

# *L'hypertension pulmonaire thrombo-embolique chronique*

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## DEFINITION

### **Chronic thrombo-embolic pulmonary disease (CTEPD)**

- symptomatic patients
- mismatched perfusion defects on V/Q scan and with signs of chronic, organized, fibrotic clots on CTPA
- after at least 3 months of therapeutic anticoagulation

CTEPD with pulmonary hypertension (PH) = **Chronic thrombo-embolic pulmonary hypertension (CTEPH)**

# DEFINITION - CLASSIFICATION

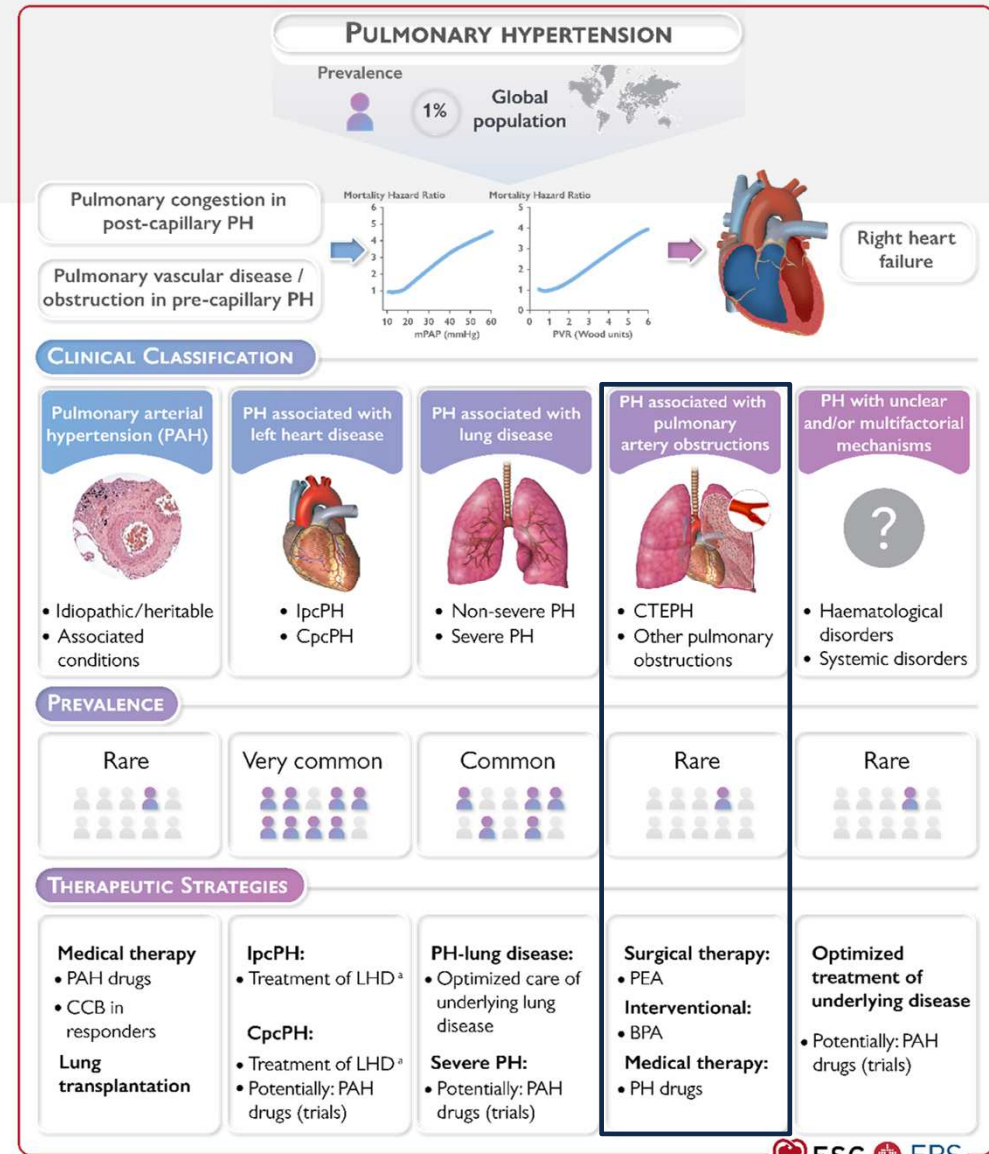
Pulmonary hypertension (PH)

mPAP >20 mmHg

GROUP 4 PH associated with pulmonary artery obstructions

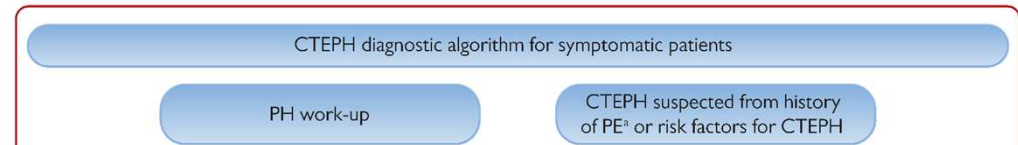
4.1 Chronic thrombo-embolic PH

4.2 Other pulmonary artery obstructions



# DIAGNOSIS

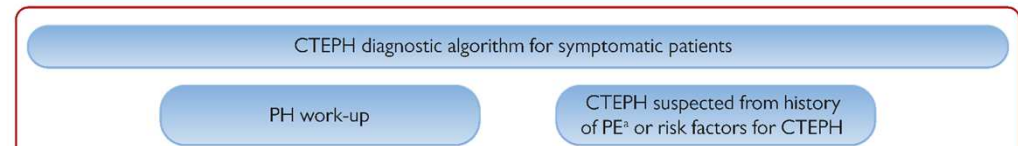
## Circumstances of diagnosis:



- Assessment of pulmonary hypertension: 55% of cases
- Follow-up after pulmonary embolism:  $\leq 5\%$  of cases
- At the time of acute pulmonary embolism with abnormally high pulmonary artery pressure (PAPs  $> 60$  mmHg)

# DIAGNOSIS

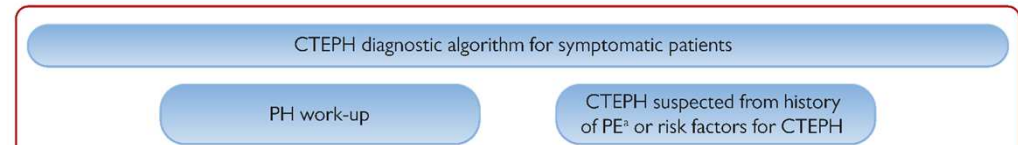
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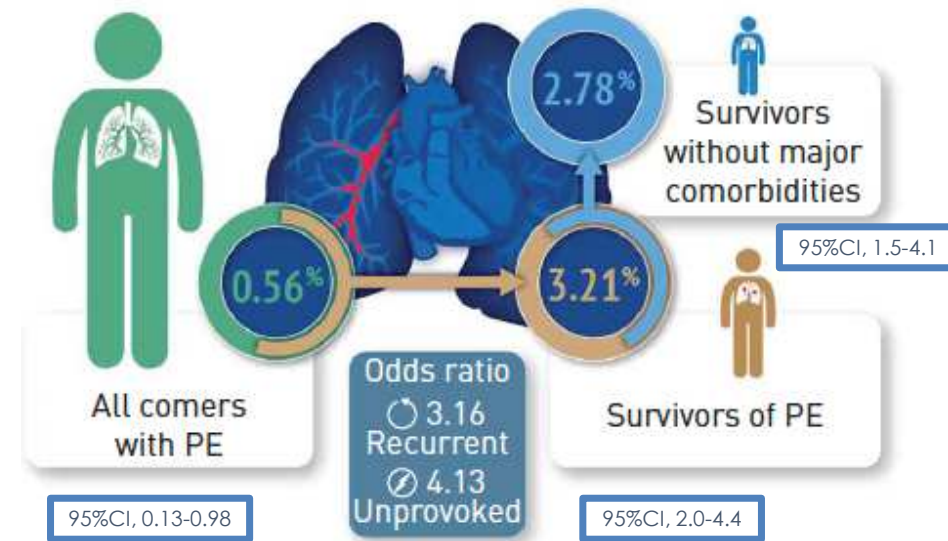


- Assessment of pulmonary hypertension: 55% of cases
- **Follow-up after pulmonary embolism: ≤5% of cases**
- At the time of acute pulmonary embolism with abnormally high pulmonary artery pressure (PAPs>60mmHg)

# DIAGNOSIS

## Follow-up after pulmonary embolism:

- Incidence of **3.7** per 1000 patients per year with a cumulative incidence of **0.79%**.(1)
- Cumulative incidence CTEPH **2.3%** (95%CI, 1.2-4.4%) (FOCUS study) (2)
- Cumulative incidence of **2.8%** with a median follow-up of 8 years in patients with unprovoked PE (PADIS Study).



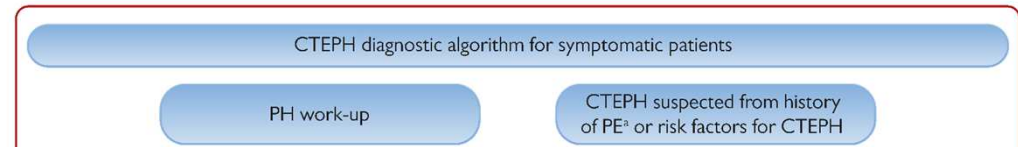
| Risk factor   | Odds Ratio | 95% CI  |
|---------------|------------|---------|
| Unprovoked PE | 4.1        | 2.1–8.2 |
| Recurrent VTE | 3.2        | 1.7–5.9 |

Ende-Verhaar YM et al. *Eur Respir J* 2017;49:1601792.

1. Coquoz et al, *Eur Respir J* 2018;  
 2. Valerio L et al. *Eur Heart J*. 2022;43(36):3387-3398  
 3. Fauché et al, *J Thromb Haemost* 2022.

