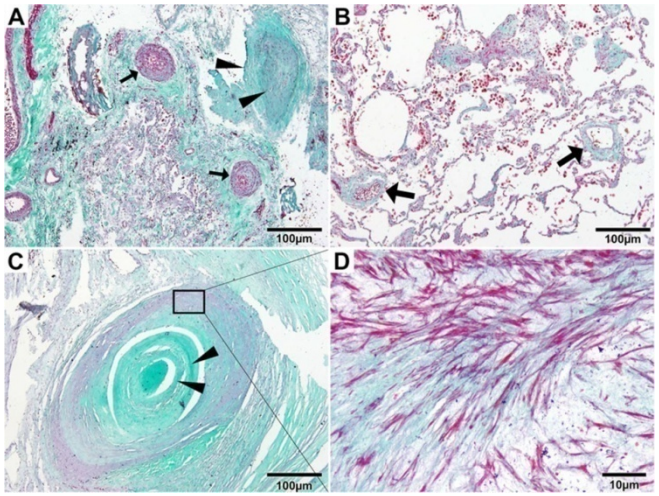
	Kumulativní incidence	Roční incidence
2 týdny	2%	55%
3 měsíce	6.4%	30%
6 měsíce	8%	18%
2 roky	17%	8.5%
5 roky	24%	4.8%
8 roky	30%	3.8%

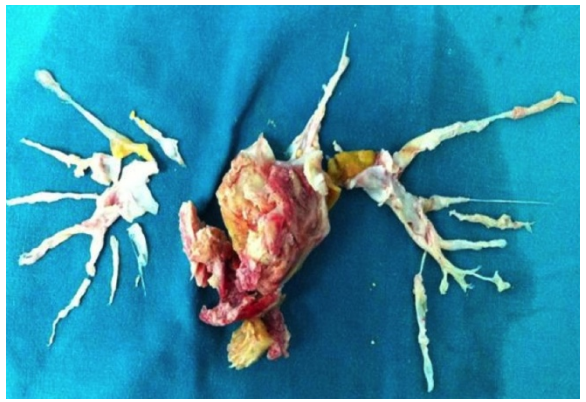


Prandoni P *et al*. *Ann Intern Med* 1996;125:1–7

Prandoni P *et al*. *Haematologica* 1997;82:423–428







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

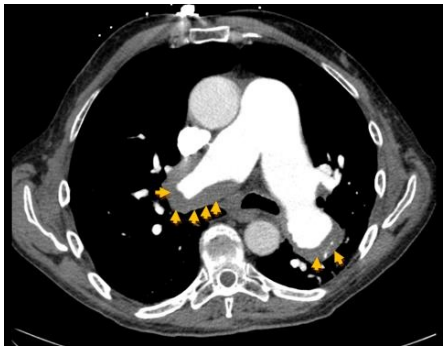
Hemodynamická definice plicní hypertenze/CTEPH

Definice PH

MPAP ≥ 25 mmHg

Definice prekapilární PH

- **MPAP ≥ 25 mmHg**
- **PAWP ≤ 15 mmHg**
- **PVR > 3 Wood units**



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.

Plicní hypertenze - definice a klasifikace

Journal of the American College of Cardiology
© 2013 by the American College of Cardiology Foundation
Published by Elsevier Inc.

Vol. 62, No. 25, Suppl D, 2013
ISSN 0735-1097/$36.00
http://dx.doi.org/10.1016/j.jacc.2013.10.029

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)

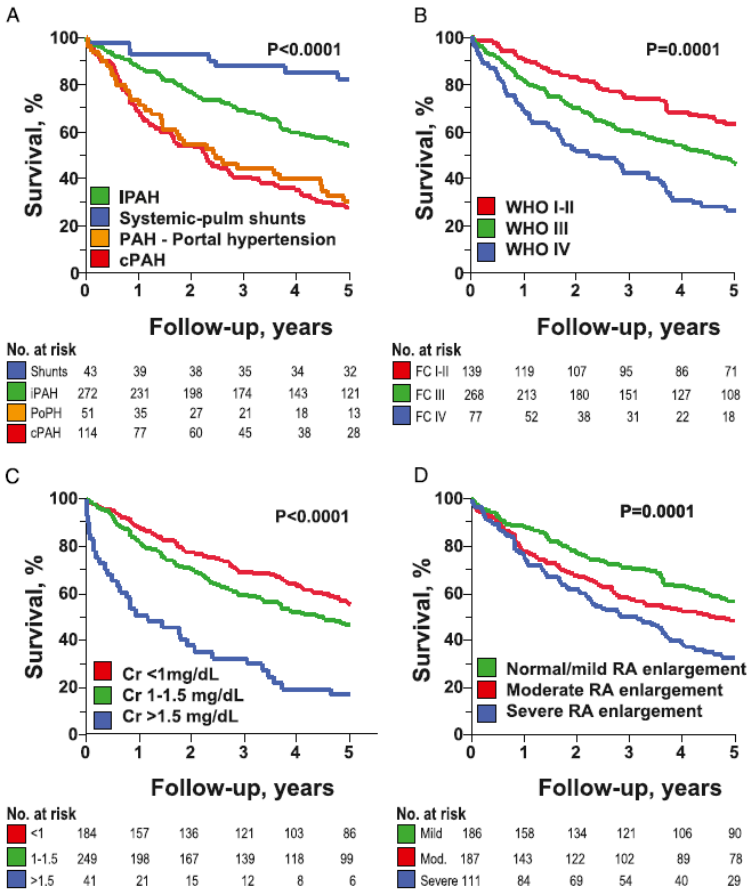
2. Pulmonary hypertension due to left heart disease
   - 2.1 Left ventricular systolic dysfunction
   - 2.2 Left ventricular diastolic dysfunction
   - 2.3 Valvular disease
   - 2.4 Congenital/acquired left heart inflow/outflow tract obstruction and congenital cardiomyopathies

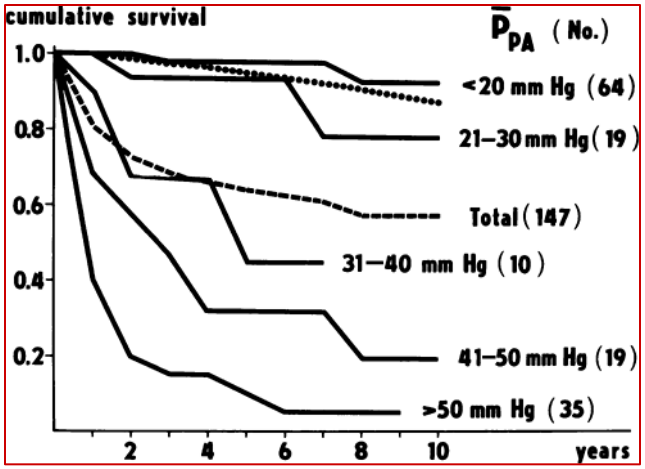
3. Pulmonary hypertension due to lung diseases and/or hypoxia
   - 3.1 Chronic obstructive pulmonary disease
   - 3.2 Interstitial lung disease
   - 3.3 Other pulmonary diseases with mixed restrictive and obstructive pattern
   - 3.4 Sleep-disordered breathing
   - 3.5 Alveolar hypoventilation disorders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

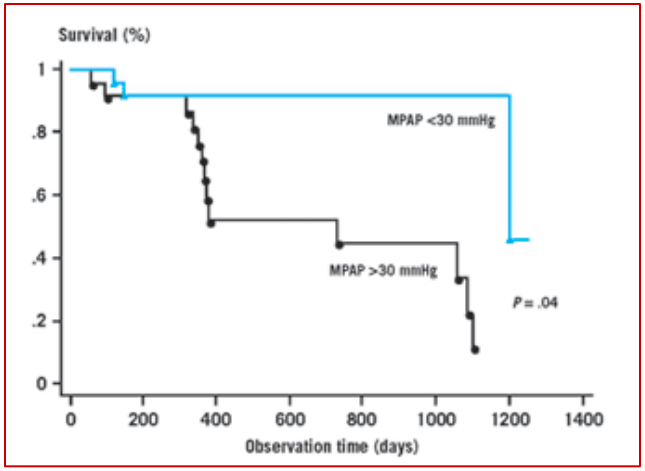
4. Chronic thromboembolic pulmonary hypertension (CTEPH)

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

Plicní hypertenze - prognóza







Epidemiologie CTEPH

Parameters	Japanese Registry[12]	International Registry[5]	University of California–San Diego Pulmonary Endarterectomy Registry[90]
No. of patients	519	679	2700
Sex, % male	28.1	50.1	49.7
Age, y	67 (53, 75)*	63 (51, 72)*	52 (40, 63)* (8–88)†
World Health Organization class, % I/II/III/IV	5.2/41.9/47.7/5.2	0.7/17.8/68.6/12.8	1.5/9.7/80.3/8.6
History of deep vein thrombosis, %	50.4	56.1	49.2
History of acute pulmonary embolism, %	37.2	74.8	70.6
Coagulopathies, %	11.7	31.9	30.1
Mean pulmonary arterial pressure, mm Hg, median	38 (33, 46)*	47 (38, 55)*	46 (38, 53)*
Pulmonary vascular resistance, dyne·s/cm^5, median	621 (439, 916)*	709 (480, 988)*	814 (476, 1018)*
Pulmonary endarterectomy, %	13.9	56.8	100
Inferior vena cava filter, %	26.9	12.4	>90
PAH-targeted therapy, %	52.2	37.9‡	37.0‡

CTEPH indicates chronic thromboembolic pulmonary hypertension; and PAH, pulmonary arterial hypertension.
*Medians and quartiles (quartile 1, quartile 3).
†Range.
‡Preoperative treatments.

