WSPH 2024

TRANSPLNTACE, CTEPD, ROLE PACIENTŮ

PAVEL JANSA

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KOMPLEXNÍ KARDIO VASKULÁRNÍ CENTRUM VFN Praha

European Reference Network
for rare or low prevalence complex diseases

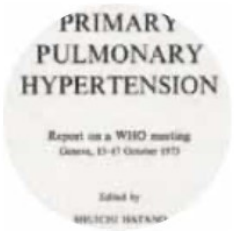
Network Respiratory Diseases (ERN-LUNG)

Member General University Hospital in Prague — Czechia

WHO Committees and World Symposia on Pulmonary Hypertension

1960 Geneva

1973 Geneva



1998 Evian

2003 Venice

2008 Dana Point

2013 Nice

2018 Nice

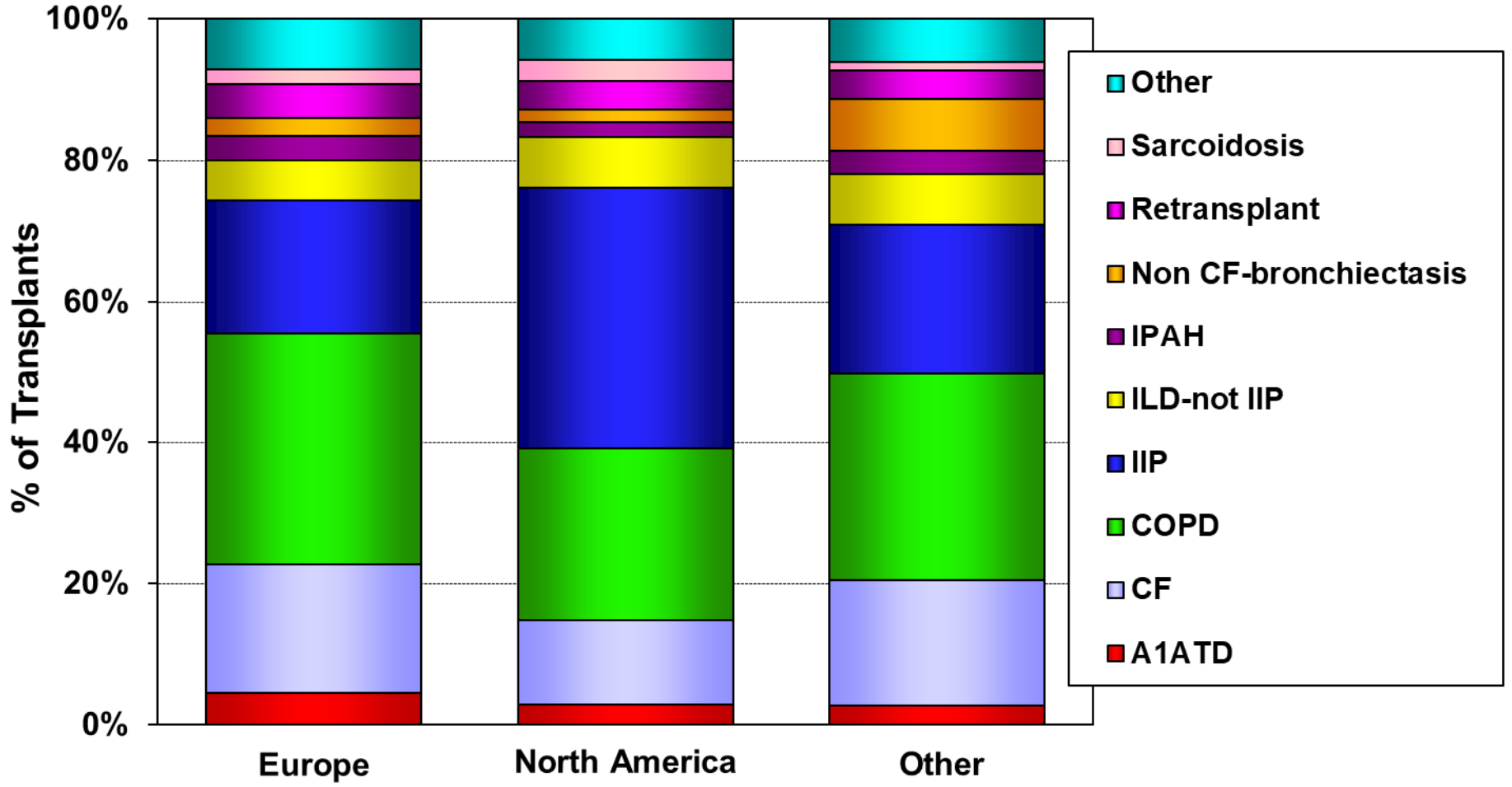
2024 Barcelona

Barcelona 2024:

- 124 Task Force Members
- 1192 HCPs
- 471 Industry Staff

nbert M et al. The Seventh World Symposium on Pulmonary Hypertension: our journey to Barcelona. *Respir J 2024*; in press: 2401222 [DOI: 10.1183/ 13993003.01222-2024

Adult Lung Transplants
Diagnosis Distribution by Location
(Transplants: January 2005 – June 2018)

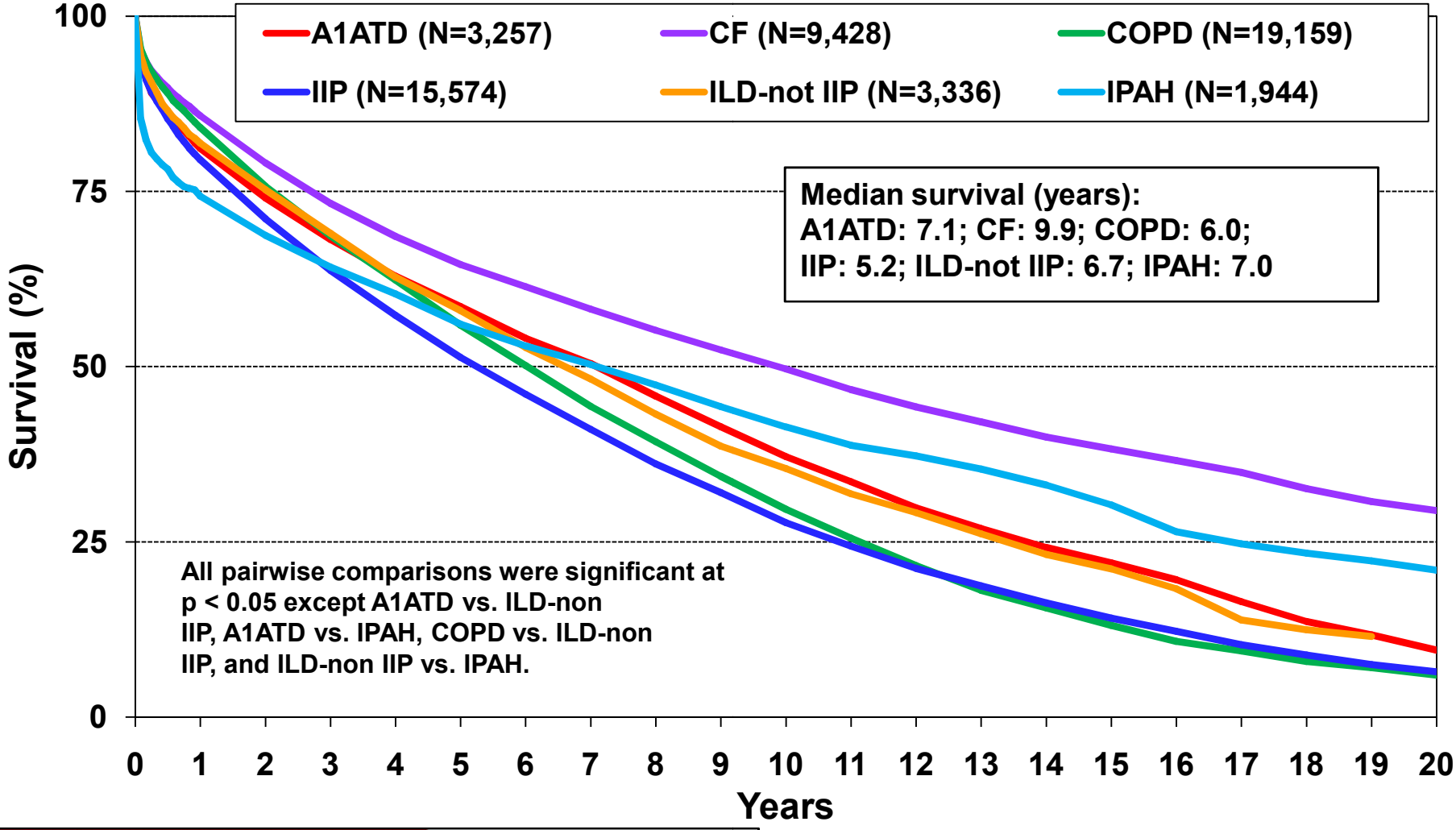


ISHLT • INTERNATIONAL SOCIETY FOR HEART AND LUNG TRANSPLANTATION

2019

JHLT. 2019 Oct; 38(10): 1015-1066

Adult Lung Transplants
Kaplan-Meier Survival by Major Diagnosis
(Transplants: January 1992 – June 2017)