# DIAGNOSIS

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## DIAGNOSIS

### **In the context of acute PE, CTEPH should be considered:**

1. If radiological signs suggest CTEPH on the CTPA performed to diagnose PE (thrombus adhering to the vascular wall, webs, bands, PA retraction/dilatation, mosaic perfusion and enlarged bronchial arteries), and/or if estimated sPAP is  $>60$  mmHg on echo
2. When dyspnoea or functional limitations persist in the clinical course post-PE
3. In asymptomatic patients with risk factors for CTEPH or a high CTEPH prediction score

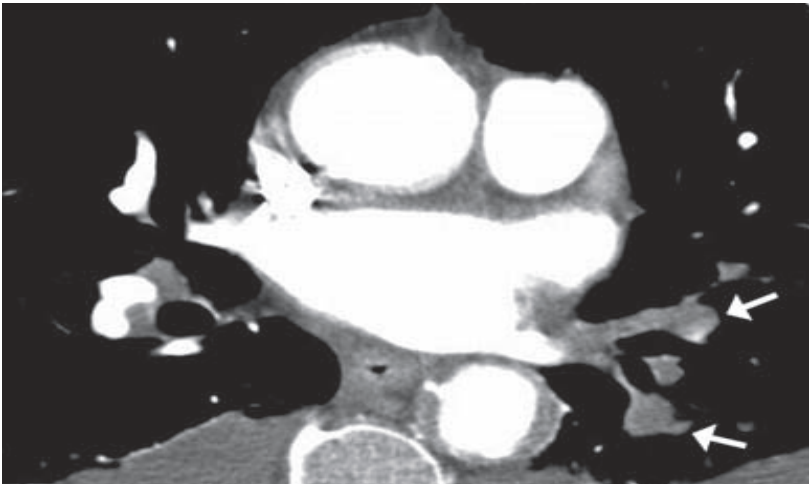
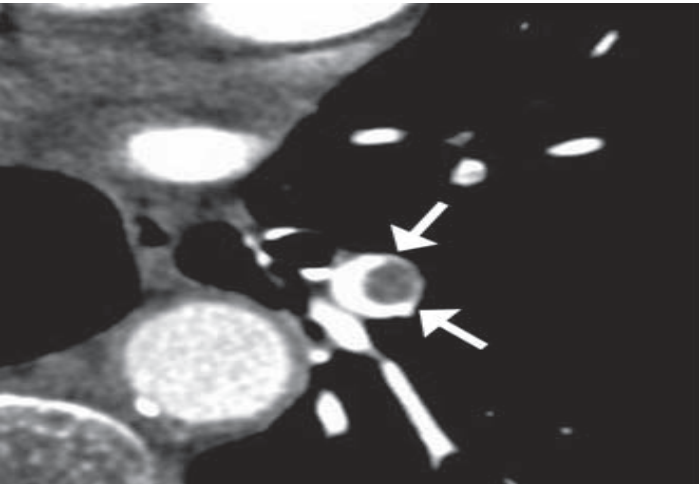
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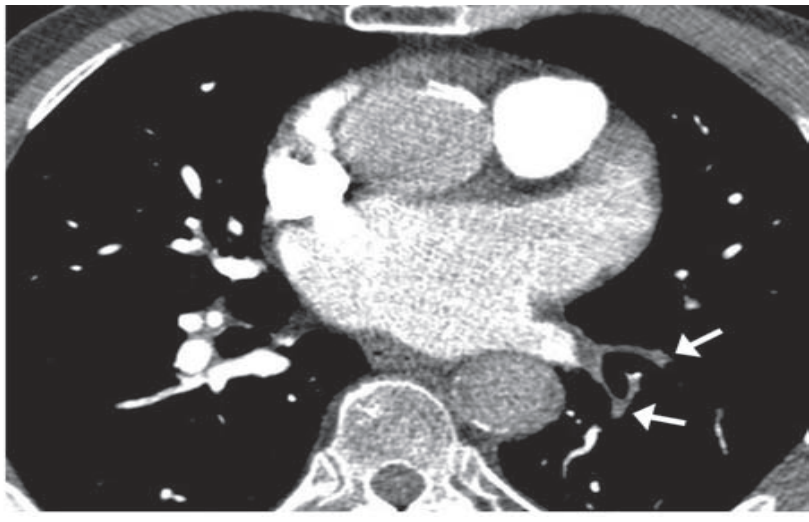
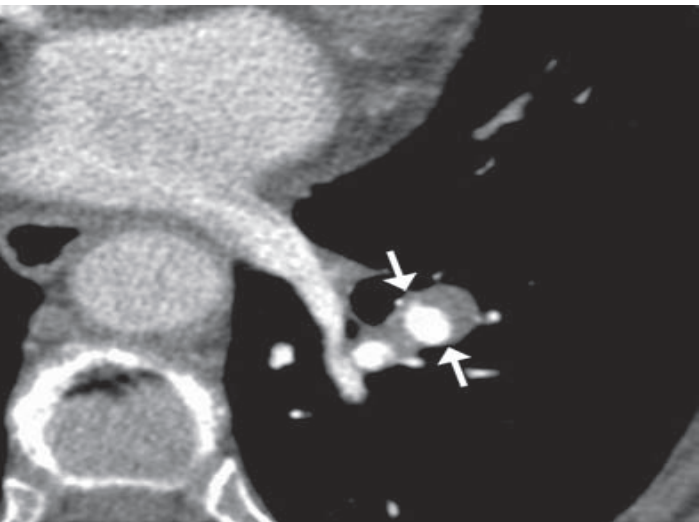
- 1. If radiological signs suggest CTEPH on the CTPA performed to diagnose PE (thrombus adhering to the vascular wall, webs, bands, PA retraction/dilatation, mosaic perfusion and enlarged bronchial arteries), and/or if estimated sPAP is >60 mmHg on echo**
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# DIAGNOSIS

**ACUTE PE**



**CHRONIC PE**



# DIAGNOSIS

## CT features of chronic obstruction of pulmonary arteries

| CT Features                             | Acute PE                                     | Chronic PE                                    |
|---|--|---|
| <b>Mediastinal images</b>               |  |   |
| Partial filling defects                 | Yes  | Yes   |
| Complete filling defects                | Yes  | Yes   |
| Arterial retraction                     |  | Yes   |
| Reperfusion channels                    |  | Yes   |
| Webs, bands                             |  | Yes   |
| Focal stenosis                          |  | Yes   |
| Enlarged bronchial arteries             |  | Yes   |
| Enlarged nonbronchial systemic arteries |  | Yes   |
| Pleural abnormalities                   | Yes (effusion)                               | Yes   |
| <b>Lung images</b>                      |  |   |
| Lung infarction/sequelae                | Yes (subpleural, wedge-shaped consolidation) | Yes (nonspecific fibrotic infiltration/cysts) |
| Bronchial dilatation                    |  | Yes (adjacent to severely stenosed arteries)  |
| Mosaic perfusion                        |  | Yes   |

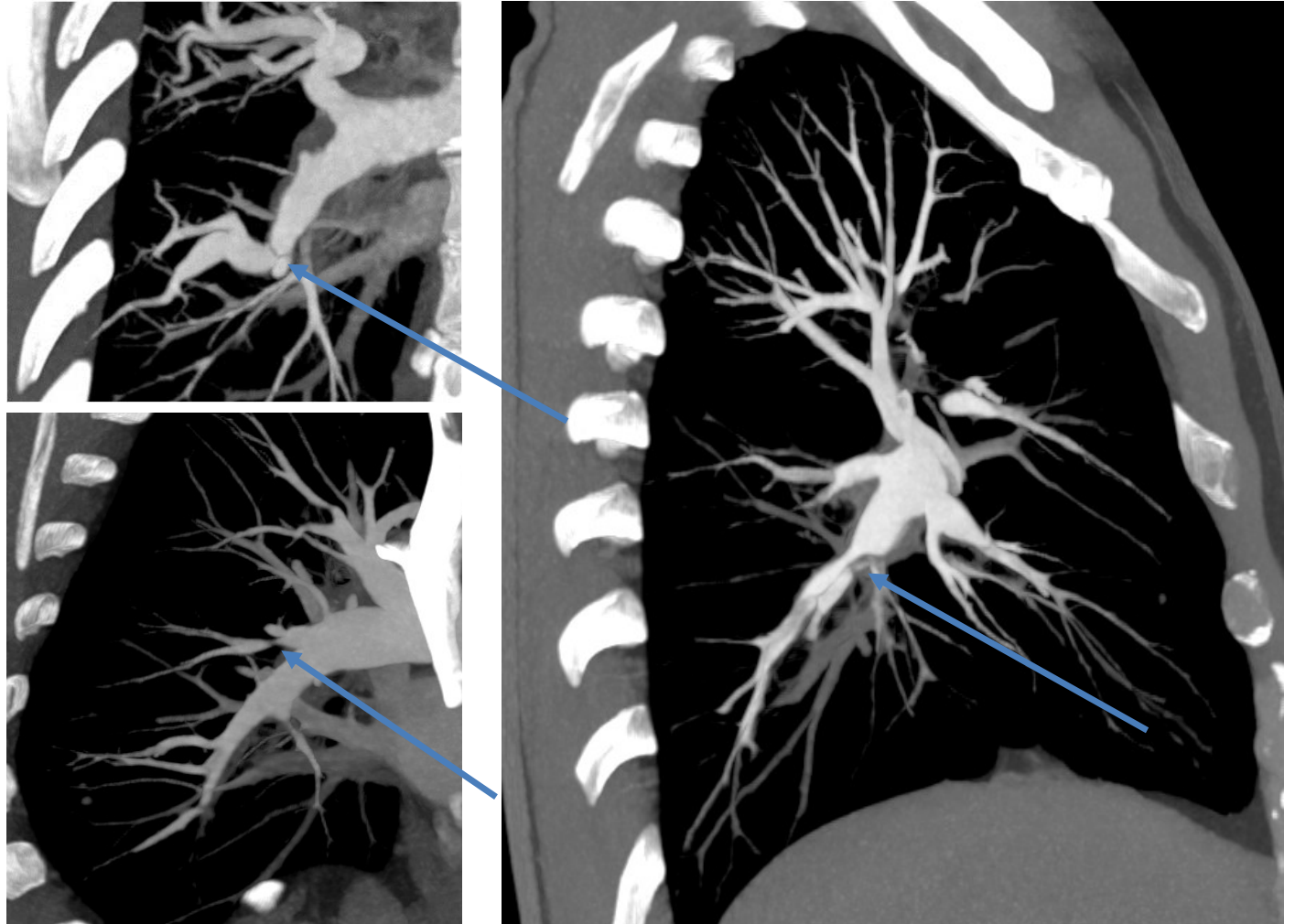
PE: pulmonary embolism.