No. of Patients With Acute Pulmonary Embolism	Average Observation Time After Acute Event, mo	Cumulative Incidence of CTEPH, %
325	16.3	4.6
744	14	8.3
110	24	9.1
877	34	0.57
110	36	2.7
239	36	0.4
700	26	4.7
91	6–12	8.8
259	46	1.0
834	25	1.0
314	94.3	3.8
78	12	5.0

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

Chronic Thromboembolic Pulmonary Hypertension (CTEPH)

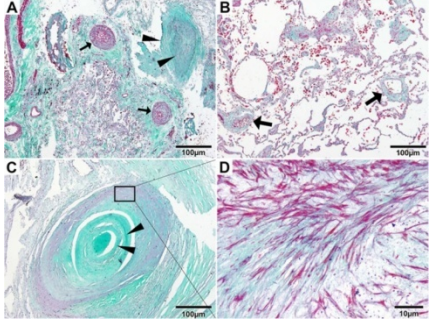
Results From an International Prospective Registry

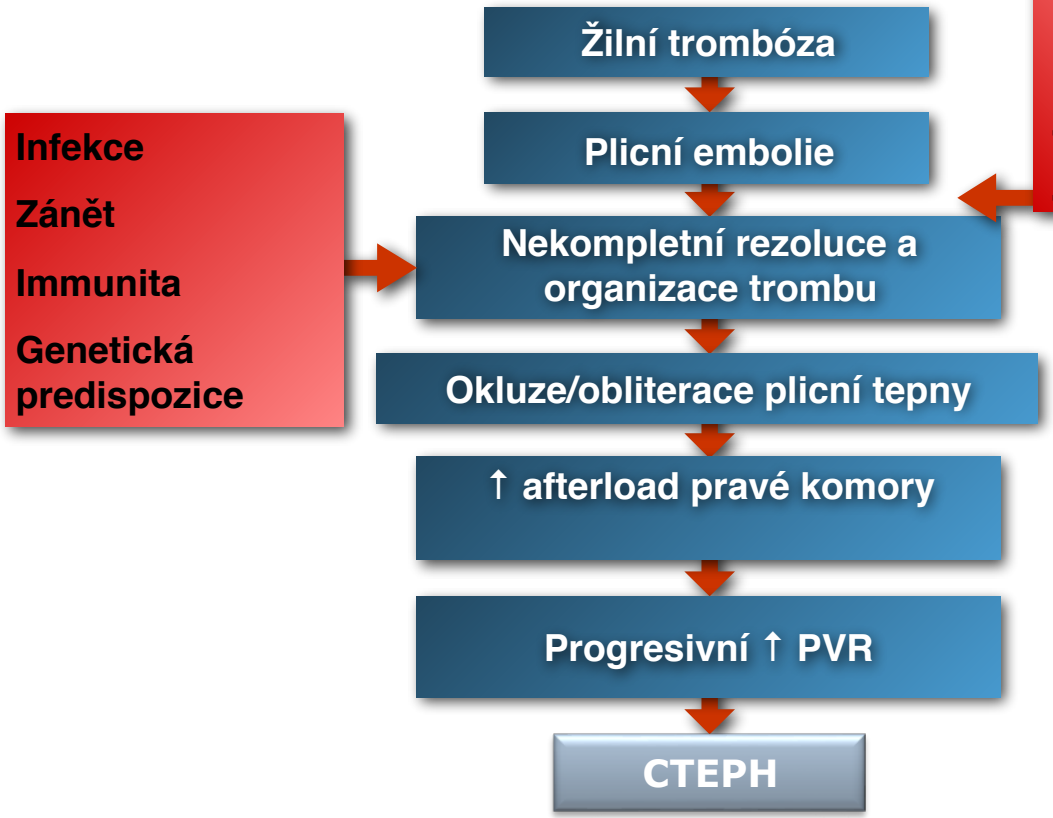
Joanna Pepke-Zaba, MD; Marion Delcroix, MD; Irene Lang, MD; Eckhard Mayer, MD; Pavel Jansa, MD; David Ambroz, MD; Carmen Treacy, BSc; Andrea M. D'Armini, MD; Marco Morsolini, MD; Repke Snijder, MD; Paul Bresser, MD; Adam Torbicki, MD; Bent Kristensen, MD; Jerzy Lewczuk, MD; Iveta Simkova, MD; Joan A. Barberà, MD; Marc de Perrot, MD; Marius M. Hoeper, MD; Sean Gaine, MD; Rudolf Speich, MD; Miguel A. Gomez-Sanchez, MD; Gabor Kovacs, MD; Abdul Monem Hamid, MD; Xavier Jaïs, MD; Gérald Simonneau, MD

Table 2. Patients' History of Venous Thromboembolism

	All Patients (n=679)	Operable Patients* (n=427)	Nonoperable Patients* (n=247)	*P* (Exploratory)
Confirmed previous acute PE, % (n)	74.8 (678)	77.5 (427)	70.0 (247)	0.0344
PE diagnosed more than once, % (n)	32.8 (469)	35.0 (303)	28.8 (163)	0.2145
Size of previous PE reported as massive, % (n)	40.8 (240)	47.1 (155)	29.4 (85)	0.0090
Confirmed previous DVT, % (n)	56.1 (426)	60.4 (280)	49.0 (143)	0.0295
Acute PE and DVT, % (n)	55.4 (413)	59.3 (270)	48.9 (141)	0.0477
Acute PE no DVT, % (n)	42.6 (413)	39.3 (270)	48.2 (141)	0.0926
Thrombolytic treatment, % (n)	14.4 (404)	18.5 (265)	6.6 (137)	0.0009
Vena cava filter implanted, % (n)	12.4 (491)	13.7 (322)	10.2 (166)	0.3139

P values from Fisher exact test. (n): patients with assessment. DVT indicates deep vein thrombosis; PE, pulmonary embolism.
*5 patients had no data on operability.





Chronic Thromboembolic Pulmonary Hypertension (CTEPH)

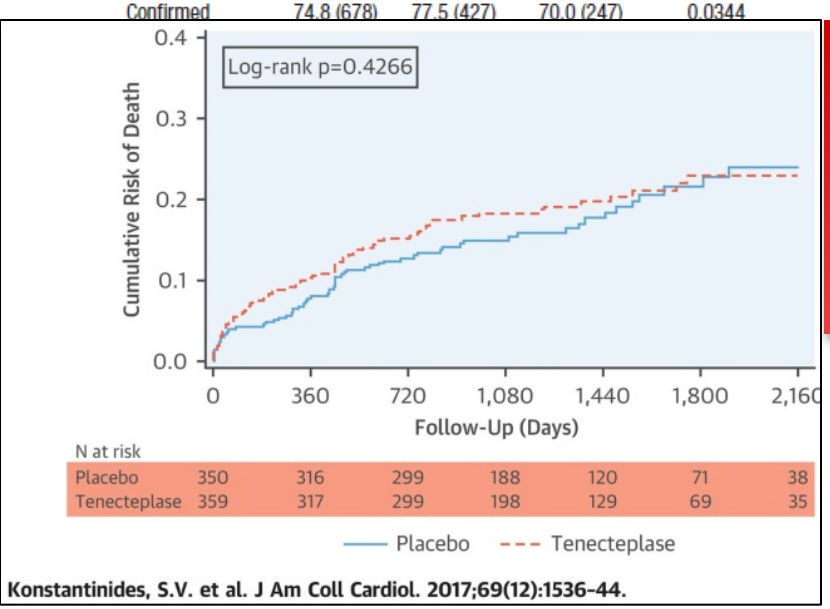
Results From an International Prospective Registry

Joanna Pepke-Zaba, MD; Marion Delcroix, MD; Irene Lang, MD; Eckhard Mayer, MD; Pavel Jansa, MD; David Ambroz, MD; Carmen Treacy, BSc; Andrea M. D'Armini, MD; Marco Morsolini, MD; Repke Snijder, MD; Paul Bresser, MD; Adam Torbicki, MD; Bent Kristensen, MD; Jerzy Lewczuk, MD; Iveta Simkova, MD; Joan A. Barberà, MD; Marc de Perrot, MD; Marius M. Hoeper, MD; Sean Gaine, MD; Rudolf Speich, MD; Miguel A. Gomez-Sanchez, MD; Gabor Kovacs, MD; Abdul Monem Hamid, MD; Xavier Jaïs, MD; Gérald Simonneau, MD

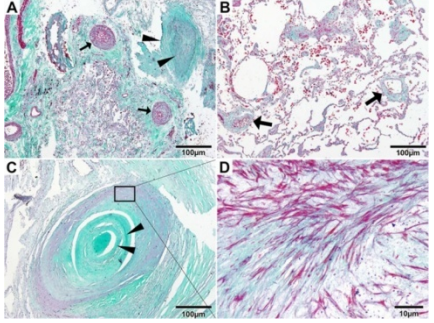
Table 2. Patients' History of Venous Thromboembolism

	All Patients (n=679)	Operable Patients* (n=427)	Nonoperable Patients* (n=247)	*P* (Exploratory)
Confirmed	74.8 (678)	77.5 (427)	70.0 (247)	0.0344
implanted, % (n)				

P values from Fisher exact test. (n): patients with assessment. DVT indicates deep vein thrombosis; PE, pulmonary embolism.
*5 patients had no data on operability.



