Likelihood of PH based on echocardiographic findings[6]

PH is unlikely
- Estimated systolic PAP ≤ 36 mmHg, with
- no indirect signs of PH and with normal RV systolic function

PH is possible
- Estimated systolic PAP ≤ 36 mmHg, but with
- indirect signs of PH or with abnormal RV systolic function or

- estimated systolic PAP is 37-50 mmHg

PH is likely
- Estimated systolic PAP > 50 mmHg

Abbreviations

FAC:	*fractional area change*
HR:	*heart rate*
IVC:	*inferior vena cava*
LA:	*left atrium*
LV:	*left ventricle*
LVOT:	*left ventricular outflow tract*
PAP:	*pulmonary artery pressure*
PH:	*pulmonary hypertension*
RA:	*right atrium*
RAP:	*right atrial pressure*
RV:	*right ventricle*
TAPSE:	*tricuspid annular plane systolic excursion*
TDI:	*Tissue Doppler Imaging*

References

1. *Badesch DB et al. Diagnosis and assessment of pulmonary arterial hypertension. J Am Coll Cardiol. 2009;54(1 Suppl):S55-66.* ***2.*** *Hoeper MM et al. Diagnosis, assessment, and treatment of non-pulmonary arterial hypertension pulmonary hypertension. J Am Coll Cardiol. 2009;54(1 Suppl):S85-96.* ***3.*** *Chemla D et al. Evaluation of various empirical formulas for estimating mean pulmonary artery pressure by using systolic pulmonary artery pressure in adults. Chest. 2009;135(3):760-768.* ***4.*** *Abbas AE et al. Echocardiographic determination of mean pulmonary artery pressure. Am J Cardiol. 2003;92(11):1373-1376.* ***5.*** *Simonneau G et al. Updated clinical classification of pulmonary hypertension. J Am Coll Cardiol. 2009;54(1 Suppl):S43-54.* ***6.*** *Guidelines for the diagnosis and treatment of pulmonary hypertension: The 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 the International Society of Heart and Lung Transplantation (ISHLT). Eur Heart J. 2009:ehp297.*

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Transthoracic echocardiography for the evaluation of pulmonary hypertension

- Introduction
- Patient groups at risk
- Recommended measures
- Likelihood of PH
- Abbreviations
- References

Introduction

Pulmonary arterial hypertension (PAH) is defined as a mean pulmonary artery pressure (PAP) ≥ 25 mmHg at rest (cardiac catheterization value) with normal left ventricular filling pressures (mean pulmonary wedge pressure ≤ 15 mmHg).[1] PAH is a rare form of pulmonary hypertension (PH).

PH is frequent in patients with left heart disease, obstructive pulmonary disease, pulmonary venous thromboembolism and other conditions. These patients have not-PAH forms of PH and should be treated according to the underlying disease, whenever possible.[2]

Doppler echocardiography is the best non-invasive method to evaluate PAP and should be used in all patients suspected to have PAH. Cardiac catheterization is mandatory for the final diagnosis of PAH.

Patient groups at risk to develop PAH

The following patient groups are at increased risk to develop PAH[1] (non exhaustive list).

Yearly echocardiography is recommended in patients

- at risk for heritable PAH
- with connective tissue disease, especially patients with scleroderma
- with sickle cell disease

Echocardiography should be considered, in patients with PH-suggestive symptoms

- after pulmonary embolism
- with HIV infection
- with portal hypertension
- with prior appetite suppressant use
- with sarcoidosis
- after splenectomy

Recommended measures

The following echo measures are recommended in patients with suspected PH. Measures in bold should be obtained in every patient, when possible.

Assessment of PAP	**Normal values**
Systolic PAP	
Tricuspid regurgitation gradient plus RAP	≤ 36 mmHg[3]
RAP: 5 to 20 mmHg based on estimated RAP (IVC diameter and respiratory variation)	
Rule out right ventricular outflow tract obstruction Not applicable in severe tricuspid regurgitation Shows good correlation with invasive data, except in patients with COPD	
Diastolic PAP	
End-diastolic pulmonary insufficiency gradient (PA-RV-gradient) plus RAP	< 15 mmHg
Not applicable in severe pulmonary regurgitation	
Mean PAP	
Early pulmonary insufficiency peak gradient[4]	< 25 mmHg
Not applicable in severe pulmonary regurgitation	

Doppler studies need to be performed carefully to obtain best and complete flow signals (Doppler interrogation parallel to flow, mean of 3 end-expiratory values)

Assessment of RV function

TAPSE/TAM	**> 20 mm**
TDI systolic velocity of the RV lateral annulus	**> 11 cm/s**
RV-FAC	> 30 %

Indirect signs of PH might be detected at first glance, when present. The most relevant indirect signs of PH are the presence of:

D-shaping of the interventricular septum Measured by systolic and diastolic eccentricity index (EI) Systolic EI > 1 RV pressure overload Diastolic EI > 1 RV volume overload	EI = 1
Notching of PV (midsystolic closure of the pulmonary valve at high speed sweep)	
Short IVRT (best measured on RV TDI)	
Short acceleration time of the pulmonary outflow signal	> 90 ms
Right ventricular hypertrophy RV free wall thickness measured in subcostal view	< 6 mm
Dilatation of right sided chambers RV midcavitary diameter (in apical four chamber view) RA volume Main PA diameter IVC diameter	 RV/LV < 1 < 22 ml/m^2 < 30 mm < 20 mm

In addition, the echo report should include

- systemic blood pressure at time of echocardiography
- cardiac output (LVOT area x $LVOT_{VTI}$ x HR)

To identify patients likely to have PH due to left heart disease or associated with congenital heart disease,[5] the echo report should comment on

- Valvular heart disease (e. g. mitral insufficiency, aortic stenosis)
- LV diastolic and systolic function
- Intracardiac shunts