# DIAGNOSIS

## CT features of chronic obstruction of pulmonary arteries

### Direct signs:

- Arterial retraction
- Webs, bands
- Focal stenosis

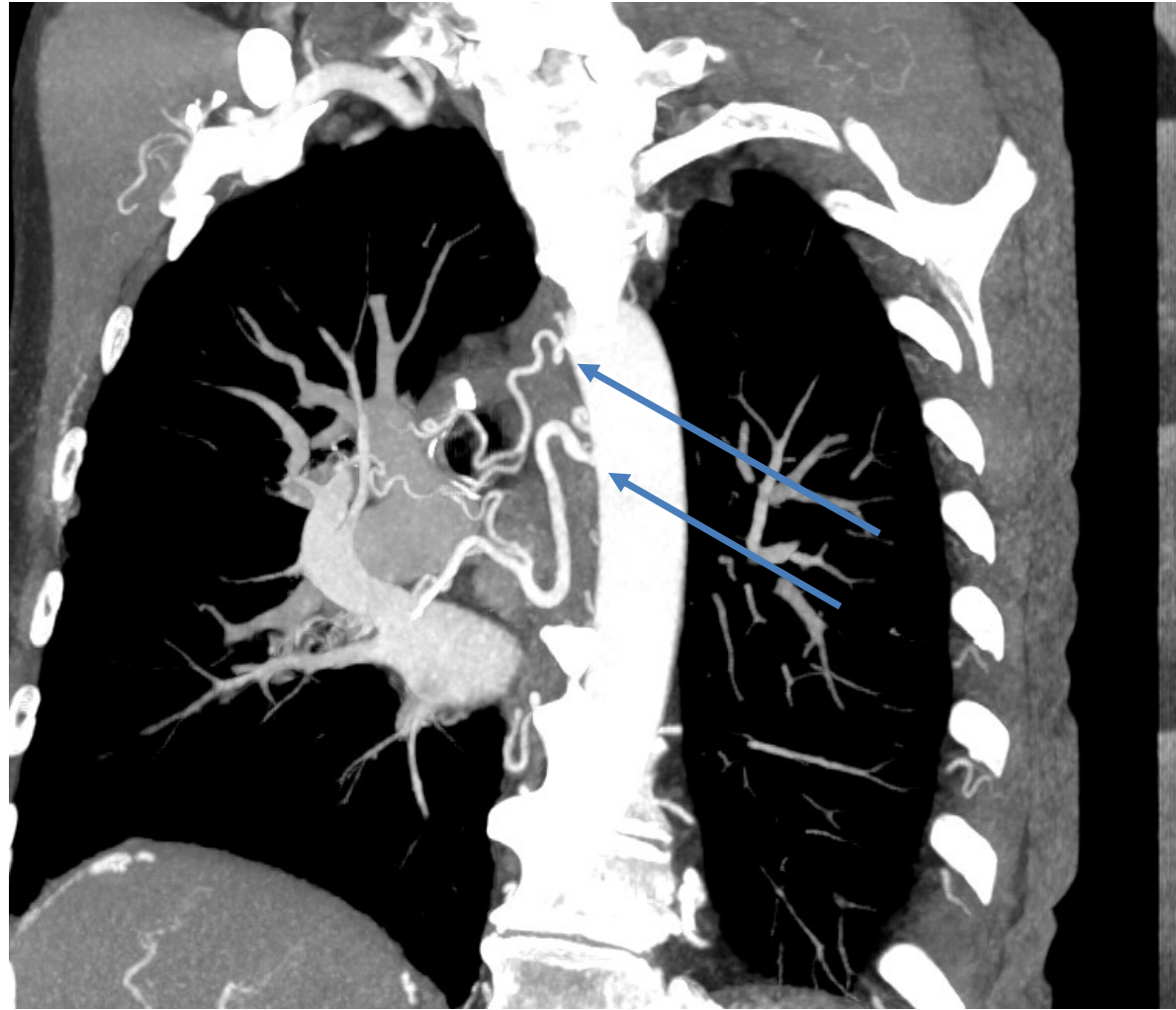


## DIAGNOSIS

### CT features of chronic obstruction of pulmonary arteries

#### Indirect signs :

- Enlarged bronchial arteries
- Mosaic perfusion

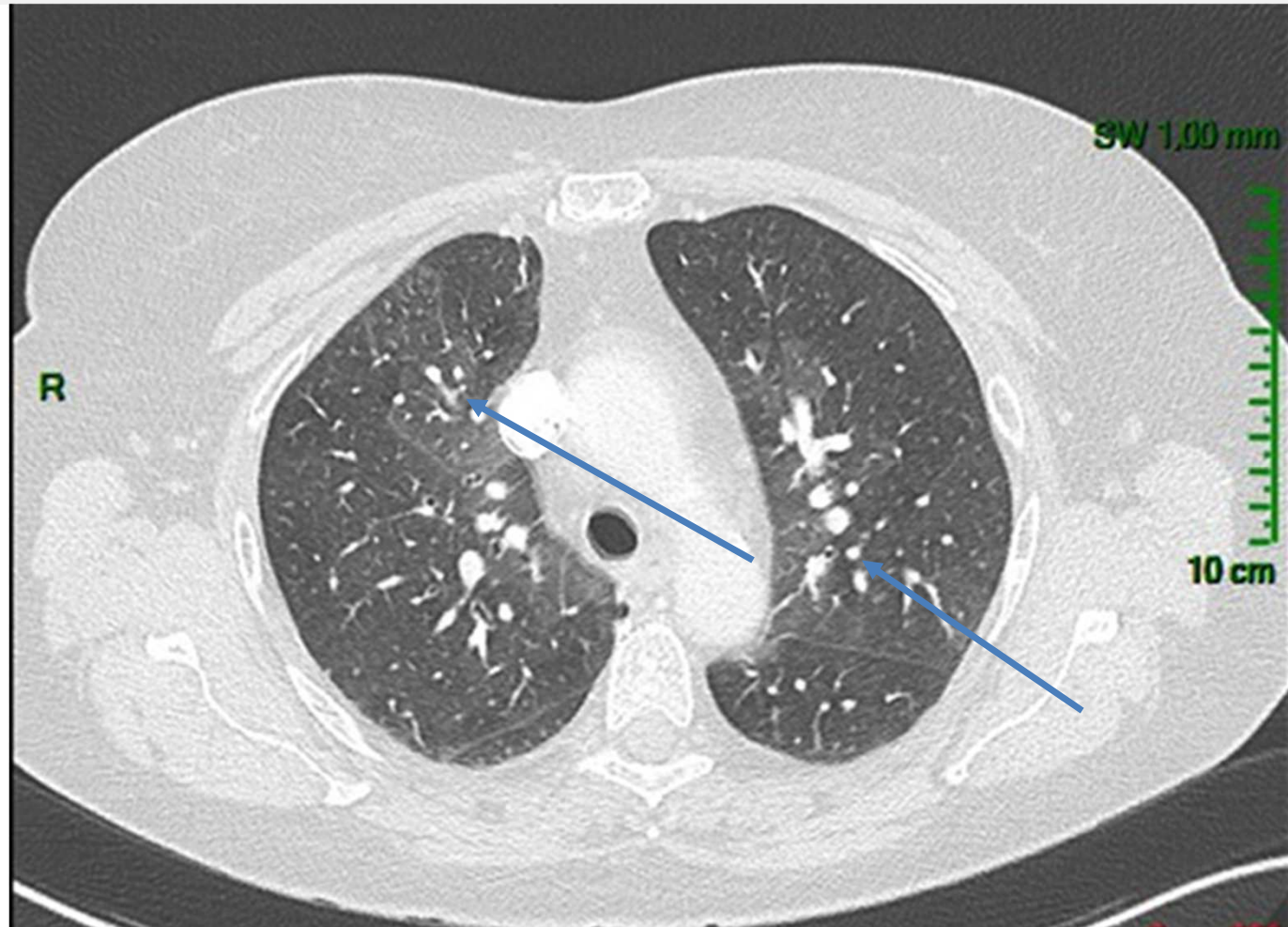


## DIAGNOSIS

### CT features of chronic obstruction of pulmonary arteries

#### Indirect signs :

- Enlarged bronchial arteries
- Mosaic perfusion



# DIAGNOSIS

≥ 3 signs:  
 Se 70% (95%CI, 55-82)  
 Sp 96% (86-100)