Konstantinides, S.V. et al. J Am Coll Cardiol. 2017;69(12):1536-44.



Infekce

Zánět

Immunita

Genetická predispozice

Žilní trombóza

Plicní embolie

In situ trombózy

Nekompletní rezoluce a organizace trombu

Okluze/obliterace plicní tepny

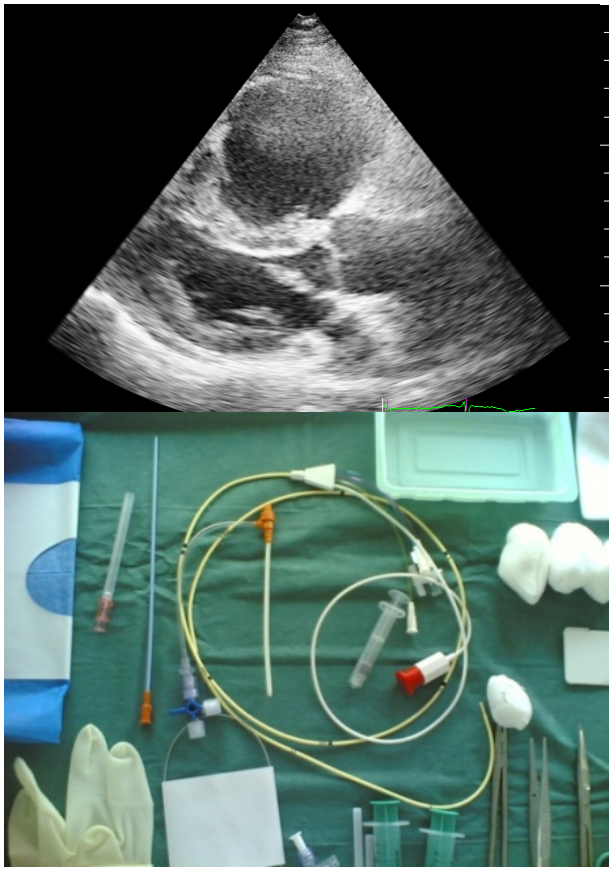
↑ afterload pravé komory

Progresivní ↑ PVR

CTEPH

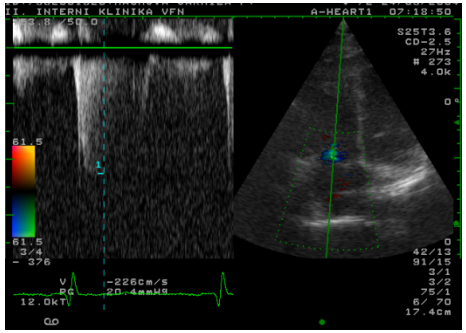
Plicní hypertenze - screening po plicní embolii