ISHLT • INTERNATIONAL SOCIETY FOR HEART AND LUNG TRANSPLANTATION
2019
JHLT. 2019 Oct; 38(10): 1015-1066

TRANSPLANTACE U PLICNÍ HYPERTENZE (2022)

ommendations	Class[a]	Level[b]
recommended that potentially eligible lidates are referred for LTx evaluation when have an inadequate response to oral bination therapy, indicated by an intermediate– or high risk or by a REVEAL risk score >7	I	C
recommended to list patients for LTx who ent with a high risk of death or with a REVEAL score ≥10 despite receiving optimized lical therapy including s.c. or i.v. prostacyclin ogues	I	C

Referral
Potentially eligible patients for whom LTx might be an option in treatment failure
ESC/ERS intermediate–high or high risk or REVEAL risk score > appropriate PAH medication
Progressive disease or recent hospitalization for worsening PAH
Need for i.v. or s.c. prostacyclin therapy
Known or suspected high-risk variants, such as PVOD or PCH, s sclerosis, or large and progressive pulmonary artery aneurysms
Signs of secondary liver or kidney dysfunction due to PAH or o potentially life-threatening complications, such as recurrent haem
Listing
Patient has been fully evaluated and prepared for transplantatio
ESC/ERS high risk or REVEAL risk score >10 on appropriate PA medication, usually including i.v. or s.c. prostacyclin analogues
Progressive hypoxaemia, especially in patients with PVOD or P
Progressive, but not end-stage liver of kidney dysfunction due to P life-threatening haemoptysis

Humbert M et al. 2022 ESC/ERS Guidelines for the diagnosis and treatment of pulmonary hypertension, *EHJ* 2022, *ERJ*

Transplantation, bridging, and support technologies in pulmonary hypertension

Laurent Savale[1,2,3], Alberto Benazzo[4], Paul Corris[5], Shaf Keshavjee[6], Deborah Jo Levine[7], Olaf Mercier[1,2,8], R. Duane Davis[9] and John T. Granton[10]

cations to list for transplantation
igh-risk category despite optimal medical therapy
ersistent intermediate–high risk despite optimal medical therapy with significant RV dysfunction
ecurrent hospitalisation for RV failure despite optimal medical therapy
ife-threatening haemoptysis
iver or kidney dysfunction[#]
n some instances, persistent severe impairment in quality of life can be considered as an indication for transplantation
iagnosis of PVOD or PCH that has failed a trial of conventional PAH therapy
iagnosis of underlying ILD, COPD or combined pulmonary fibrosis/emphysema combined with severe RV dysfunction despite optimal management
nticipated programme waitlist times

Eur Respir J 2024; in press: 2401

Transplantation, bridging, and support technologies in pulmonary hypertension

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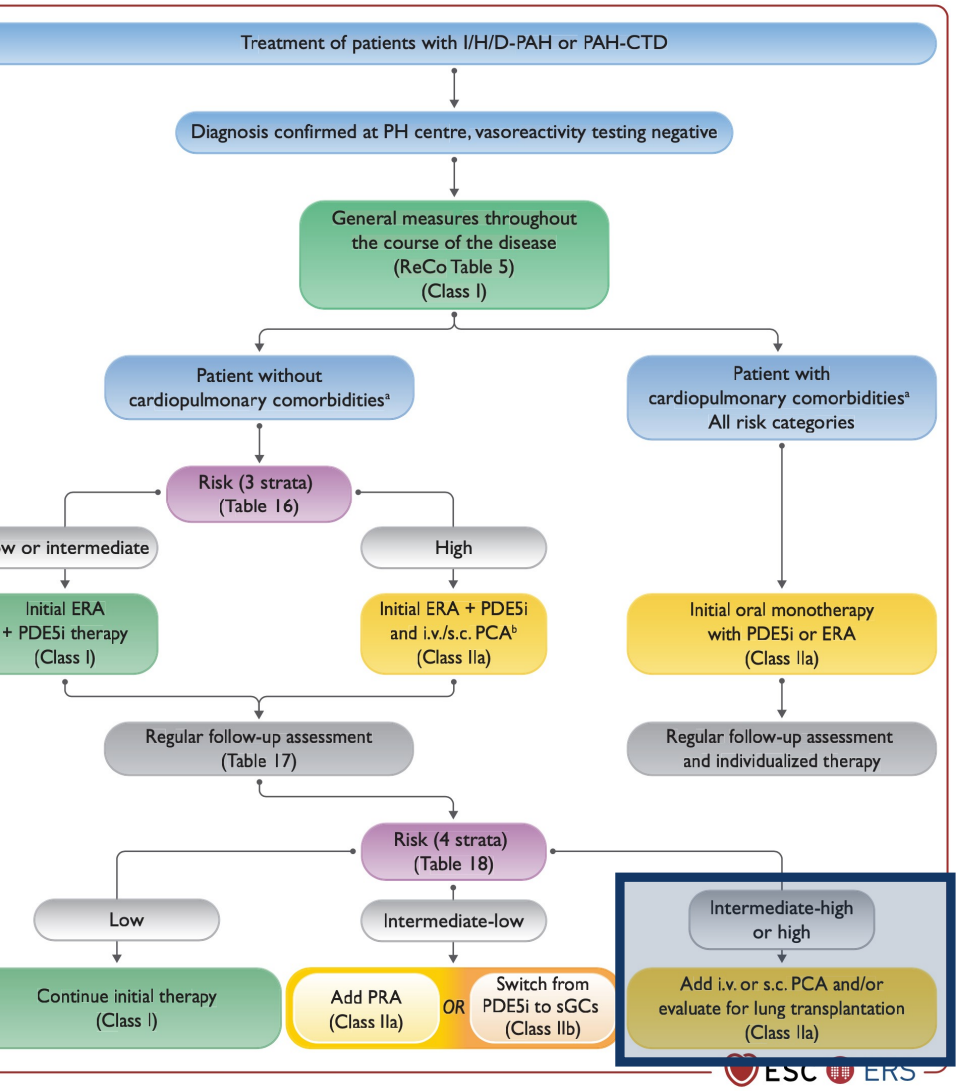
Rizika hemodynamické nestability a primární dysfunkce štěpu