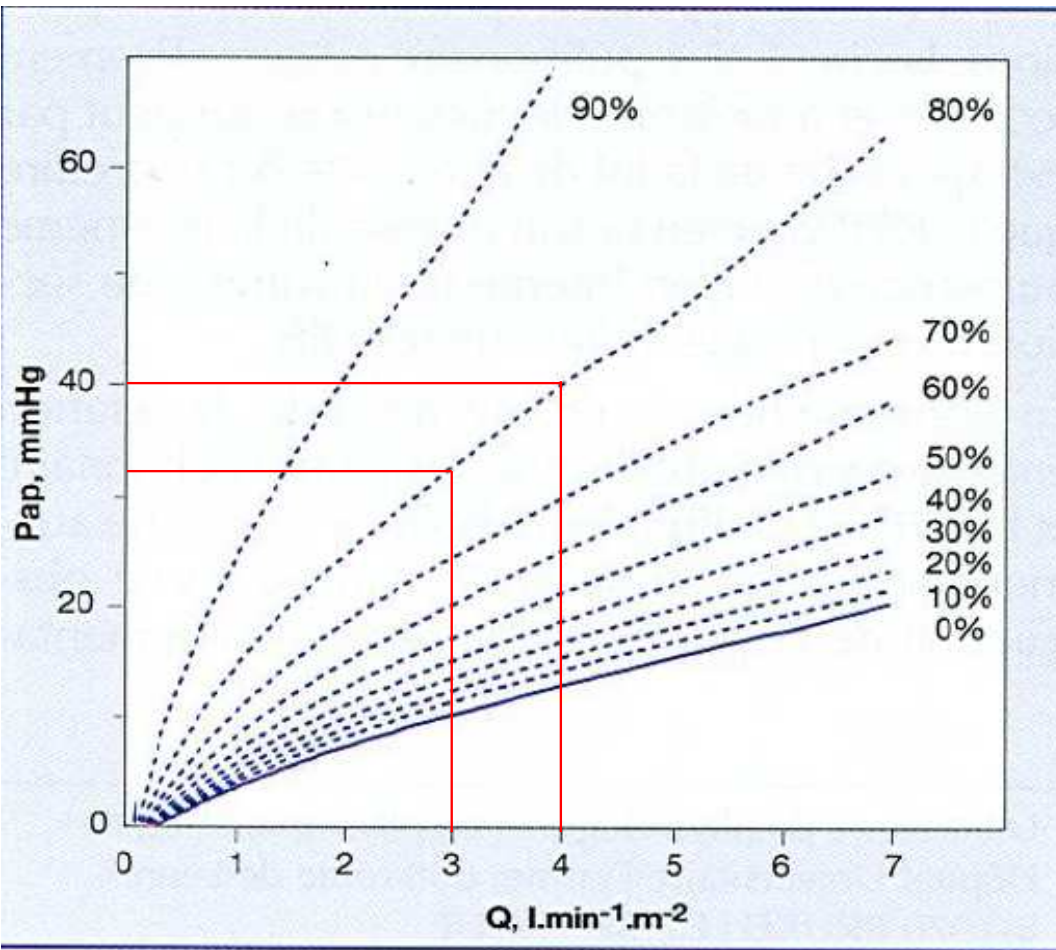
## Radiologic parameters of a future CTEPH diagnosis in clinical course of acute PE

| Scored radiologic parameter               | Scored in number of cases (n = 36) | Scored in number of controls (n = 50) | Univariate analysis |         | Multivariate analysis |               |
|---|------------------------------------|---------------------------------------|---------------------|---------|-----------------------|---------------|
|   |                                    |                                       | OR                  | 95% CI  | OR                    | 95% CI        |
| <b>Signs of chronic PE</b>                |                                    |                                       |                     |         |                       |               |
| Intravascular webs                        | 29                                 | 4                                     | 48                  | 13–177  | 209                   | 4.2 to >1,000 |
| Thrombus attached to the vascular wall    | 34                                 | 14                                    | 44                  | 9.2–207 |                       |               |
| Complete arterial occlusion               | 30                                 | 25                                    | 5.0                 | 1.8–14  |                       |               |
| Arterial retraction                       | 28                                 | 6                                     | 26                  | 8.0–82  | 47                    | 1.9 to >1,000 |
| Post-stenotic vascular dilatation         | 2                                  | 0                                     | Infinite            |         |                       |               |
| Pulmonary infarction                      | 21                                 | 12                                    | 4.4                 | 1.8–11  |                       |               |
| Parenchymal bands                         | 10                                 | 4                                     | 4.4                 | 1.3–16  |                       |               |
| <b>Signs of PH</b>                        |                                    |                                       |                     |         |                       |               |
| Dilatation of the main pulmonary artery   | 28                                 | 8                                     | 18                  | 6.2–55  | 14                    | 0.82–248      |
| RV hypertrophy                            | 14                                 | 0                                     | Infinite            |         | Infinite              |               |
| Flattening of the interventricular septum | 27                                 | 7                                     | 18                  | 6.1–55  | 9.9                   | 0.61–161      |
| Dilated bronchial arteries                | 21                                 | 5                                     | 13                  | 4.0–39  | 19                    | 0.71–516      |
| Mosaic perfusion                          | 23                                 | 4                                     | 20                  | 6.0–69  |                       |               |

CI, confidence interval; OR, odds ratio; PE, pulmonary embolism, PH, pulmonary hypertension; RV, right ventricular.



# DIAGNOSIS



Mélot C et al. Am J Physiol 1995

| Patient | Initial PE  |             |       | During follow-up |           |             |       |
|---------|-------------|-------------|-------|------------------|-----------|-------------|-------|
|         | Age (years) | sPAP (mmHg) | RV/LV | MRC              | VTR (m/s) | sPAP (mmHg) | RV/LV |
| 1       | 71          | 45          | 0.9   | 2                | 3.8       | 73          | 1.1   |

**57% with CTEPH at initial PE**

|      |    |     |      |   |     |    |      |
|------|----|-----|------|---|-----|----|------|
| 6    | 75 | 62  | 0.5  | 2 | 2.8 | 56 | 0.72 |
| 7    | 72 | 102 | 0.8  | 2 | 4   | 81 | 1.1  |
| Mean | 75 | 75  | 0.97 |   |     |    |      |
| ± SD | 4  | 20  | 0.3  |   |     |    |      |

**sPAP is >60 mmHg on echo :**

Suspicion of chronic pulmonary embolism

Guerin L et al. Thromb Haemost 2014;112:598–605.

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# DIAGNOSIS

| <b>Findings related to the acute PE event (at PE diagnosis)</b>         | <b>Concomitant chronic diseases and conditions predisposing to CTEPH (at PE diagnosis or 3–6-month FU)</b> |
|---|--|
| Previous episodes of PE or DVT  | Ventriculo-atrial shunts   |
| Large pulmonary arterial thrombi on CTPA                                | Infected chronic i.v. lines or pacemakers  |
| Echo signs of PH/RV dysfunction   | History of splenectomy   |
| CTPA findings suggestive of pre-existing chronic thromboembolic disease | Antiphospholipid syndrome  |
|   | Non-O blood group  |
|   | History of cancer  |
|   | Myeloproliferative disorders   |
|   | Inflammatory bowel disease   |
|   | Chronic osteomyelitis  |

# DIAGNOSIS

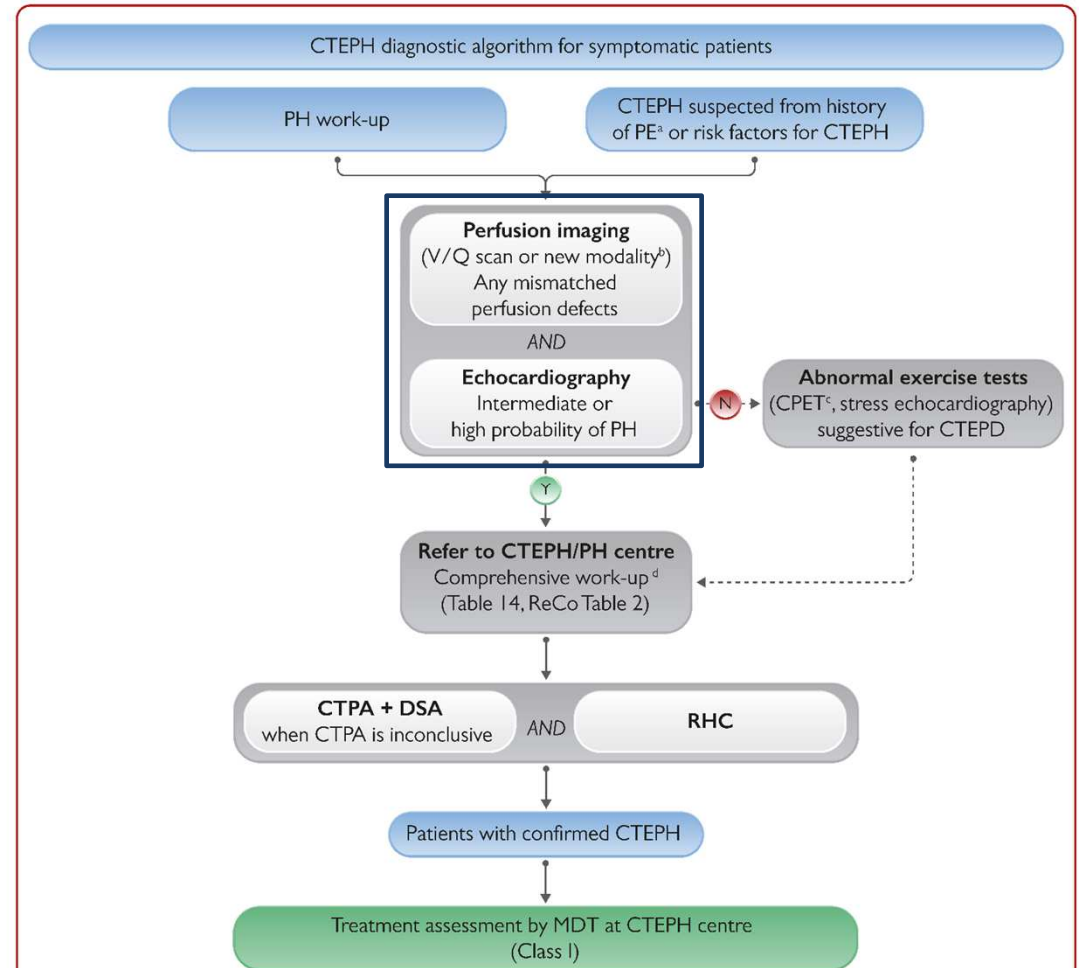
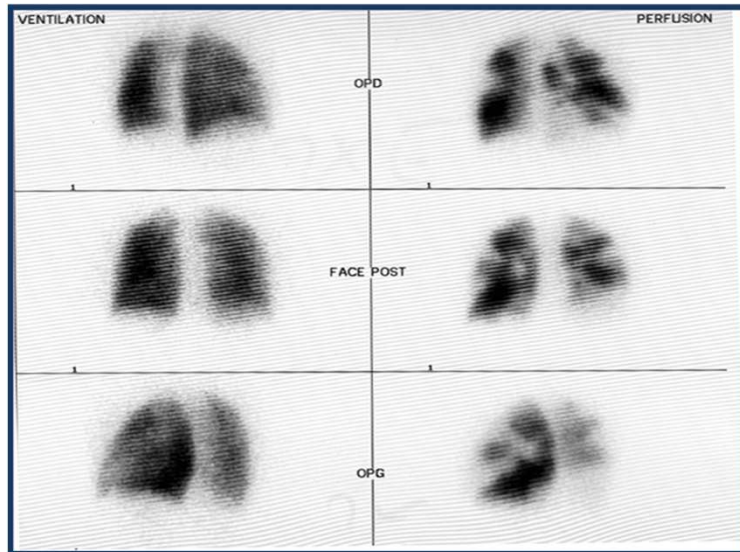
**Ventilation/perfusion scintigraphy remains the most effective tool in excluding CTEPD**