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

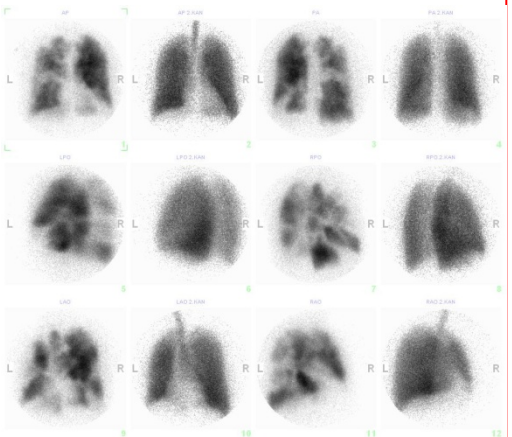


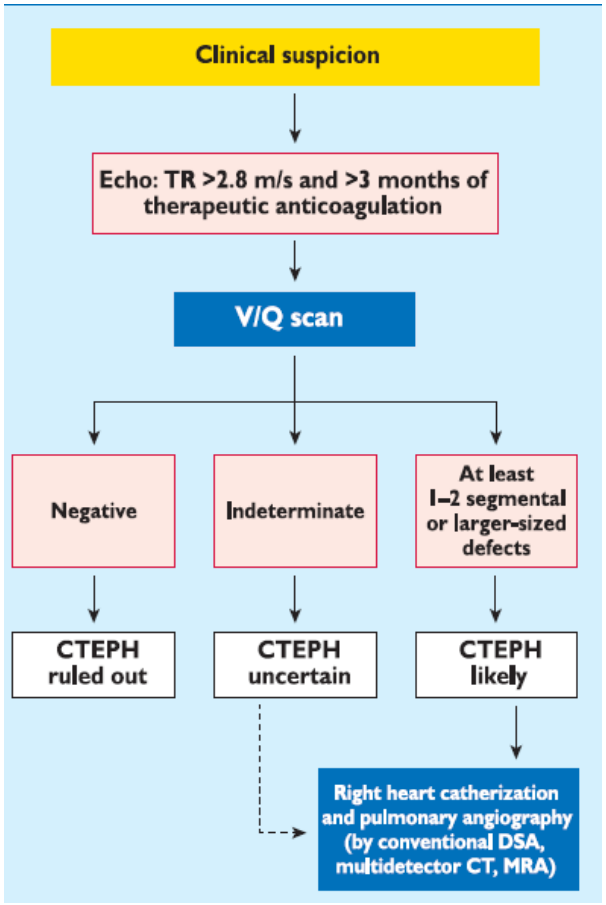
1. SCREENING

- **Echokardiografie**



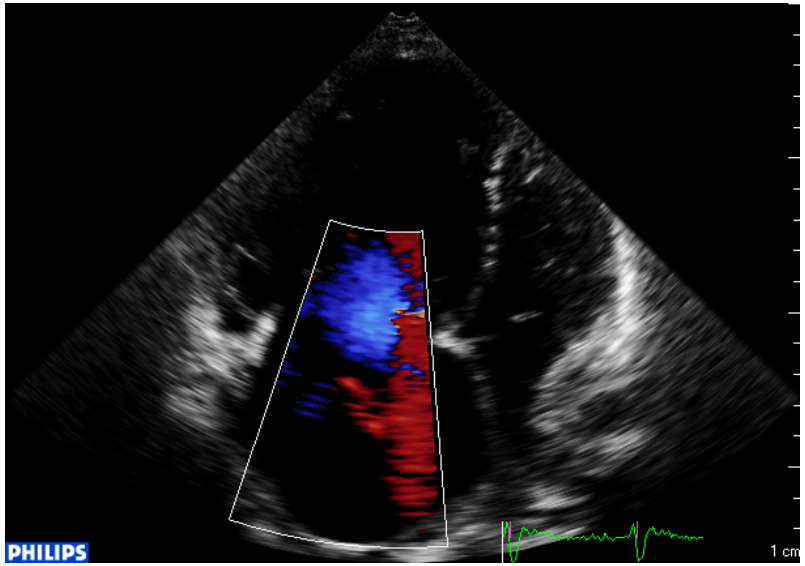
- **Scintigrafie plic**

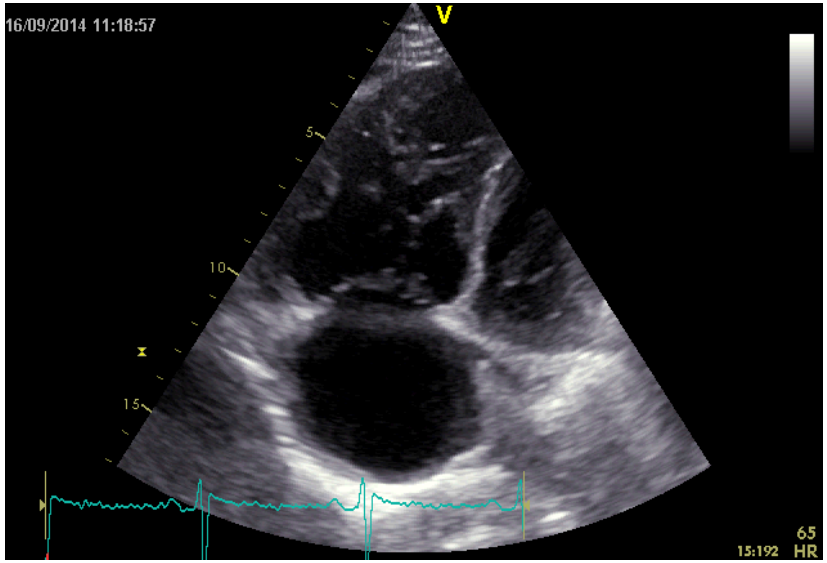


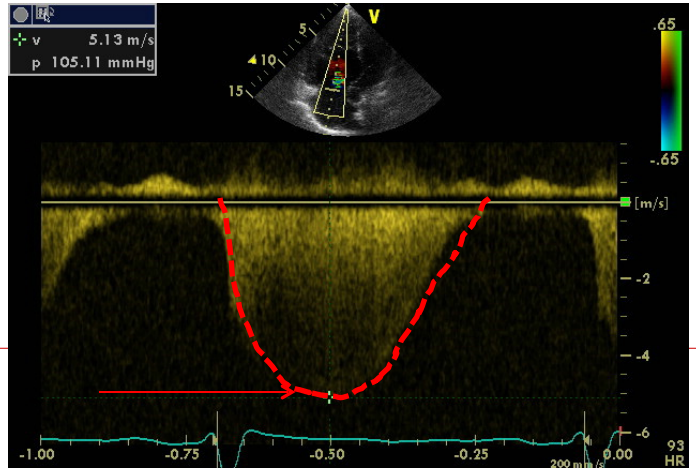


Obrázky poskytnuty laskavostí doc. Jansy

Echokardiografie - klíčové screeningové vyšetření







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

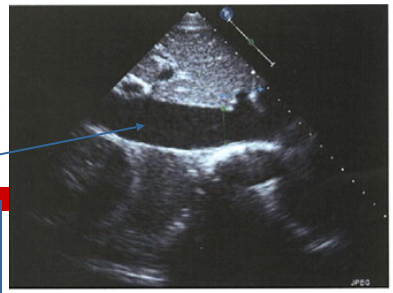
Maximální gradient regurgitace na pulmonální chlopni (PR) predikuje střední tlak v plicnici **(MAP)** .
Endiastolický gradient pulmonální regurgitace predikuje diastolický tlak v plicnici **(DAP)** .

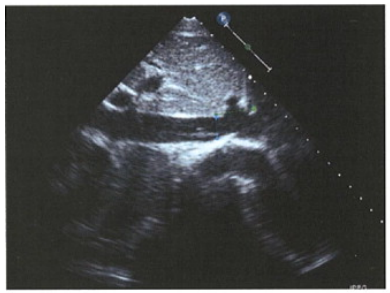
Dolní dutá žíla **(IVC)** , její rozměr a stupeň inspiračního kolapsu predikují tlak v pravé síni **(RAP resp. CVT)**:
IVC <1.2 cm a kolaps 100% = RAP 0 mmHg

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

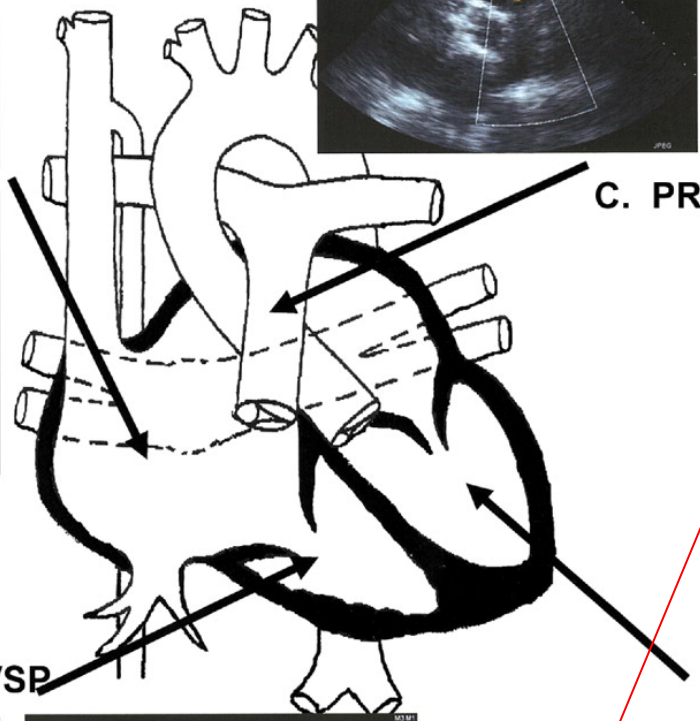
IVC >1.7 cm s >50% kolapsem = RAP 6-10 mmHg; <50% kolapsem = RAP 10-15 mmHg

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

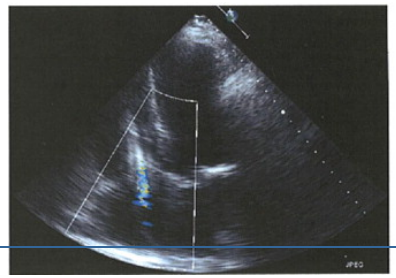


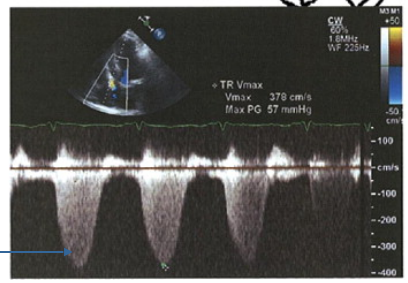


A. IVCCI--RAP

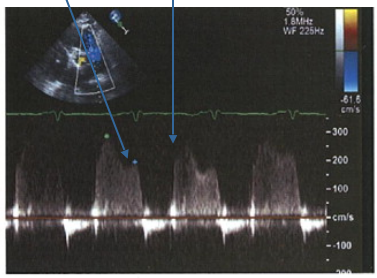


B. TR Vel.--RVSP

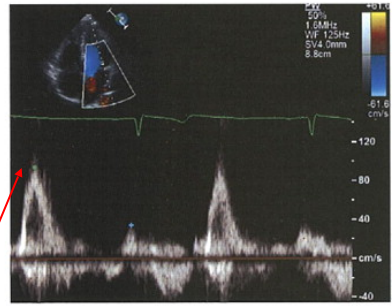


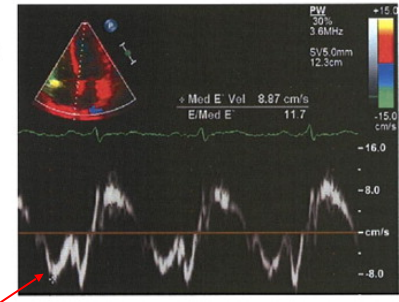


Vrcholová systolická rychlost jetu trikuspidální regurgitace **(TR)** predikuje systolický tlak v plicnici **(SAP)**:



C. PR Vel.--PAPm, PAPd





D. E/E'--PCWP

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

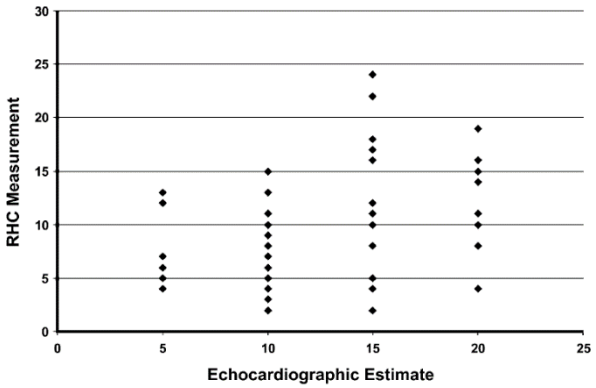
I. INTERNÍ KLINIKA
KARDIOLOGIE
FAKULTNÍ NEMOCNICE OLOMOUC

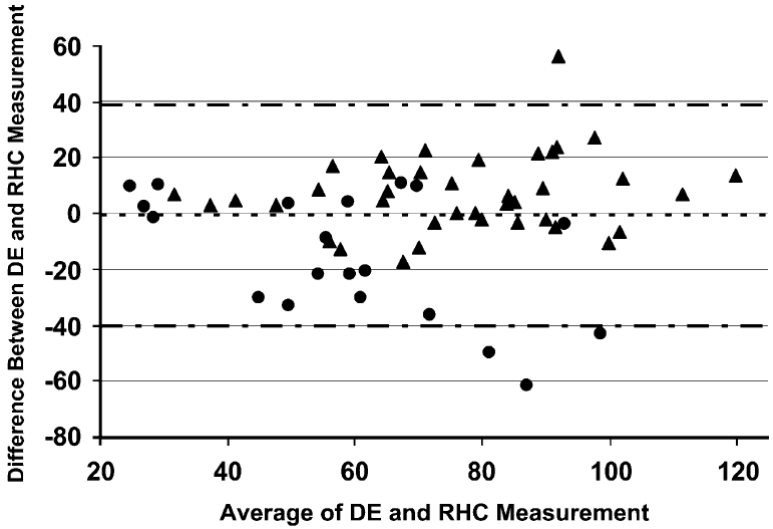
Accuracy of Doppler Echocardiography in the Hemodynamic Assessment of Pulmonary Hypertension