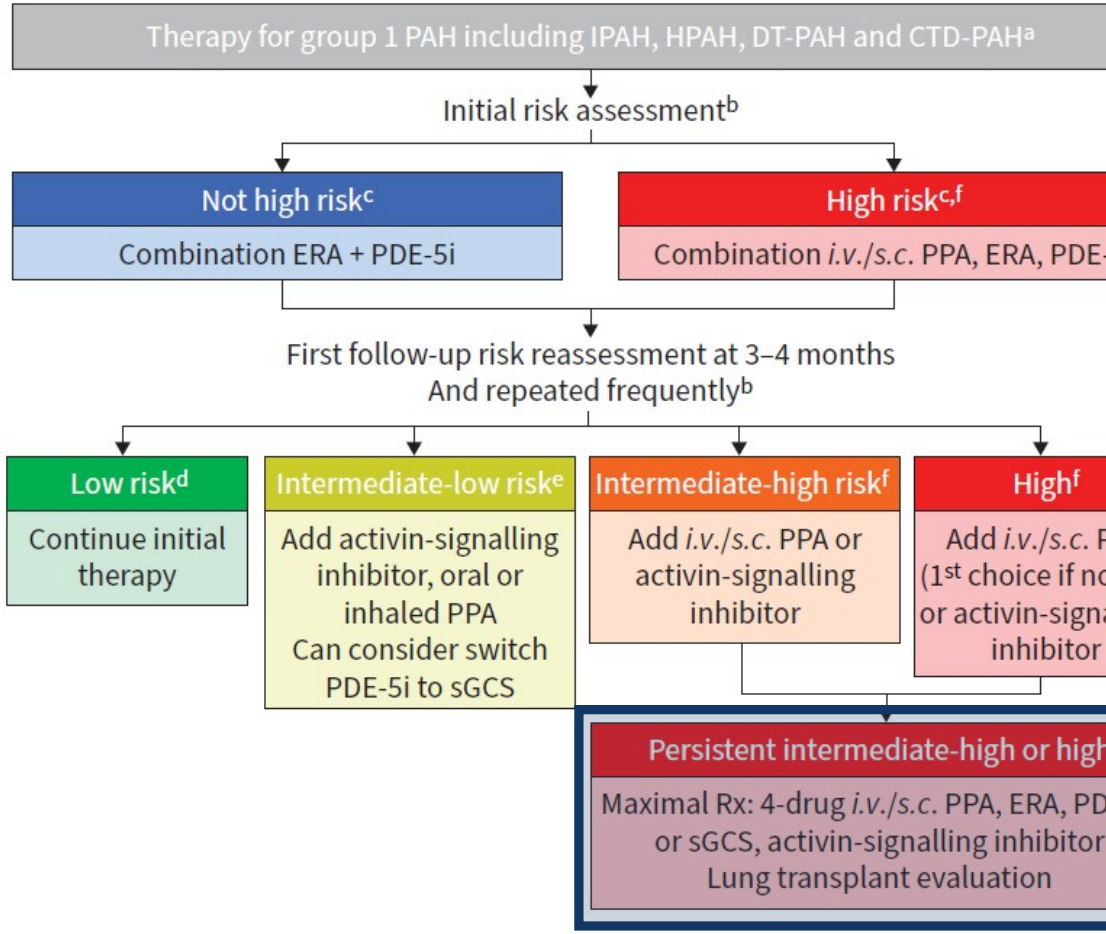
Recipient risk factors	Complication
RV function	RV dysfunction and haemodynamic instability (paradoxically, better RV function has been associated with a higher risk of primary graft dysfunction)
Listing mPAP, RAP, PVR	Primary graft dysfunction
Scleroderma	Haemodynamic instability
Heart failure with preserved ejection fraction	Haemodynamic instability, primary graft dysfunction?, worse long-term survival
RV hypertrophy	RV outflow tract obstruction
BMI	Primary graft dysfunction
Creatinine	Primary graft dysfunction
Cardiopulmonary bypass	Primary graft dysfunction
Transfusion during surgery	Primary graft dysfunction
Smoking history	Primary graft dysfunction

Eur Respir J 2024; in press: 2401

22 ESC/ERS Guidelines for the diagnosis and atment of pulmonary hypertension



Treatment algorithm for pulmonary arterial hyperten



Eur Respir J 2024; in press: 2401325
Eur Respir J 2022; DOI: 10.1183/13993003.0

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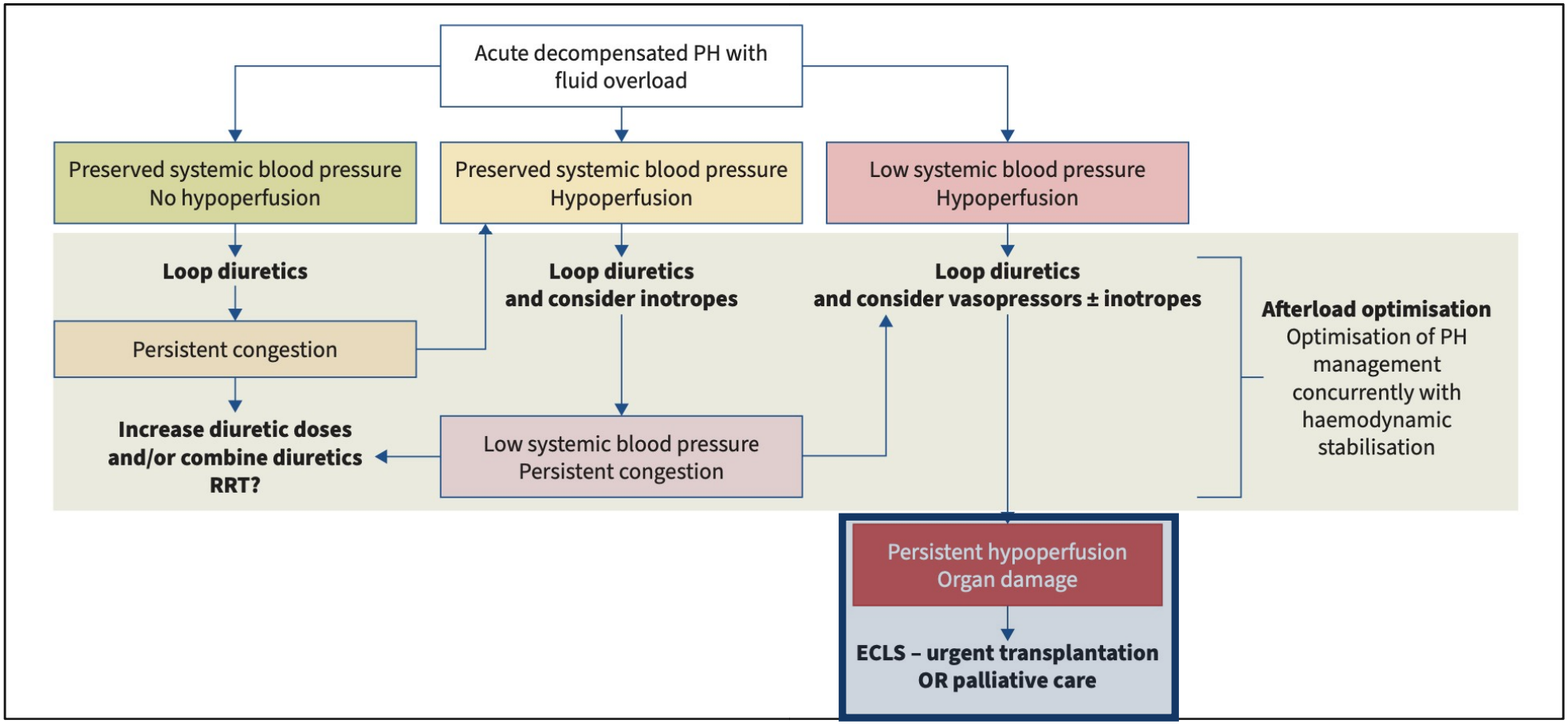
Laurent Savale[1,2,3], Alberto Benazzo[4], Paul Corris[5], Shaf Keshavjee[6], Deborah Jo Levine[7], Olaf Mercier[1,2,8], R. Duane Davis[9] and John T. Granton[10]

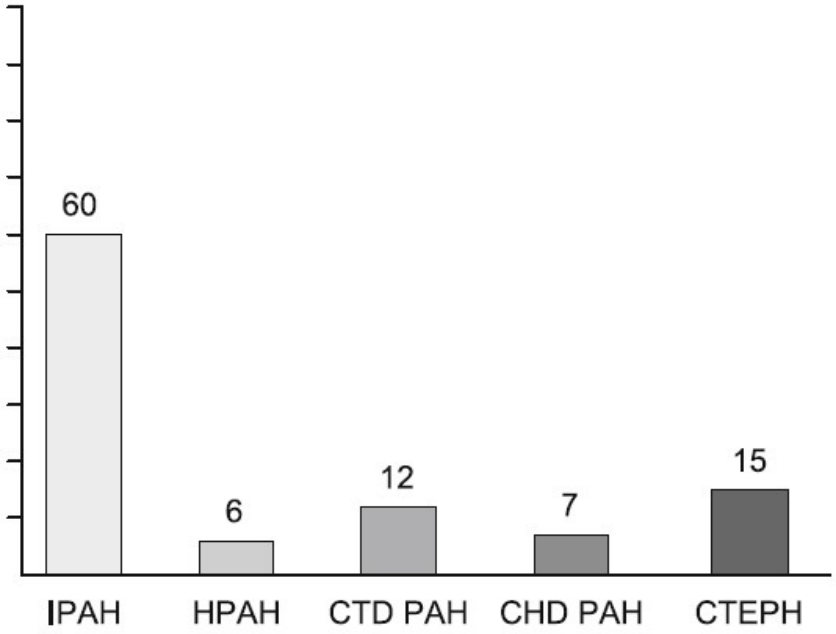


Eur Respir J 2024; in press: 2401

Predictors of survival in patients with pulmonary hypertension and acute right heart failure