Sensitivity: 96-99%

Specificity: 90-95%

Negative predictive value: 98,5%

V/Q scintigraphy does not anatomically localize the extent of disease



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

# DIAGNOSIS

## Echocardiography

**A** Enlarged right ventricle; parasternal long-axis view

**B** Dilated RV with basal RV/LV ratio >1.0; four-chamber view

**C** Flattened interventricular septum (arrows) leading to 'D-shaped' LV; decreased LV eccentricity index; parasternal short-axis view

**D** Distended inferior vena cava with diminished inspiratory collapsibility; subcostal view

**E** RVOT AT <105 ms; 'notch'

**F** Reduced right ventricular fractional area change (<35%); four-chamber view

**G** M-Mode TAPSE <18 mm

**H** Decreased peak systolic (S') velocity of tricuspid annulus (<9.5 cm/s) measured with tissue Doppler

**I** End-systolic RA >18 cm<sup>2</sup>

**J** Increased systolic peak tricuspid regurgitation velocity (peak TRV); measured with continuous wave Doppler

**K** Estimated RAP

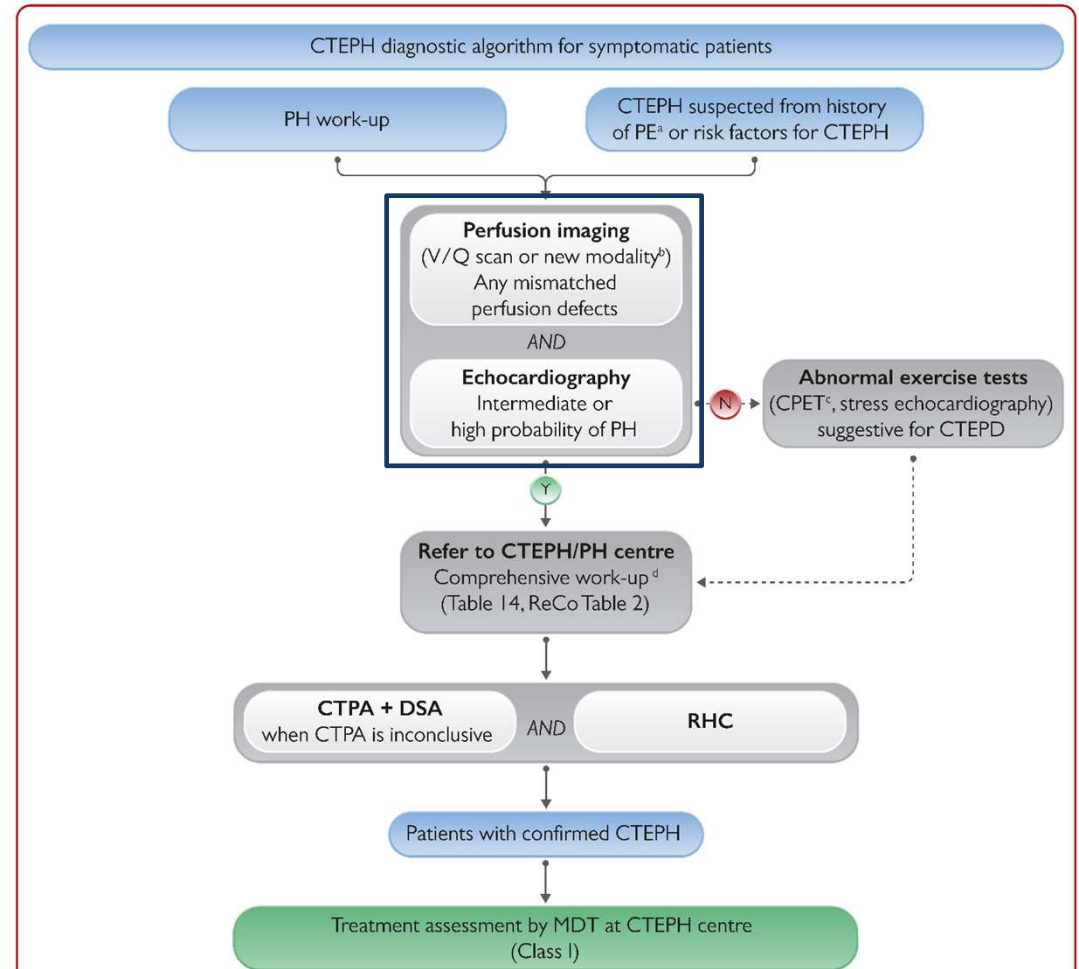
| IVC Collapse* | eRAP |            |
|---------------|------|------------|
| <2.1 cm       | >50% | 3 (0-5)    |
| >2.1 cm       | >50% | 8 (5-10)   |
| >2.1 cm       | <50% | 15 (10-20) |

Peak TRV >2.8 m/s

Estimation of systolic pulmonary artery pressure (sPAP); sPAP = TR pressure gradient + estimated RAP

**L** Presence of pericardial effusion; four-chamber view; parasternal short-axis view; other views (e.g. subcostal view)

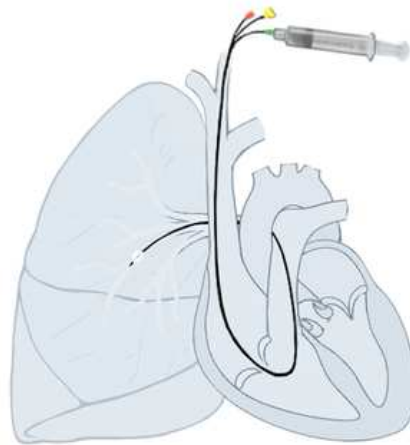
ESC ERS



# DIAGNOSIS

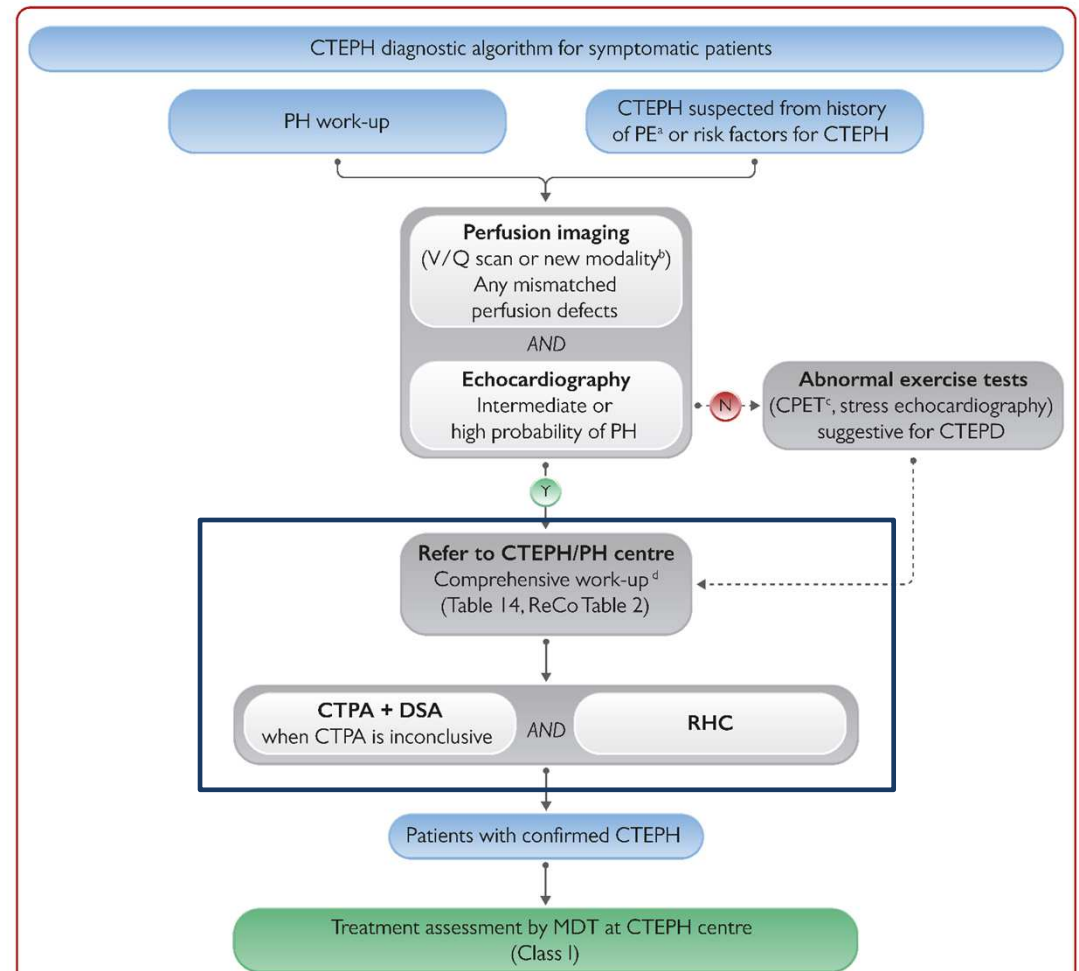
Referred to CTEPH/PH centre

Right heart catheterisation (RHC)