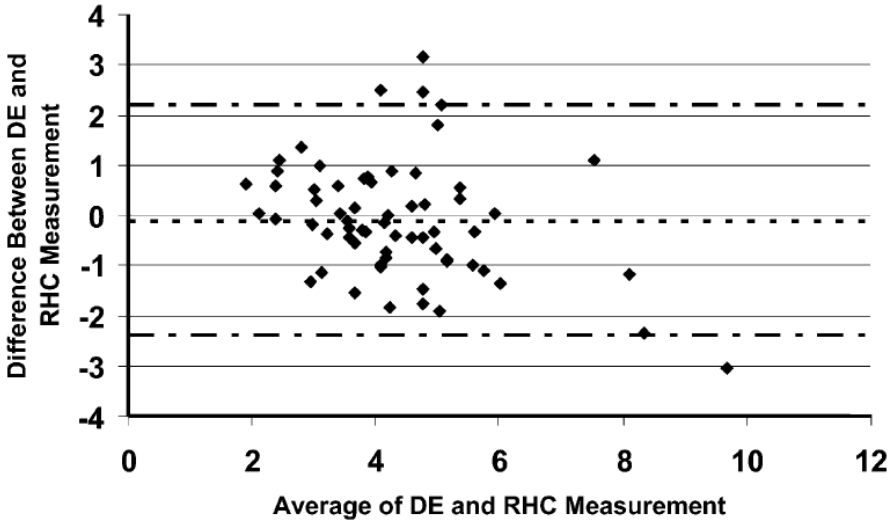
Micah R. Fisher[1]*, Paul R. Forfia[2†], Elzbieta Chamera[2], Traci Housten-Harris[1], Hunter C. Champion[2], Reda E. Girgis[1], Mary C. Corretti[2], and Paul M. Hassoun[1]

[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

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	

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)

PLICNÍ HYPERTENZE NEPRAVDĚPODOBNÁ

Rychlost trikuspidální regurgitace ≤ 2.8 m/s

Odhad PASP ≤36 mmHg

Bez přítomnosti hypertrofie, normální morfologie a systolická funkce pravé komory

PLICNÍ HYPERTENZE MOŽNÁ

Rychlost trikuspidální regurgitace ≤ 2.8 m/s

Odhad PASP ≤36 mmHg

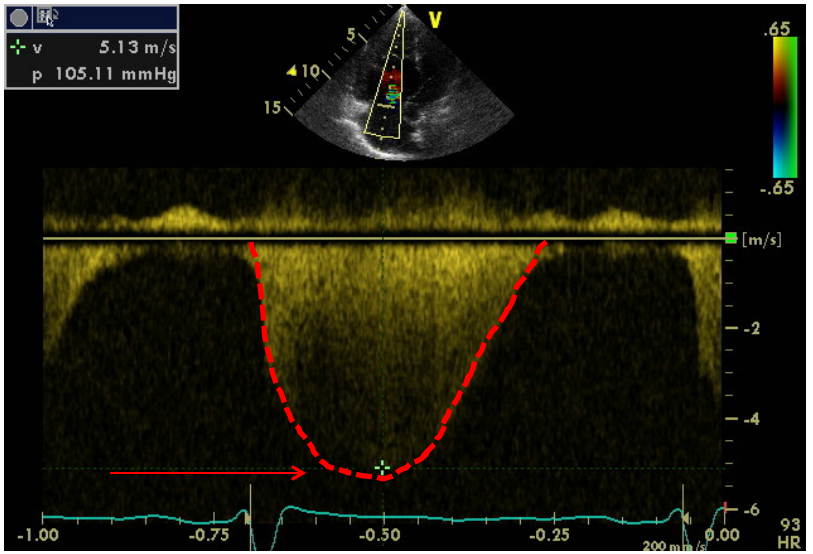
Suspektní hypertrofie, dilatace a/nebo systolická dysfunkce pravé komory

PLICNÍ HYPERTENZE PRAVDĚPODOBNÁ

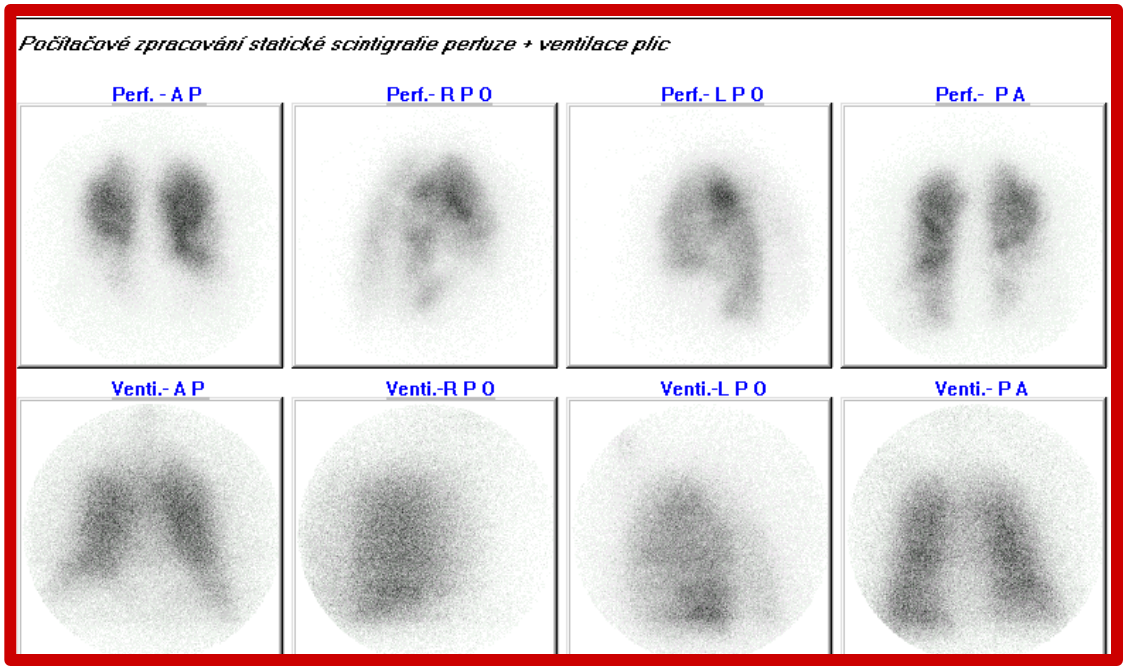
Rychlost trikuspidální regurgitace > 2.8 m/s

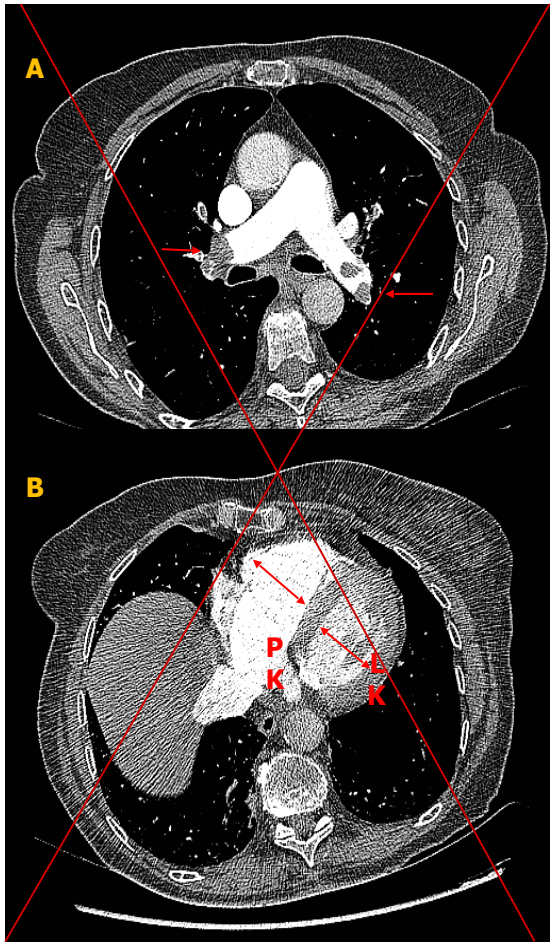
Odhad PASP >36 mmHg

Evidence/absence přítomnosti hypertrofie, dilatace a systolické dysfunkce pravé komory