Ambroz D[1], Jansa P[1], Kuchar J[2], Belohlavek J[1], Aschermann M[1], Dytrych V[1], Lindner J[3], Simkova I[4], Linhart A[1]

rospective analysis of RHF 2004-2013 (PAH, CTEPH, 70 patients, 117 hospitalizations, mean age 53.1 yea
gering factors: infection (17.9%), **SVT** (8.5%), **anemia** (5.9%), **other** (1.8%), **unknown** (66%)



Etiology of PH

	Total	ICU	Cardio war
N of cases	117	21	96
Hyponatremia (N of cases)	63	15	48
Creatinine (mean±SD)	133±53	154±74	128±
Systolic blood pressure (mean±SD)	108±17	102±16	109±
Anemia <Hb 100 g/l (N of cases)	7	3	4
Haemoglobin (g/L; mean±SD)	133±24	127±28	134±
Ascites (N of cases)	41	7	34
Paracentesis (N of cases)	27	6	21
SBP (N of cases)	11	4	7

SBP – spontaneous bacterial peritonitis

Baseline characteristics

Bratisl Med J 2020; 121 (3)230

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	Hospitalizations		
	All (n=117)	Cardiology ward (n=96)	ICU (n=21)
ity (n)	15 (13%)	4 (4%)	11 (52%)
diuretics	45 (38%)	43 (45%)	2 (10%)
uous diuretics	72 (62%)	53 (55%)	19 (91%)
mine	37 (32%)	19 (20%)	17 (81%)
nephrine	6 (5%)	-	6 (29%)
mendan	5 (4%)	-	5 (24%)
I	5 (4%)	-	5 (24%)
	10 (9%)	-	10 (48%)
	1 (1%)	-	1 (5%)
)	2 (2%)	-	2 (10%)

– Continuous veno-venous hemofiltration, NIV – non- invasive ventilation, invasive mechanic ventilation, ECMO – Extracorporeal Membrane Oxy- erapy

Therapy

	All (n=21)	Survivors (n=10)	Non-survi (n=11)
dobutamine	18	7 (39 %)	11 (61 %
norepinephrine	6	0 (0 %)	6 (100 %
levosimendan	5	2 (40 %)	3 (60 %
NIV	10	4 (40%)	6 (60 %
IMV	1	0 (0 %)	1 (100 %
CVVH	5	2 (40 %)	3 (60 %
ECMO	2	1 (50 %)	1 (50 %

CVVH – Continuous veno-venous hemofiltration, NIV – non-invasive ventil IMV – invasive mechanic ventilation, ECMO – Extracorporeal Membrane genotherapy

Therapy - ICU

Bratisl Med J 2020; 121 (3)230

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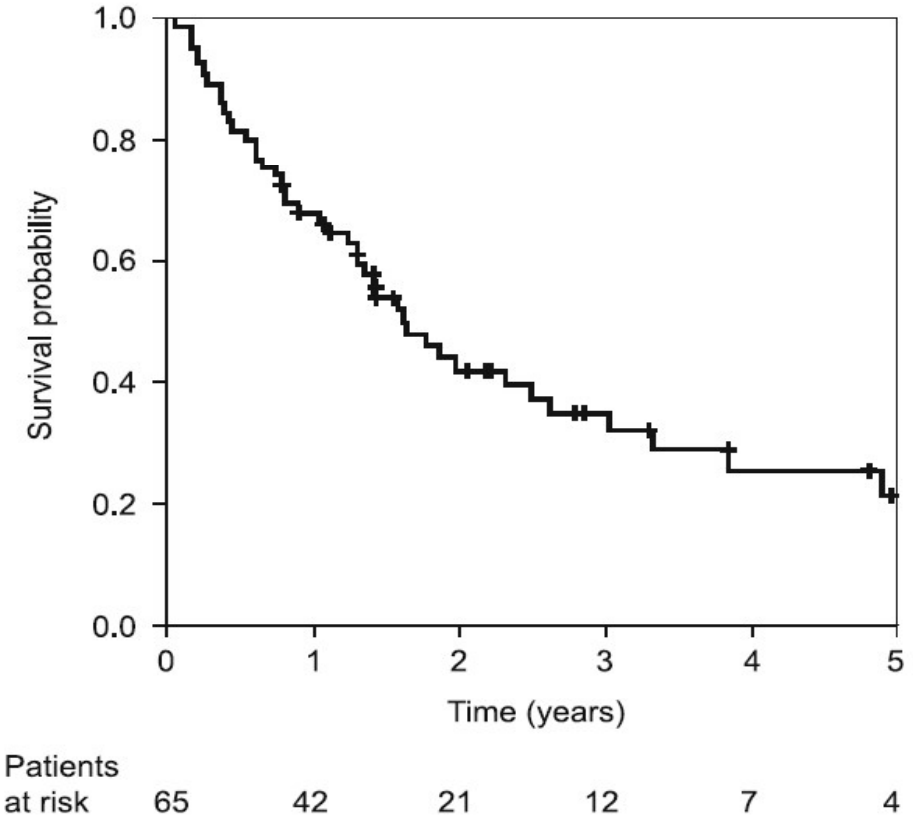
Survival after the first admission for RHF