Pre-capillary PH

mPAP >20 mmHg  
PAWP ≤15 mmHg  
PVR >2 WU

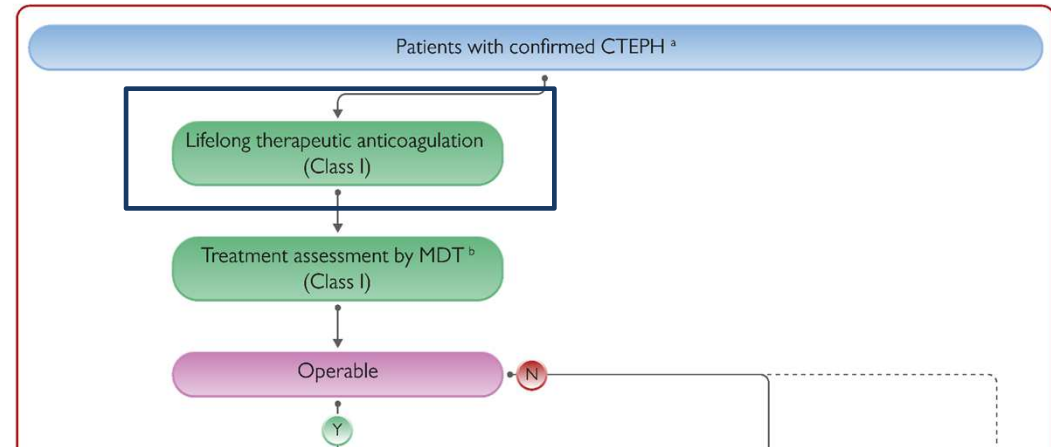


# TREATMENT MODALITIES FOR CTEPH

Lifelong therapeutic anticoagulation is recommended for patients with CTEPH

Vitamin K antagonists (VKAs) or Direct oral anticoagulants (NOACs)? No randomized controlled trial.

NOACs are less effective than VKAs in antiphospholipid syndrome (APS) (10% of CTEPH) (1,2).



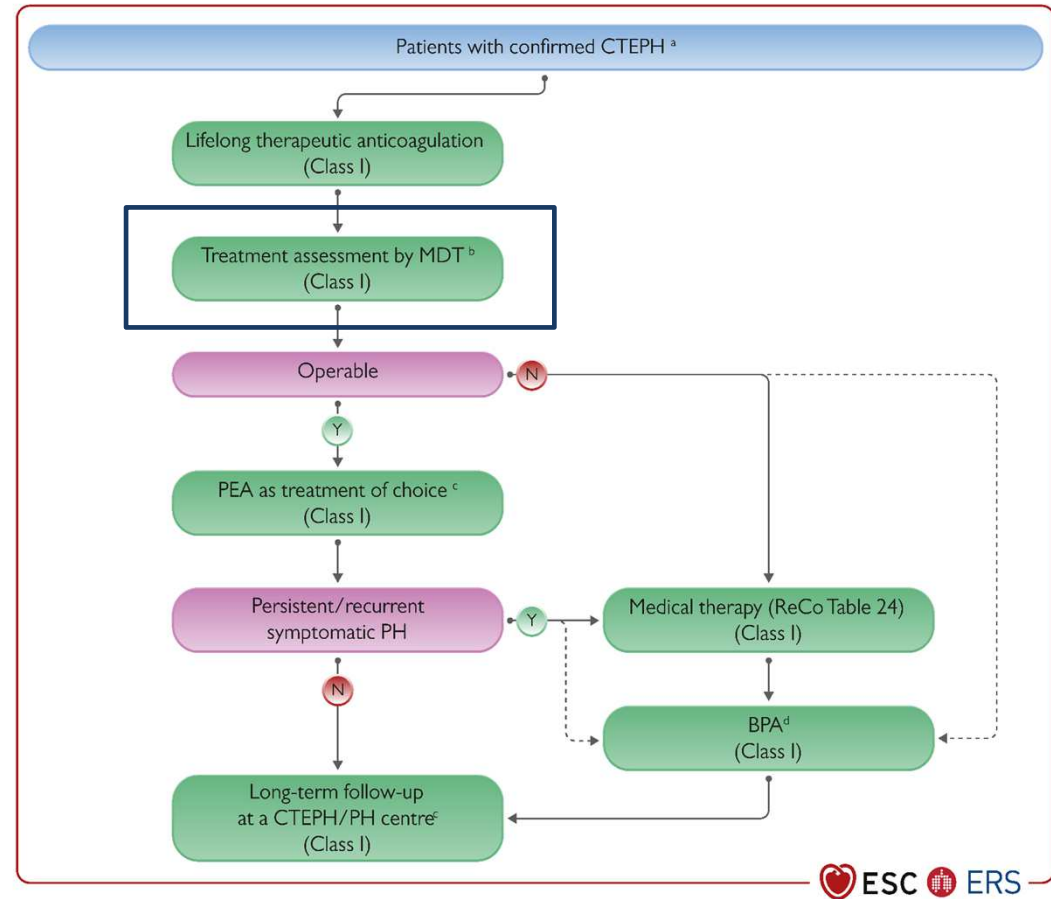
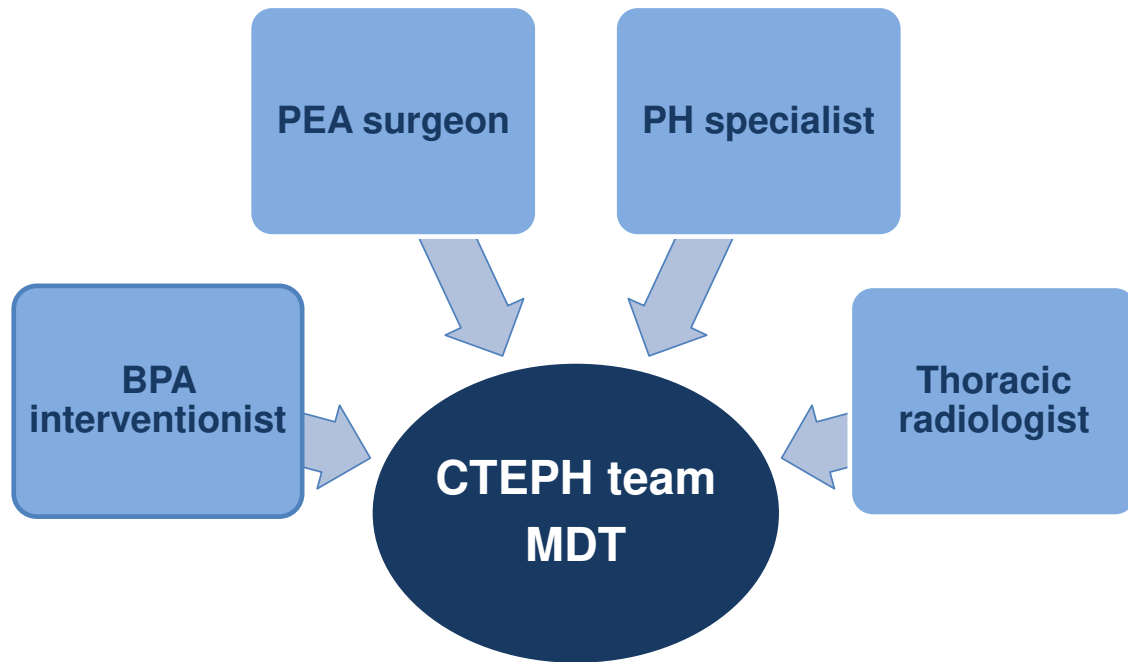
| EXPERT registry                      | Hemorrhagic events     |                         | Emboic/thrombotic events |                         |
|--------------------------------------|------------------------|-------------------------|--------------------------|-------------------------|
| Rates, n (%)                         | VKA group<br>(n = 683) | NOAC group<br>(n = 198) | VKA group<br>(n = 683)   | NOAC group<br>(n = 198) |
| <b>Any event</b>                     | <b>78 (11.4)</b>       | <b>24 (12.1)</b>        | <b>15 (2.2)</b>          | <b><u>6 (3.0)</u></b>   |
| Drug discontinuation due to event    | 2 (0.3)                | 0 (0)                   | 1 (0.1)                  | 0 (0)                   |
| Any serious event                    | 40 (5.9)               | 11 (5.6)                | 14 (2.0)                 | 5 (2.5)                 |
| Discontinuation due to serious event | 2 (0.3)                | 0 (0)                   | 1 (0.1)                  | 0 (0)                   |
| Event-related death                  | 8 (1.2)                | 1 (0.5)                 | 2 (0.3)                  | 0 (0)                   |

1. 2022 ESC/ERS Guidelines for the diagnosis and treatment of pulmonary hypertension; 2. Pengo V *et al. Blood* 2018; 2. Ordi-Ros J *et al. Ann Intern Med* 2019;