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

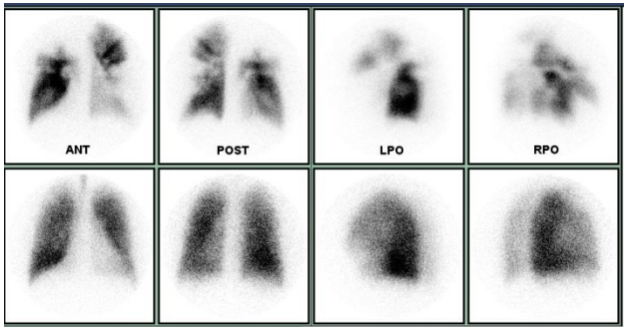


TABLE 1
Summary of V/Q Scans and CTPA Results

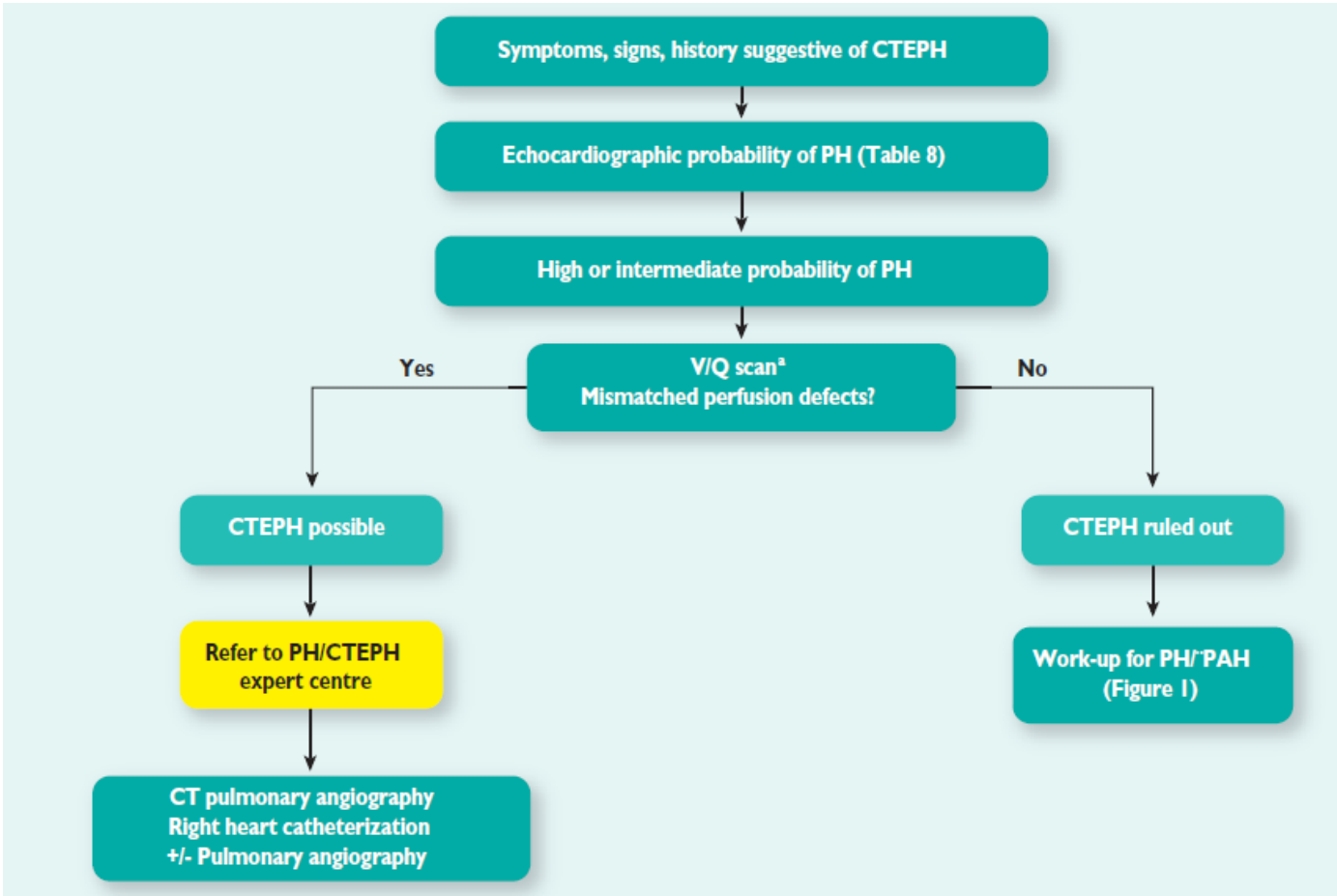
	V/Q			CTPA	
Group	Low probability	Intermediate probability	High probability	Negative	Positive
A (*n* = 78)	2	1	75	38	40
B (*n* = 149)	134	7	8	148	1

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

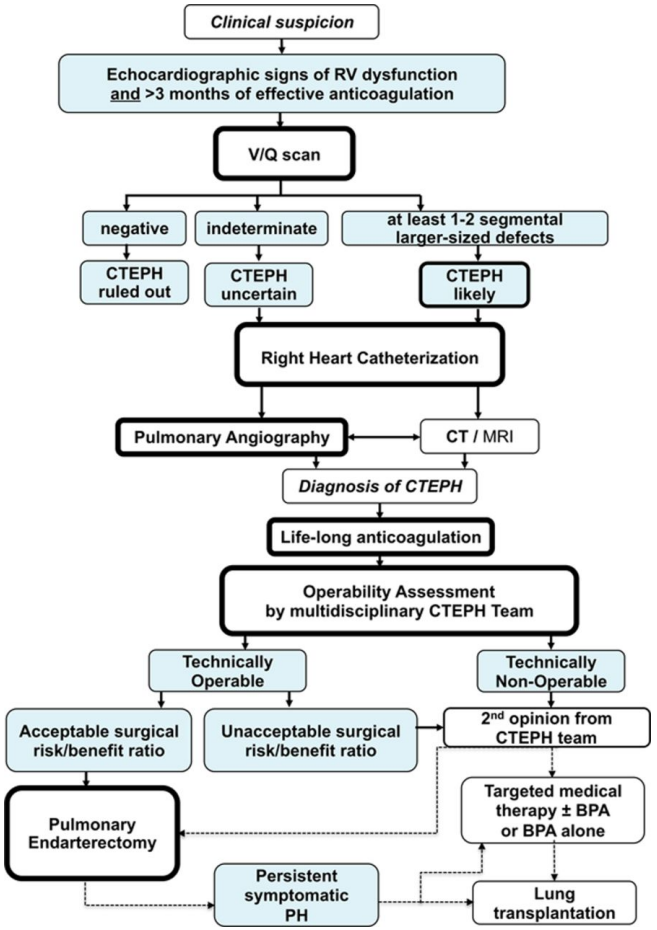
The Joint Task Force for the Diagnosis and Treatment of Pulmonary Hypertension of the European Society of Cardiology (ESC) and the European Respiratory Society (ERS)