Bratisl Med J 2020; 121 (3)230

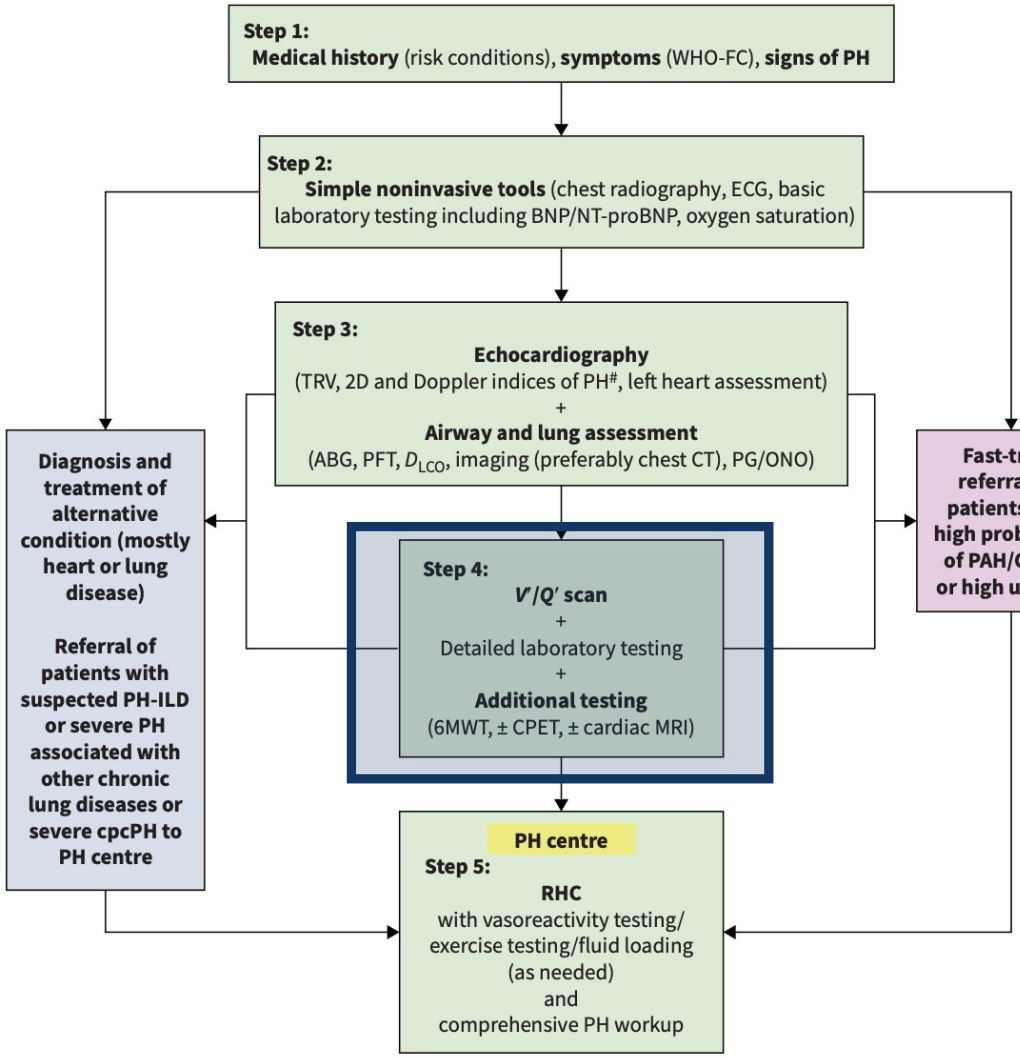
CHRONICKÁ TROMBOEMBOLICKÁ PLICNÍ NEMOC

Definition, classification and diagnosis of pulmonary hypertension

Gabor Kovacs[1,2], Sonja Bartolome[3], Christopher P. Denton[4], Michael A. Gatzoulis[5,6], Sue Gu[7], Dinesh Khanna[8], David Badesch[7] and David Montani[9,10,11]

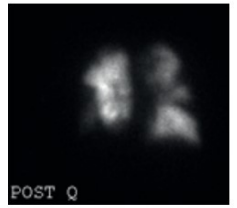
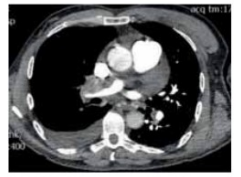
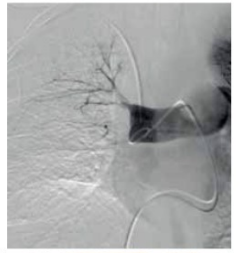
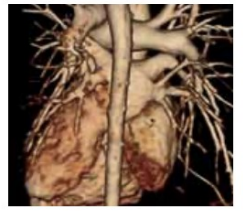
1 Haemodynamic criteria of pulmonary hypertension (PH)	
	Haemodynamic characteristics
	mPAP >20 mmHg
pillary PH	mPAP >20 mmHg PAWP ⩽15 mmHg PVR >2 WU
ed post-capillary PH (ipcPH)	mPAP >20 mmHg PAWP >15 mmHg PVR ⩽2 WU
ined post- and pre-capillary PH (cpcPH)	mPAP >20 mmHg PAWP >15 mmHg PVR >2 WU
se PH	mPAP/CO slope >3 mmHg/L/min between rest and exercise

mean pulmonary arterial pressure; PAWP: pulmonary arterial wedge pressure; PVR: pulmonary vascular nce; WU: Wood Units; CO: cardiac output.



Eur Respir J 2024; in press

Chronic thromboembolic pulmonary disease

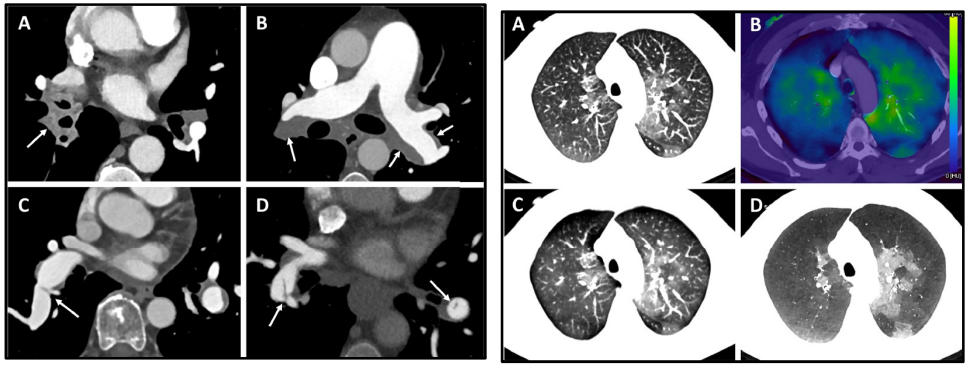
Test	Pros	Cons	Examples
***V*/*Q* scan**	• Screening test of choice • Specific to pulmonary arterial blood flow • Normal or abnormal	• Perception of being an outdated test or phasing out • Ventilation may not be available (*e.g.* accessibility, pandemic effect)	
SPECT scan	• More sensitive than planar radionucleotide perfusion scan • May become more readily available than *V*/*Q*	• Not additive if planar scan already available	
CT pulmonary angiogram (with or without dual energy)	• Most widely available • Detailed information about pulmonary circulation but also lung parenchyma and mediastinum • Dual energy capable of perfusion map	• False negative results (*e.g.* chronic segmental/subsegmental disease) • Requires radiologist with CTEPD awareness and experience • Contrast necessary	
Pulmonary angiogram	• Direct injection into pulmonary arteries can offer details of the lumen including sequential views as contrast passes • Helpful for surgical or BPA planning	• Requires right heart catheterisation with devices allowing for rapid injection without catheter migration • Limited access to expertise • Can underestimate disease	
MRI	• No radiation • Can offer views of pulmonary circulation, perfusion map and surrounding soft tissues • Valuable for pulmonary arterial tumour evaluation • Additional cardiac morphology and functional assessment	• Requires radiologist with CTEPD awareness and experience • Limited access to expertise	

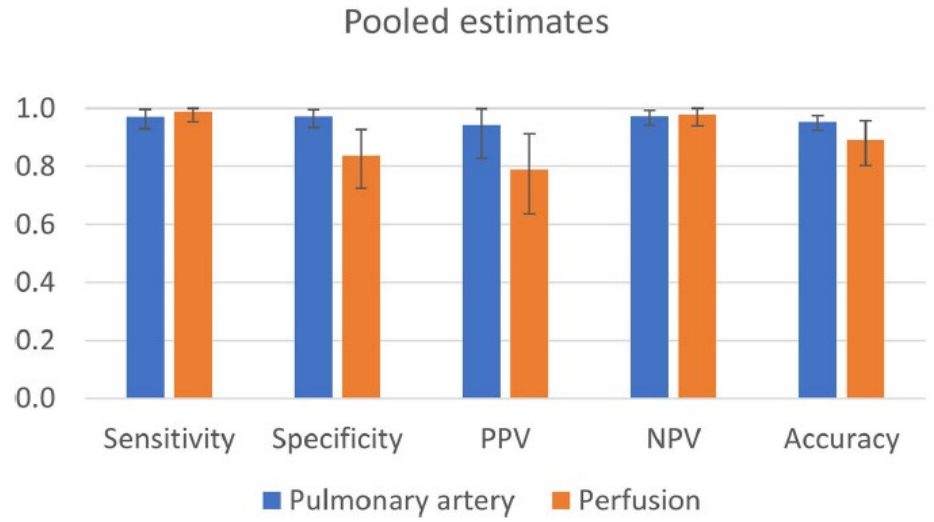
Kim NH et al. *Eur Respir J* 2024; in press

The diagnostic performance of CT pulmonary angiography in the detection of chronic thromboembolic pulmonary hypertension—systematic review and meta-analysis

10 studií, 734 pacientů
CTA má vysokou senzitivitu a vysokou specificitu, pokud je prováděna **expertním radiologem**

Author	Year published	Design	Age (years) ± SD (range)	Male gender	Inclusion criteria	Sample size	Patients with CTEPH
Tunariu [8]	2007	R	42 (18–81)	37%	PH of any type	227	78
Bartalena [13]	2008	R	55 (22–87)	36%	PH of any type	107	37
Reichelt [14]	2009	R	59 (18–76)	48%	Suspected CTEPH	27	24
Nakazawa [15]	2011	P	58 (29–80)	67%	Suspected or known CTEPH	51	51
He [16]	2012	P	43 ± 15	43%	Suspected CTEPH	114	51
Dournes [17]	2014	R	67 ± 13	35%	PH of any type	40	14
Masy [18]	2018	R	59 ± 16	25%	PH of any type	80	36
Wang [11]	2020	P	42 ± 15	34%	Suspected CTEPH	150	51
Fathala [19]	2021	R	41 ± 10	37%	CTEPH (scintigraphy, PEA)	54	54
Schüssler [20]	2021	P	63 ± 15	31%	Suspected CTEPH	71	13