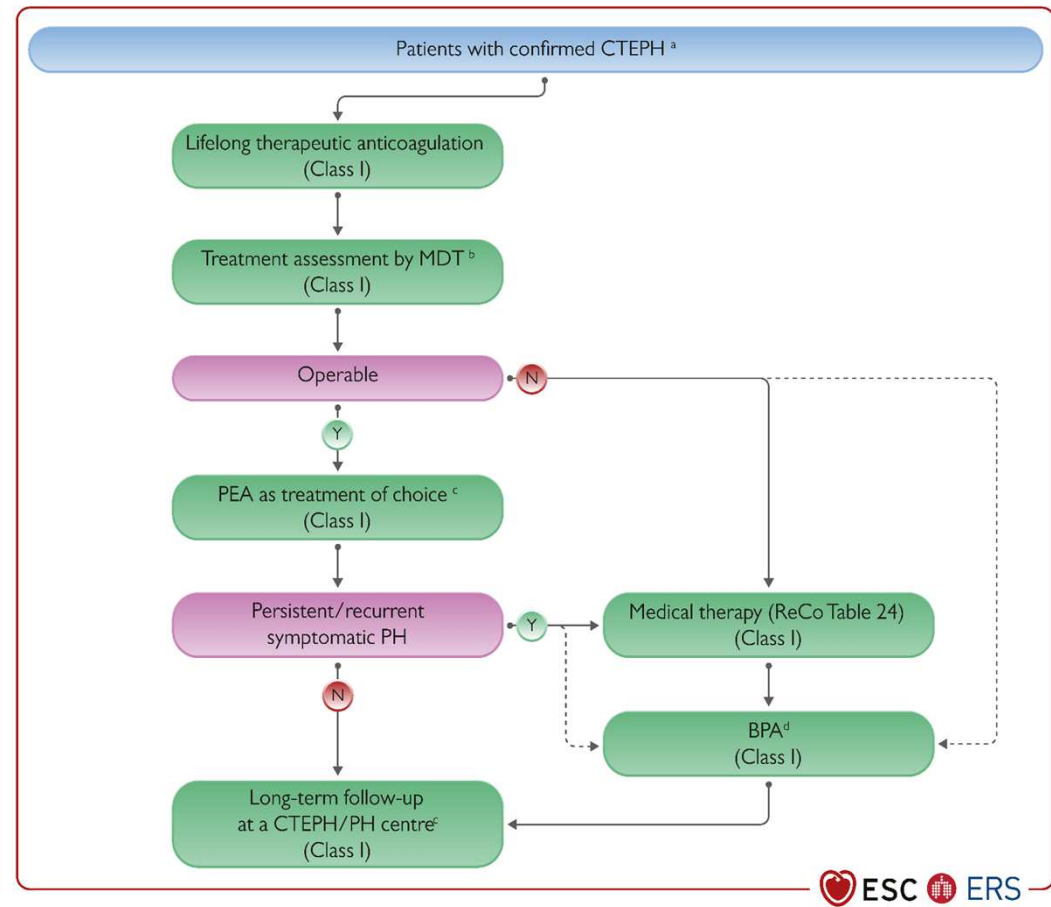
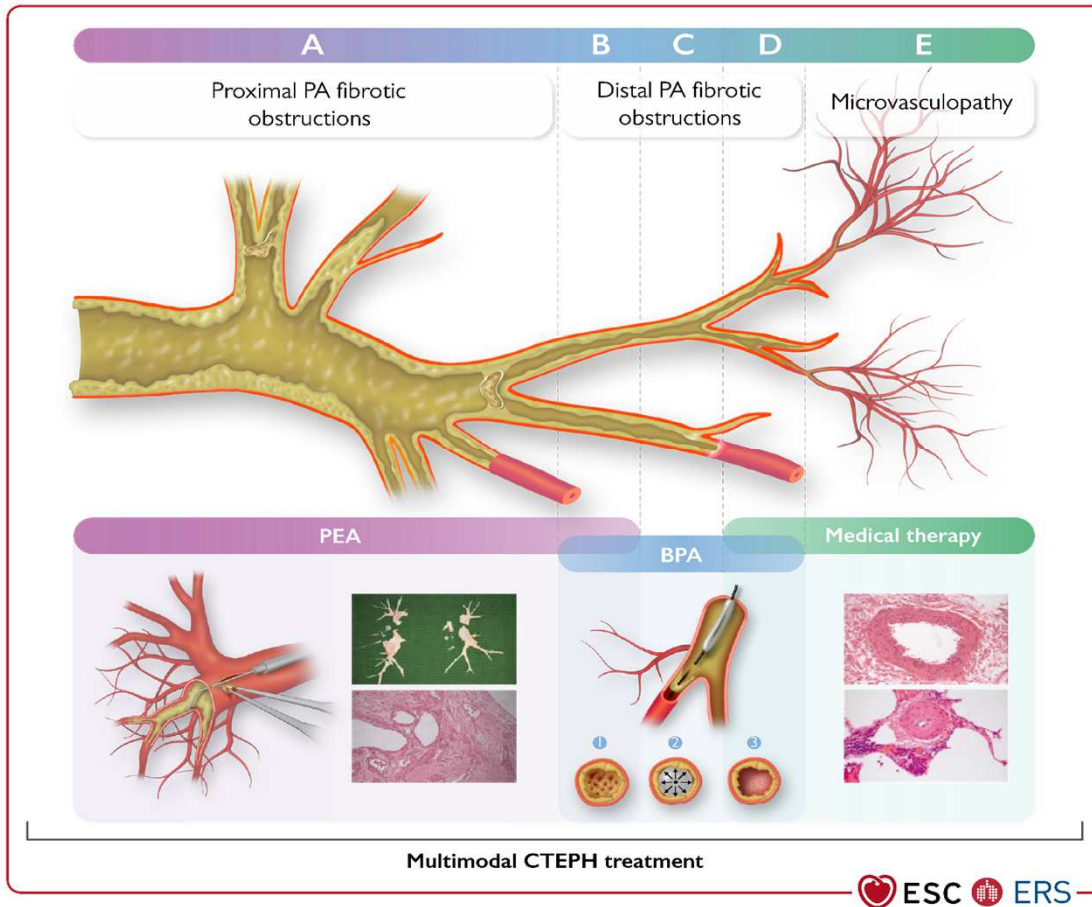
Humbert M *et al. JHLT* 2022



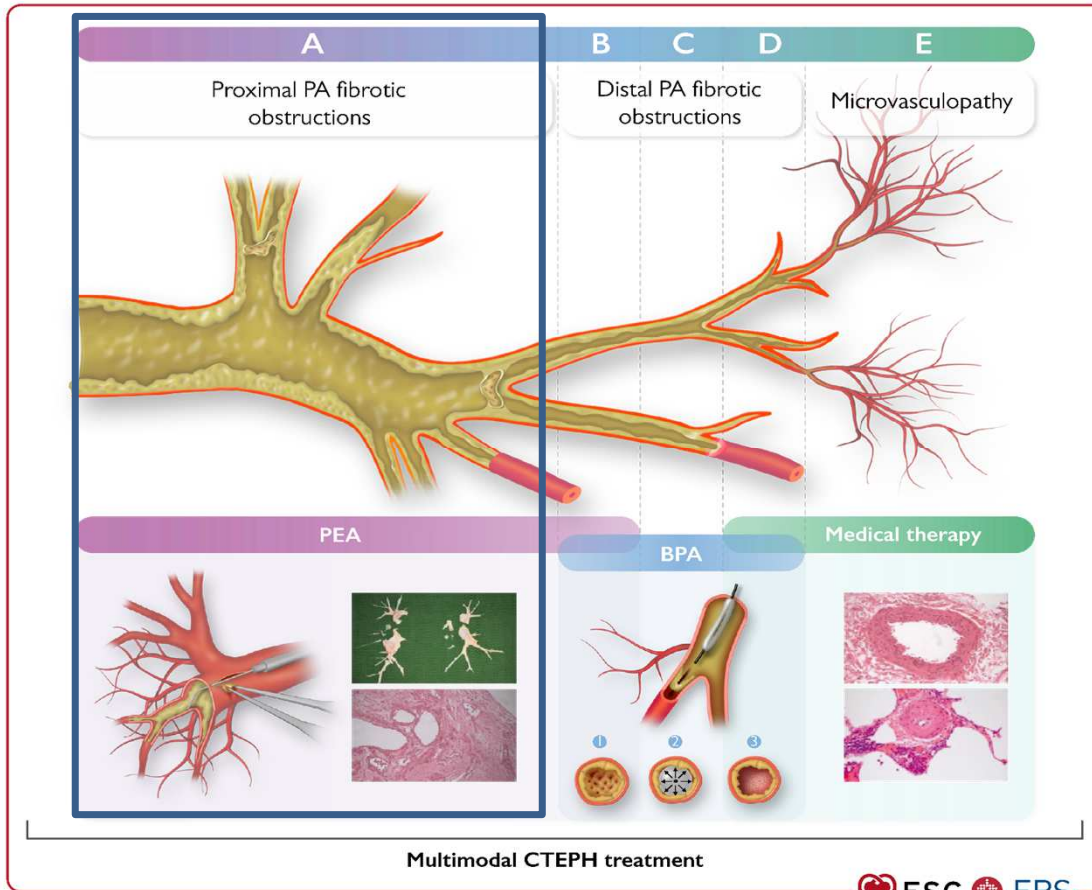
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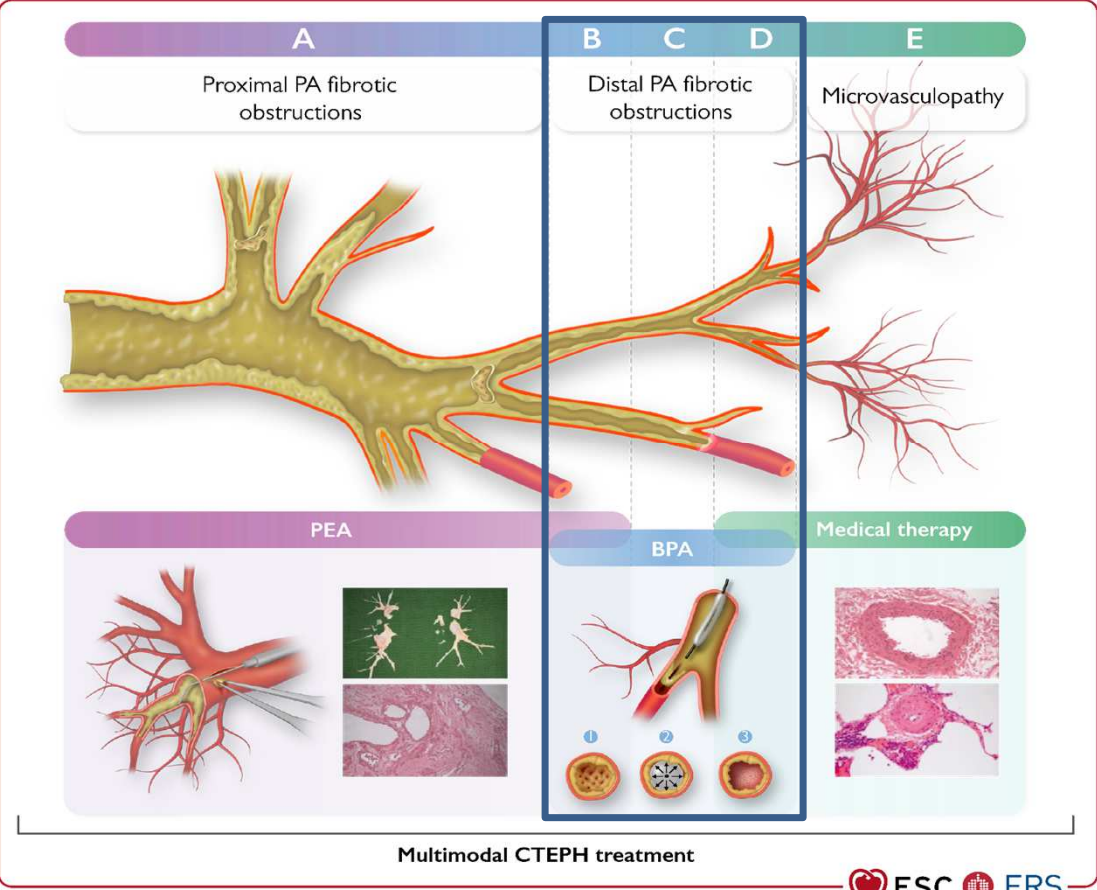