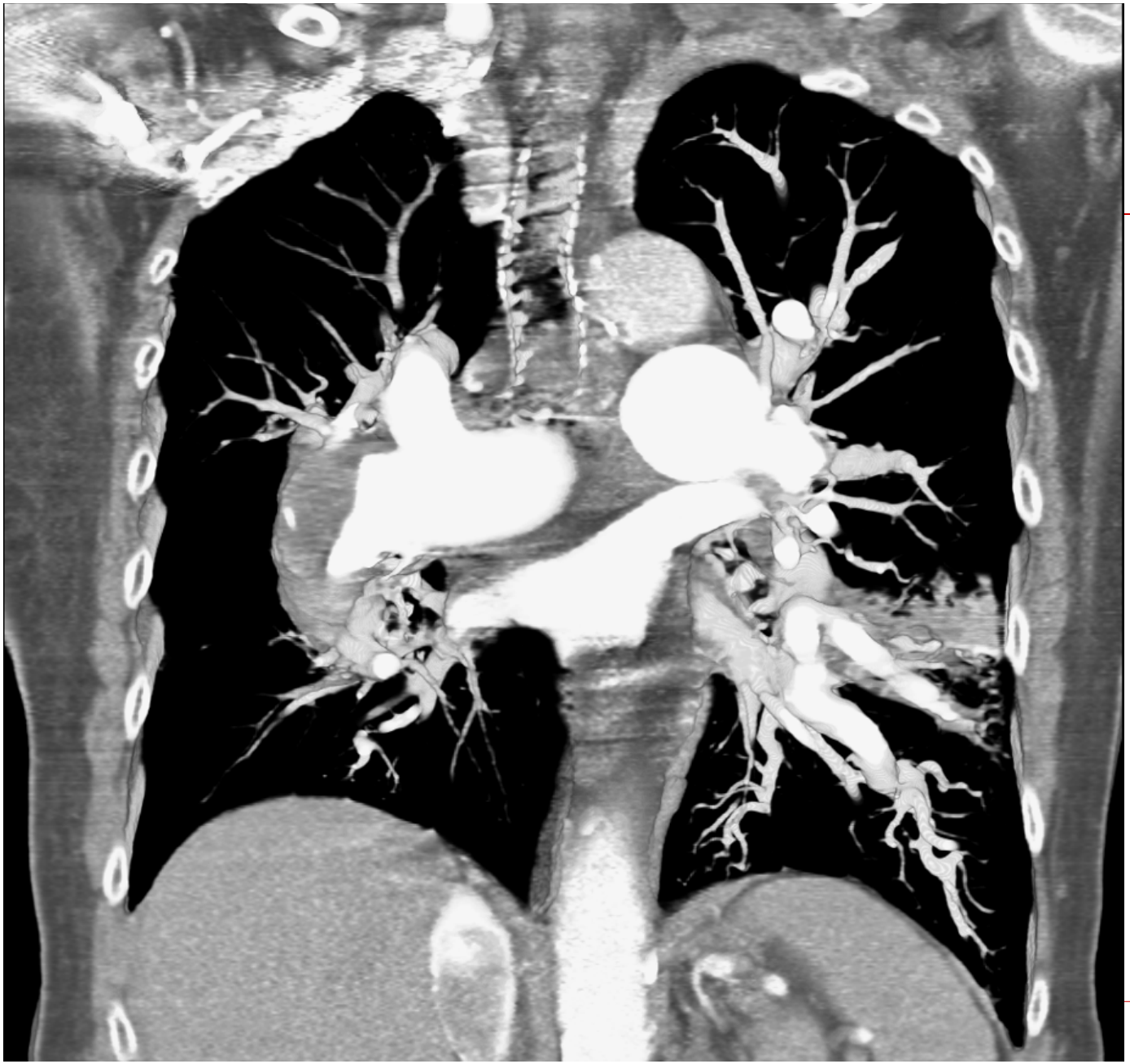
Endorsed by: Association for European Paediatric and Congenital Cardiology (AEPC), International Society for Heart and Lung Transplantation (ISHLT)



2. KONFIRMACE A EVALUACE

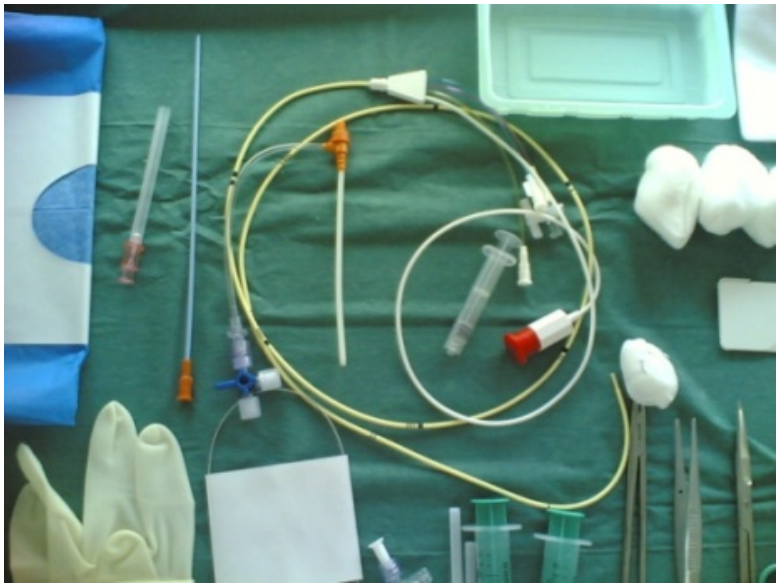
- **CTA, (MRI)**
- **PSK + hemodynamické vyšetření**
- **Angiografie plicnice**
- **Angiografie B-P kolaterál**
- **Identifikace periferní remodelace**