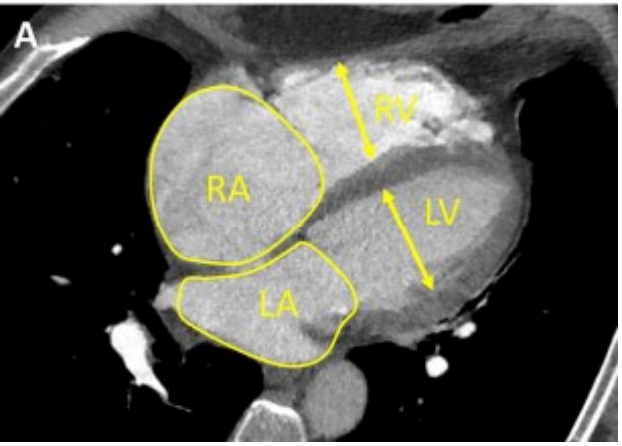


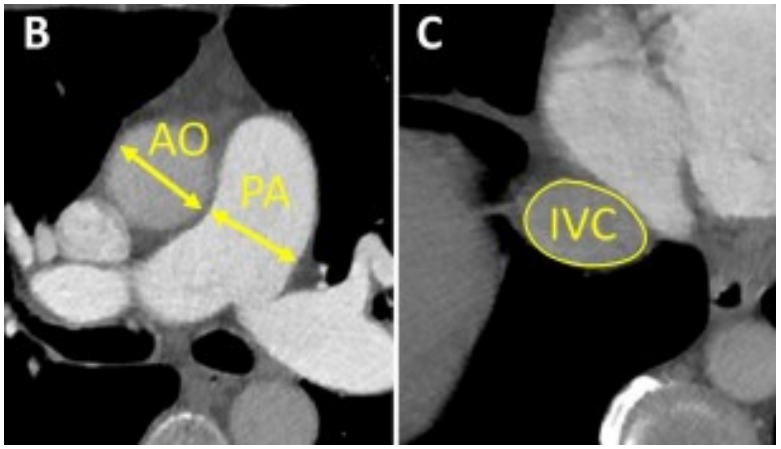
Lambert L et al. *Eur Radiol* 2022, Apr 28. doi: 10.1007/s00330-022-0

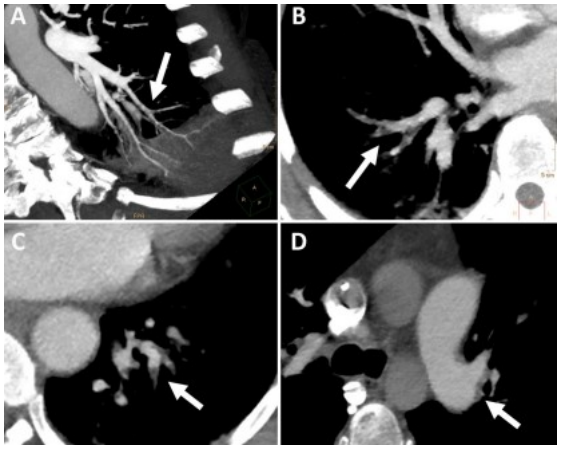
Even non-expert radiologists report chronic thromboembolic pulmonary hypertension (CTEPH) on CT pulmonary angiography with high sensitivity and almost perfect agreement

Jan Hrdlicka[1] · Martin Jurka[1] · Bianka Bircakova[1] · David Ambroz[2] · Pavel Jansa[2] · Andrea Burgetova[1] · Lukas Lambert[1]

patients with CTEPH, 49 patients without CTEPH
ree radiologists with different levels of experience in CT imaging (**R1**:15 years, **R2**:6 years, and **R3**:3 years



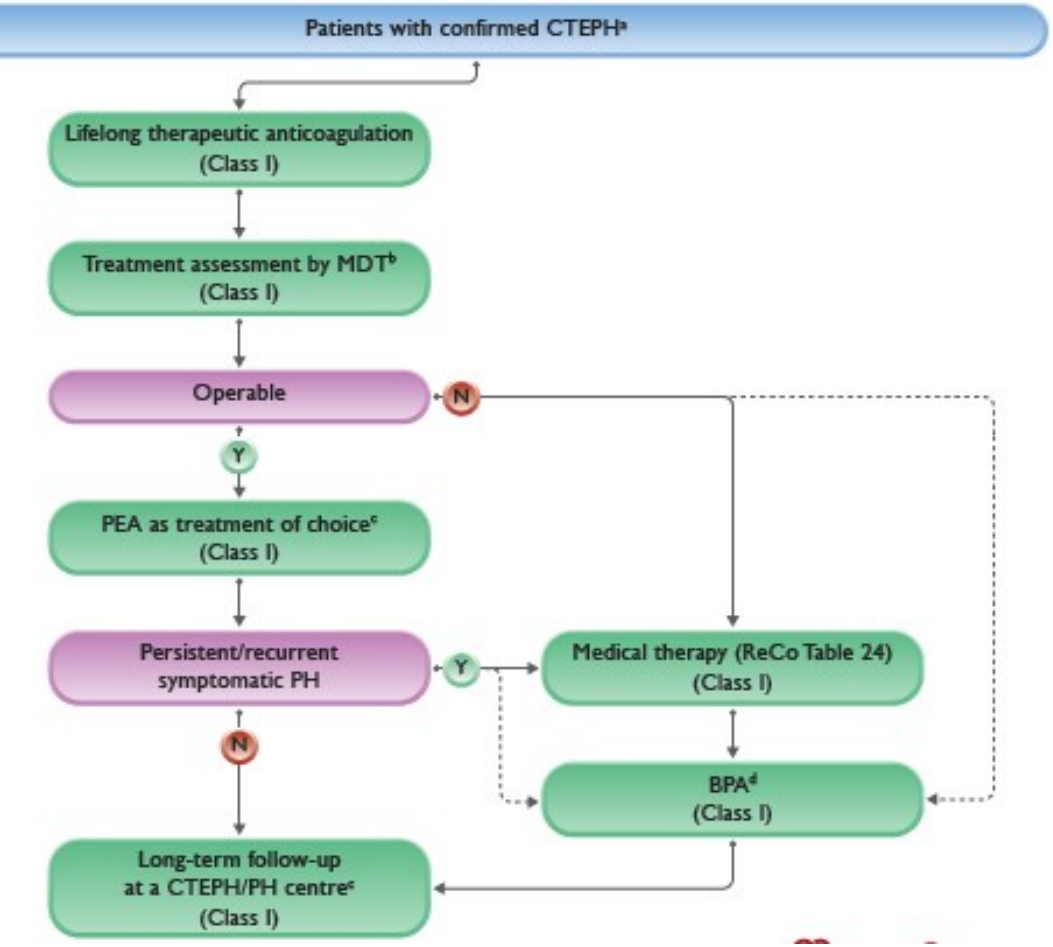




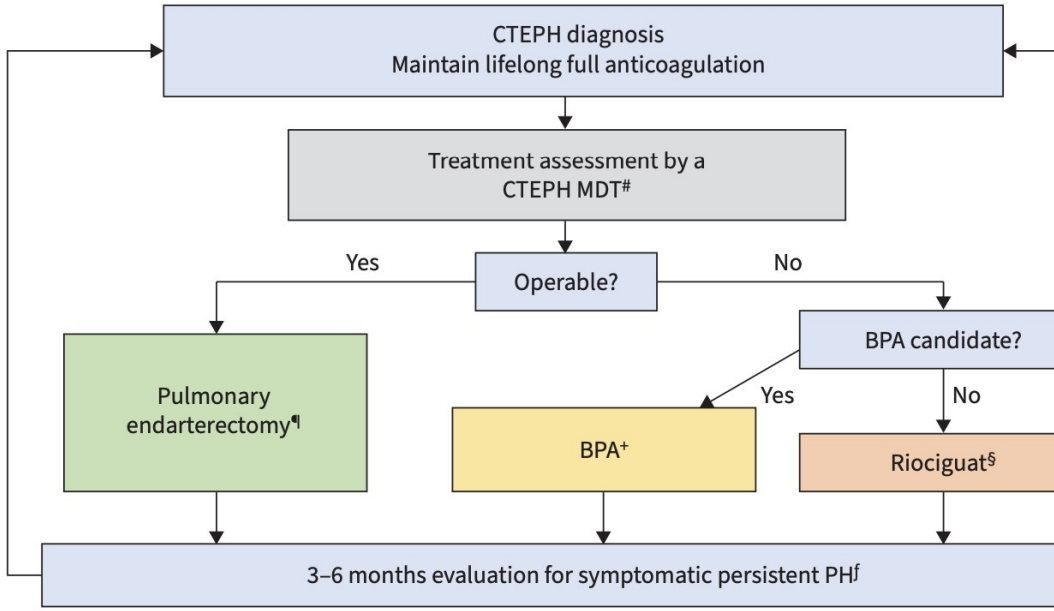
	R1		R2		R3		Overall	
	(%)	95%CI	(%)	95%CI	(%)	95%CI	(%)	95%CI
Sensitivity	100	93–100	100	93–100	100	93–100	100	98–100
Specificity	100	93–100	96	86–100	96	86–100	97	93–99
PPV	100	-	96	87–99	96	87–99	97	94–99
NPV	100	-	100	-	100	-	100	-
Accuracy	100	97–100	98	93–100	98	93–100	99	97–100

Eur Radiol 2023, Aug 22. doi: 10.1007/s00330-023-1

22 ESC/ERS Guidelines for the diagnosis and eatment of pulmonary hypertension



Chronic thromboembolic pulmonary dise



Humbert M et al. Eur Respir J 2022; DOI: 10.1183/1399300
Kim NH et al. *Eur Respir J* 2024; in press: 2401294

2022 ESC/ERS Guidelines for the diagnosis and treatment of pulmonary hypertension

Multidiscipinární CTEPH tým

- Chirurg se zkušeností s PEA
- Intervenční kardiolog se zkušeností s BPA
- Specialista na plicní hypertenzi
- Radiolog se zkušeností z vysokoobjemového CTEPH centra

Optimální počty výkonů

- PEA > 50 výkonů/rok
- BPA > 100 výkonů/rok nebo > 30 pacientů se zahájenou léčbou

Humbert M et al. 2022 ESC/ERS Guidelines for the diagnosis and treatment of pulmonary hypertension. *EHJ* 2022, *E*

Chronic thromboembolic pulmonary disease

TABLE 3 Chronic thromboembolic pulmonary hypertension (CTEPH) multidisciplinary team (MDT) and centre expertise

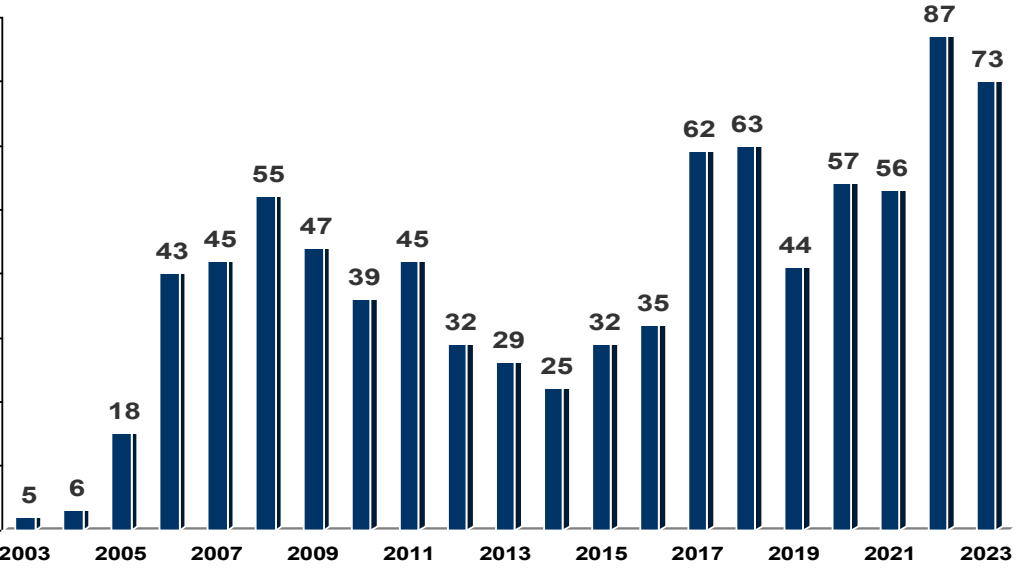
	Requirements
MDT	PEA surgeon + BPA specialist + PH expert + pulmonary vascular radiologist
PEA centre	⩾20 surgeries per year with post-operative mortality rate <5%, ECMO support
Expert PEA centre	50 surgeries per year with mortality <3%, capable of treating segmental/ subsegmental disease, ECMO support
BPA centre	⩾50 procedures per year with procedure related mortality <3%
Expert BPA centre	>100 procedures per year with mortality <1%, ECMO support
Comprehensive CTEPH centre	Combined PEA + BPA + PH + ECMO expertise available with treatments based on centre MDT

PEA: pulmonary endartectomy; BPA: balloon pulmonary angioplasty; PH: pulmonary hypertension; ECMO extracorporeal membrane oxygenation.

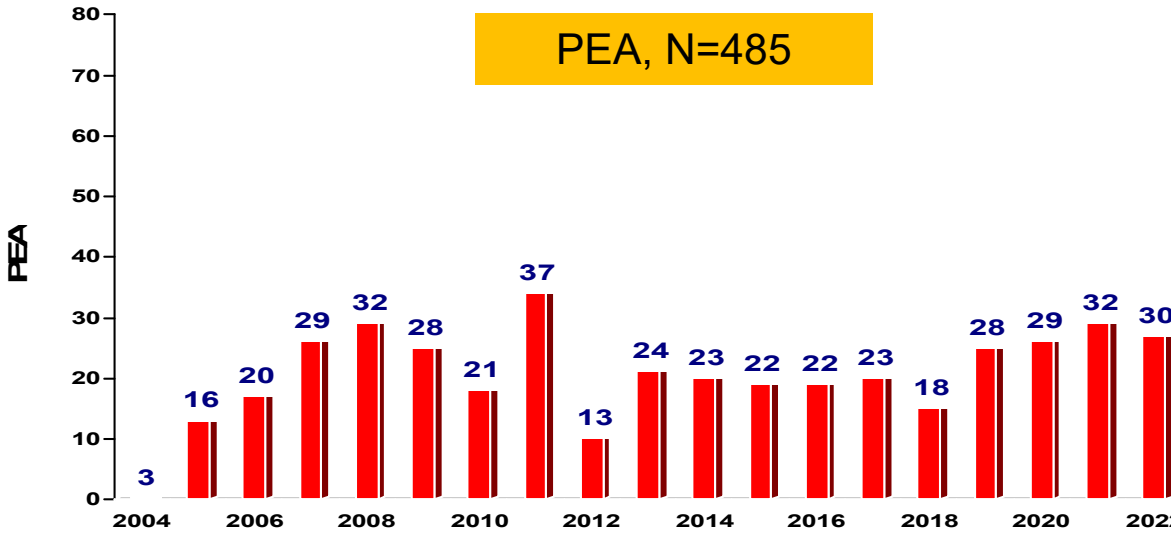
Kim NH et al. *Eur Respir J* 2024; in press

CTEPH V ČESKÉ REPUBLICE (2003-2023)