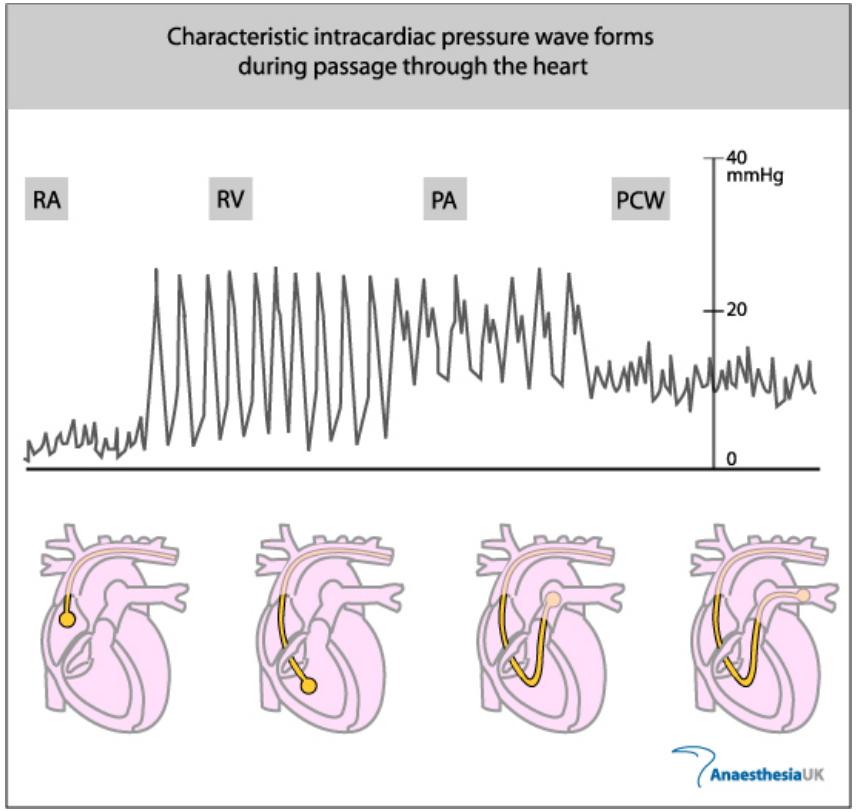


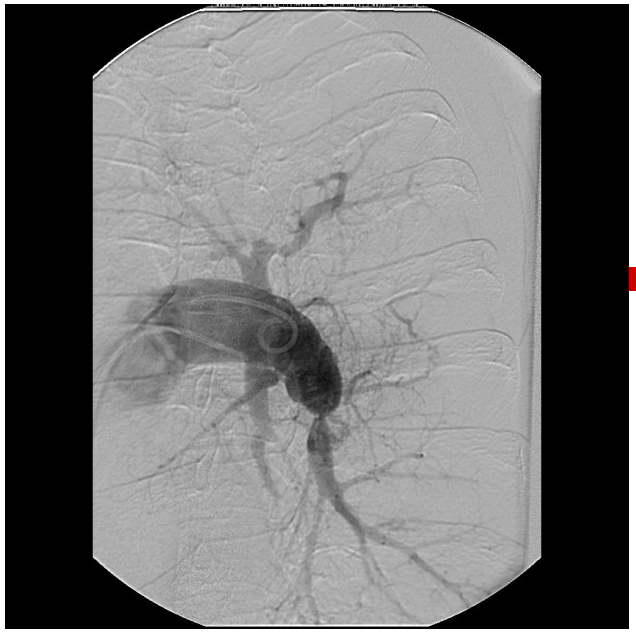
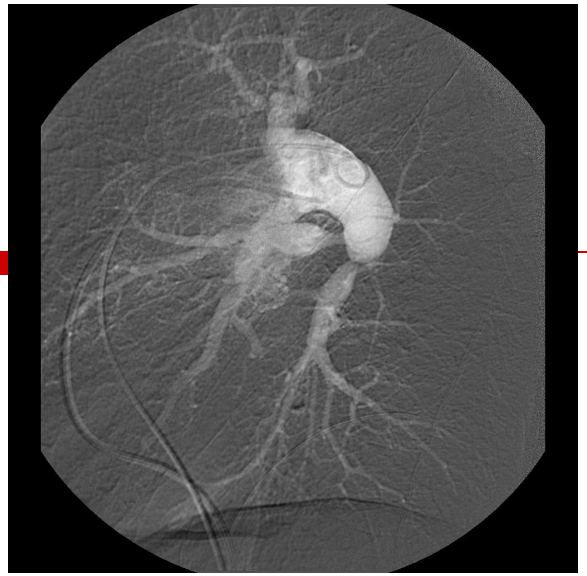
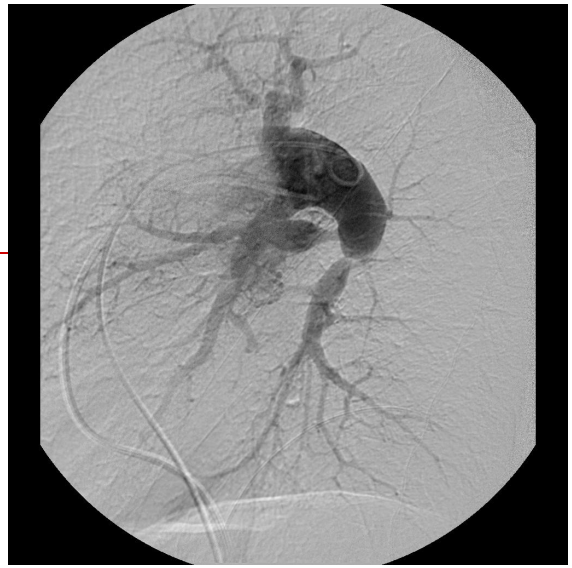
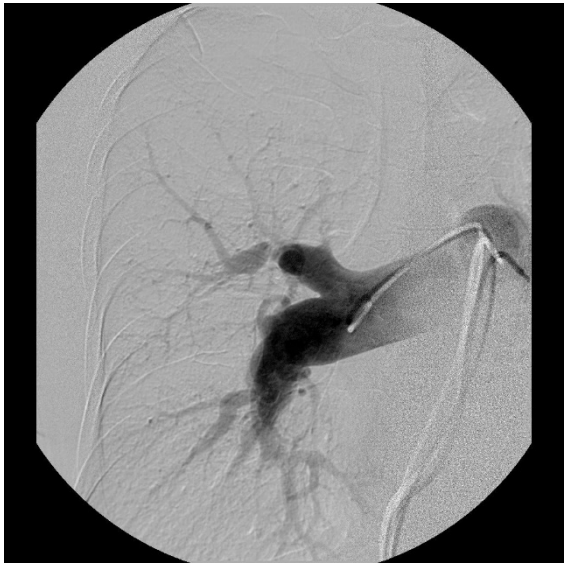
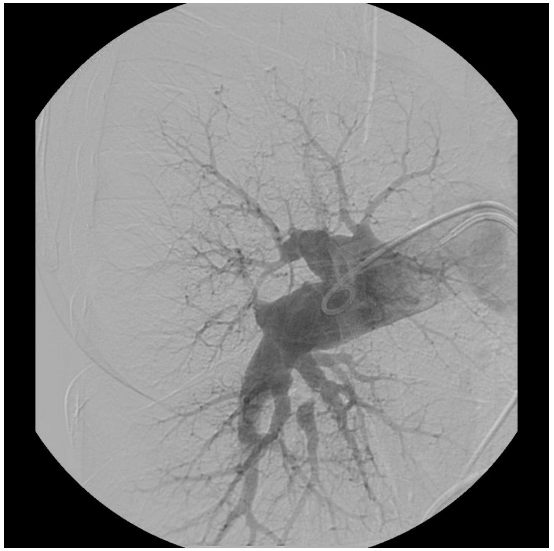
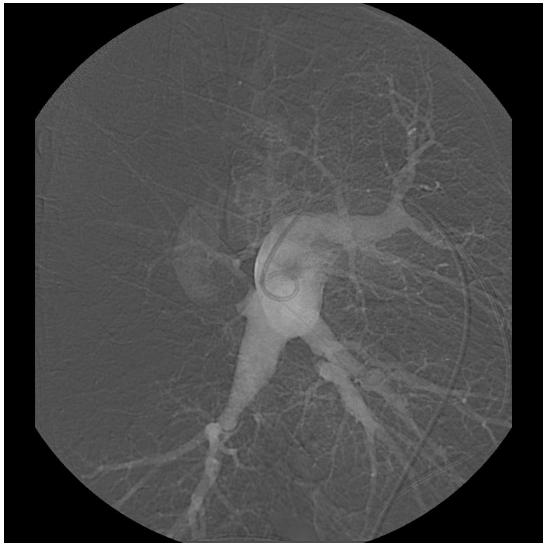


Obrázky poskytnuty laskavostí doc. Jansy

Pravostranná katetrizace - hemodynamika





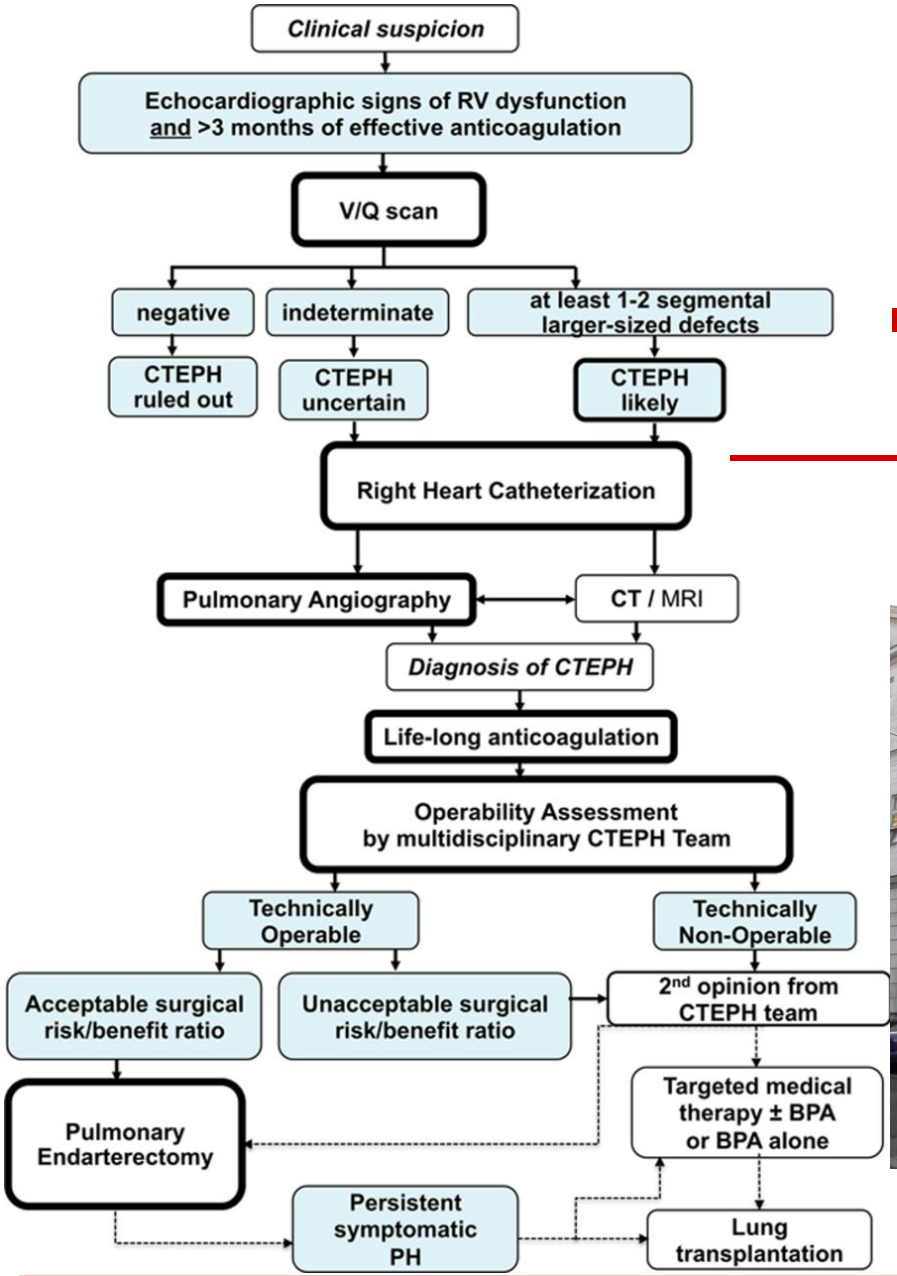







Obrázky poskytnuty laskavostí doc. Jansy

Circulation
JOURNAL OF THE AMERICAN HEART ASSOCIATION
American Heart Association

Update on Chronic Thromboembolic Pulmonary Hypertension
Irene Marthe Lang and Michael Madani

Circulation. 2014;130:508-518
doi: 10.1161/CIRCULATIONAHA.114.009309



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

Koho odeslat k evaluaci CTEPH?

- **symptomatický** pacient (námahová dušnost)
- (většinou) po předchozí **žilní trombóze/plicní embolii**
- s přetrvávajícími symptomy a PH při adekvátně vedené **antikoagulační léčbě**
- v rozumném **biologickém stavu**
- bez (velmi) četných **komorbidit**
- s možnou nebo pravděpodobnou **PREKAPILÁRNÍ PLICNÍ HYPERTENZÍ** na **echokardiografii**.
- s pozitivní **plicní scintigrafii**
- screening u **rizikových symptomatických populací**

I. INTERNÍ KLINIKA
KARDIOLOGIE
FAKULTNÍ NEMOCNICE OLOMOUC