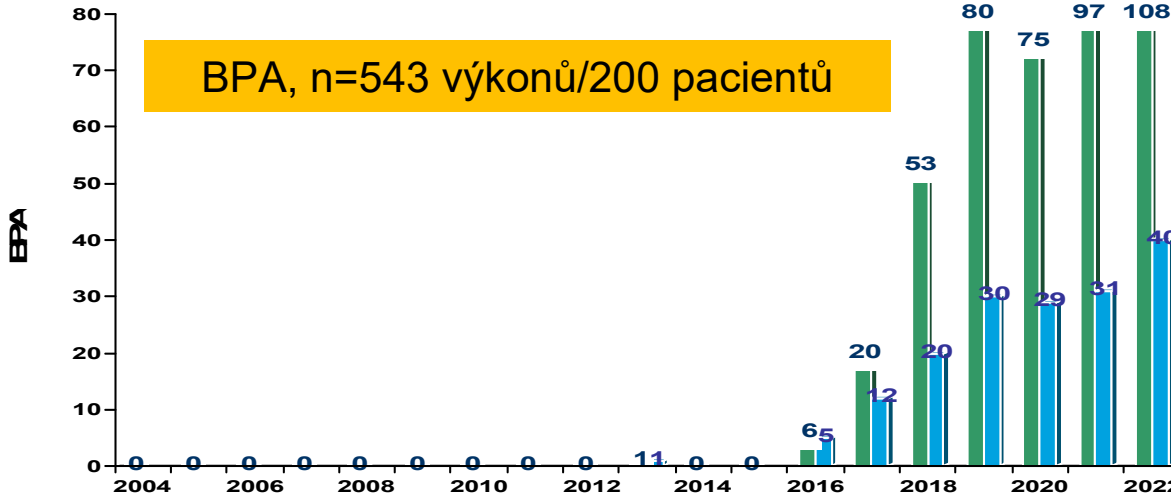
Nově diagnostikovaní pacienti (n=892)



PEA, N=485



BPA, n=543 výkonů/200 pacientů

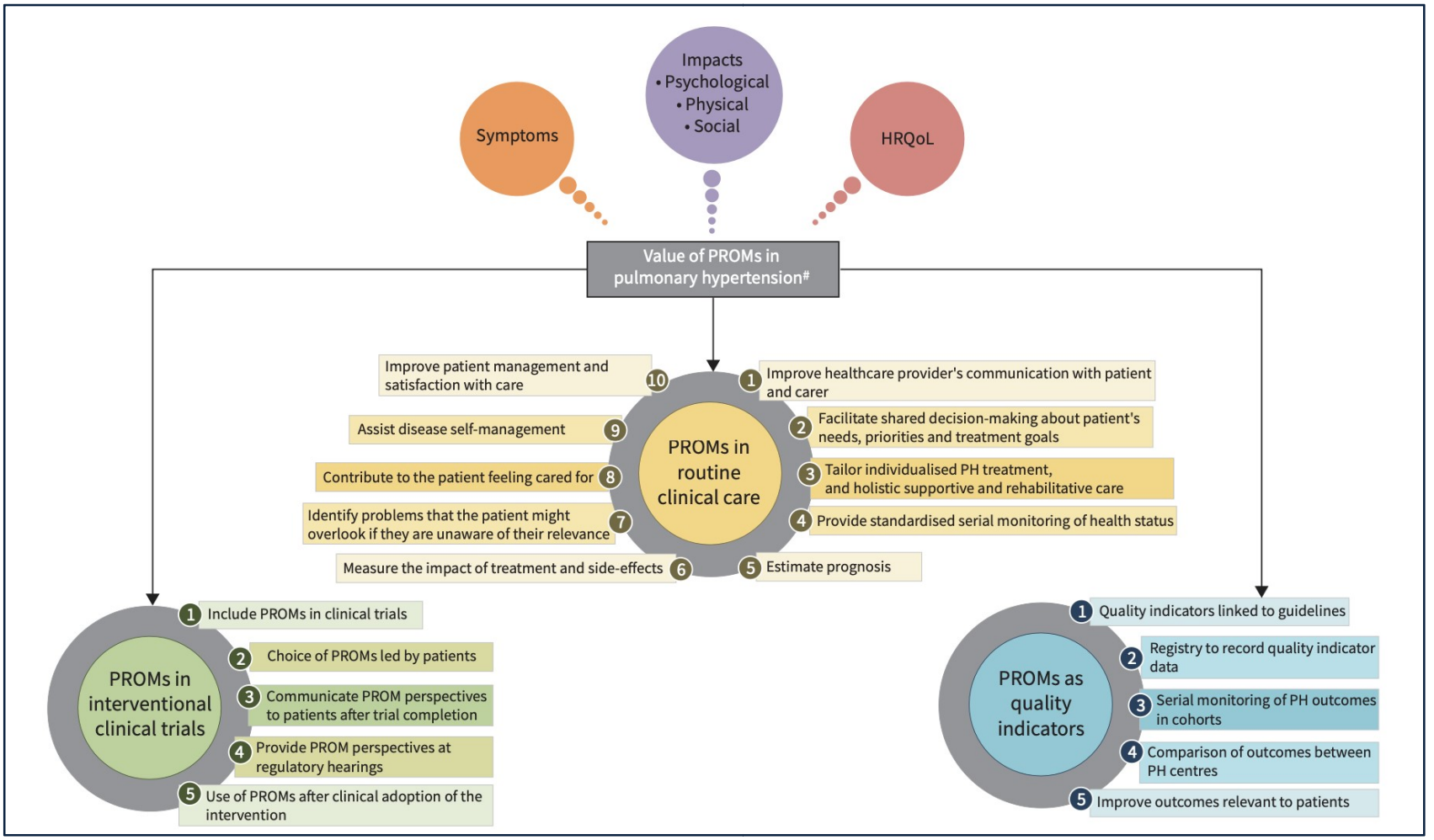


Jansa P et al. Epidemiology of chronic thromboembolic pulmonary hypertension (CTEPH) in the Czech Republic. *Pulmonary Circulation* 2022;12

ROLE PACIENTŮ

Exploring the patient perspective in pulmonary hypertension

H. James Ford [1], Colleen Brunetti[2], Pisana Ferrari[3], Gergely Meszaros[4], Victor M. Moles [5], Hall Skaara[6], Adam Torbicki [7] and J. Simon R. Gibbs [8]



Eur Respir J 2024; in press: 240112

Exploring the patient perspective in pulmonary hypertension

H. James Ford [1], Colleen Brunetti[2], Pisana Ferrari[3], Gergely Meszaros[4], Victor M. Moles [5], Hall Skaara[6], Adam Torbicki [7] and J. Simon R. Gibbs [8]

PROM	Diseases assessed	Domains assessed	Correlates with	Scale/ scoring	Questions n	Approximate completion time (min)	Time period assessed	Languages available	App or online tool	MCID (points)	References
CAMPHOR	PAH CTEPH	Symptoms Activity HRQoL	6MWD, FC, Borg dyspnoea score, clinical worsening	Yes/no and 3-point Likert	65	10	Same day	23	No	HRQoL 3 Symptoms 4 Activities 3–4	[60–64]
EmPHasis-10	PAH CTEPH	HRQoL	6MWD, FC, BNP, PVR, REVEAL risk score, survival	6-point semantic differential	10	2–3	At time of assessment	25	Yes	6–8	[60, 65–67]
Living with PH	PAH	Physical Emotional	6MWD, FC	6-point Likert	21	5–10	1 week	English only	No	Overall 7 Subsections 3	[68]
PAH-SYMPACT	PAH CTEPH	Cardiopulmonary symptoms Cardiovascular symptoms Physical impacts Cognitive/ emotional impacts	6MWD, FC, REVEAL 2.0 risk score, D_{LCO}, survival	5-point Likert	23	5–7	24 h for symptoms 7 days for impacts	22 for paper version, 33 for electronic version	Yes (research only)	Not available	[69–72]
PAHSIS	PAH	Symptoms	SF-36 scores	11-point Likert	17	<5	1 month	English only	No	Not available	[73]
EQ-5D	Generic	Mobility Self-care Pain Anxiety/depression Activity	Not available for PAH	Visual analogue	5	2–5	Same day	208	Yes	Not available	[74–75]
SF-36	Generic	Physical functioning Physical limitations Pain General health Energy/vitality Social functioning Emotional limitations Mental health	6MWD, FC, survival	Variable	36	8–10	4 weeks	193	Yes	Not available	[76–78]

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SHRNUTÍ

LUTx - detailnější indikace, stratifikace rizika transplantace

CTEPH - proti ESC/ERS Guidelines 2022 bez zásadní změny
- definice typu center
  (centrum, expertní centrum, komplexní centrum)

Pacienti - zásadní význam pacientských organizací

European Reference Network

for rare or low prevalence complex diseases

Network
Respiratory Diseases
(ERN-LUNG)

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