# TREATMENT MODALITIES FOR CTEPH



| 2022 Guidelines   | Class |
|---|-------|
| PEA is recommended as the treatment of choice for patients with CTEPH and fibrotic obstructions within pulmonary arteries accessible by surgery | I     |

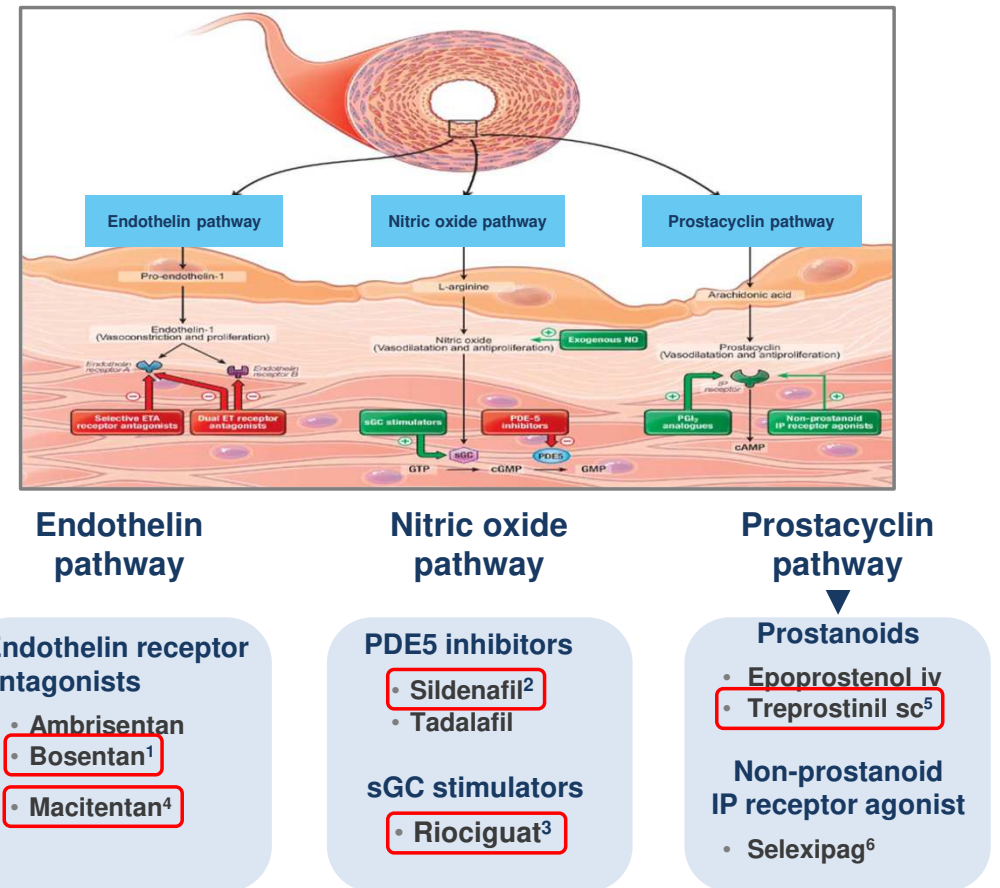
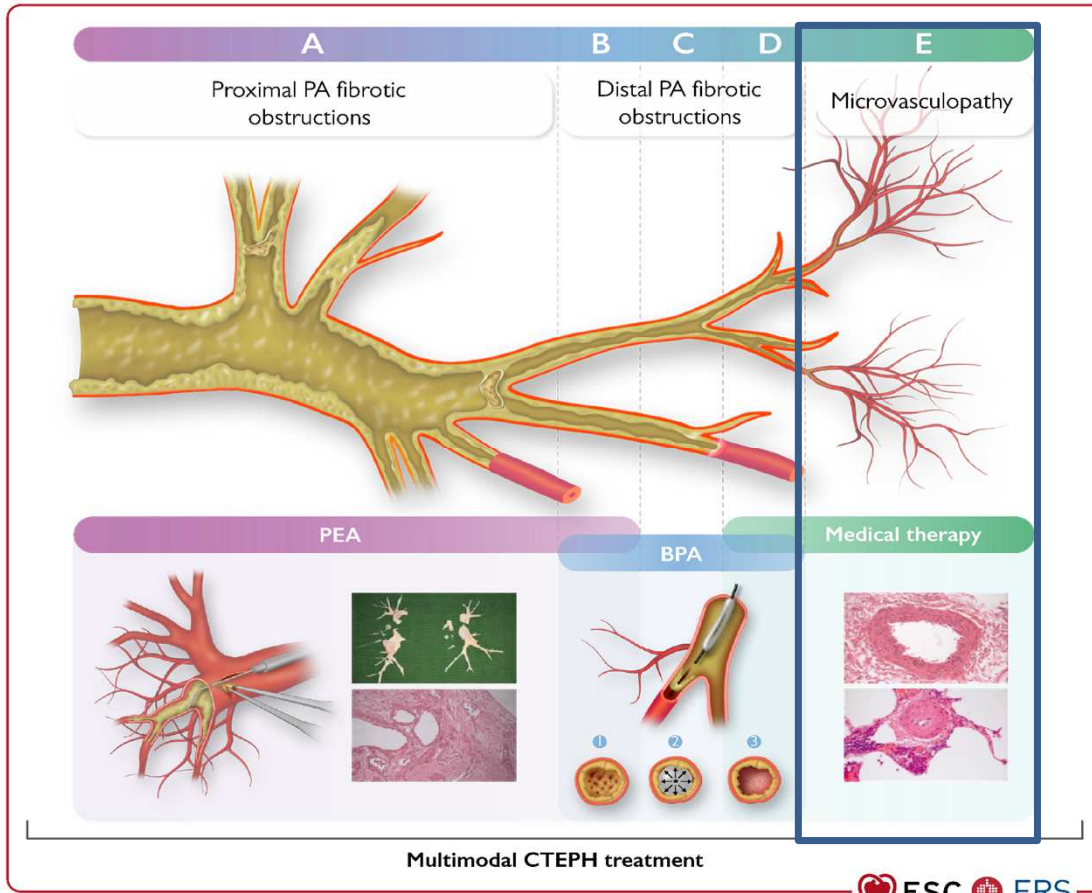
# TREATMENT MODALITIES FOR CTEPH



BPA is recommended in patients who are technically inoperable

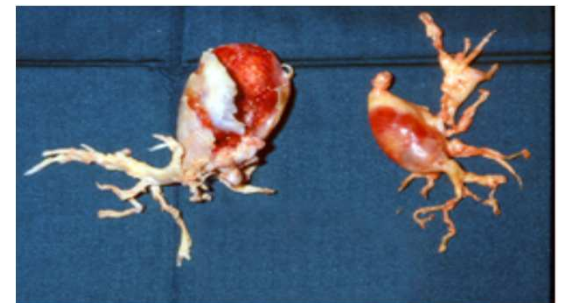
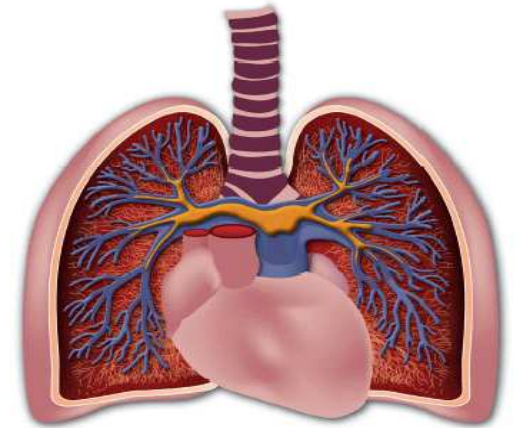
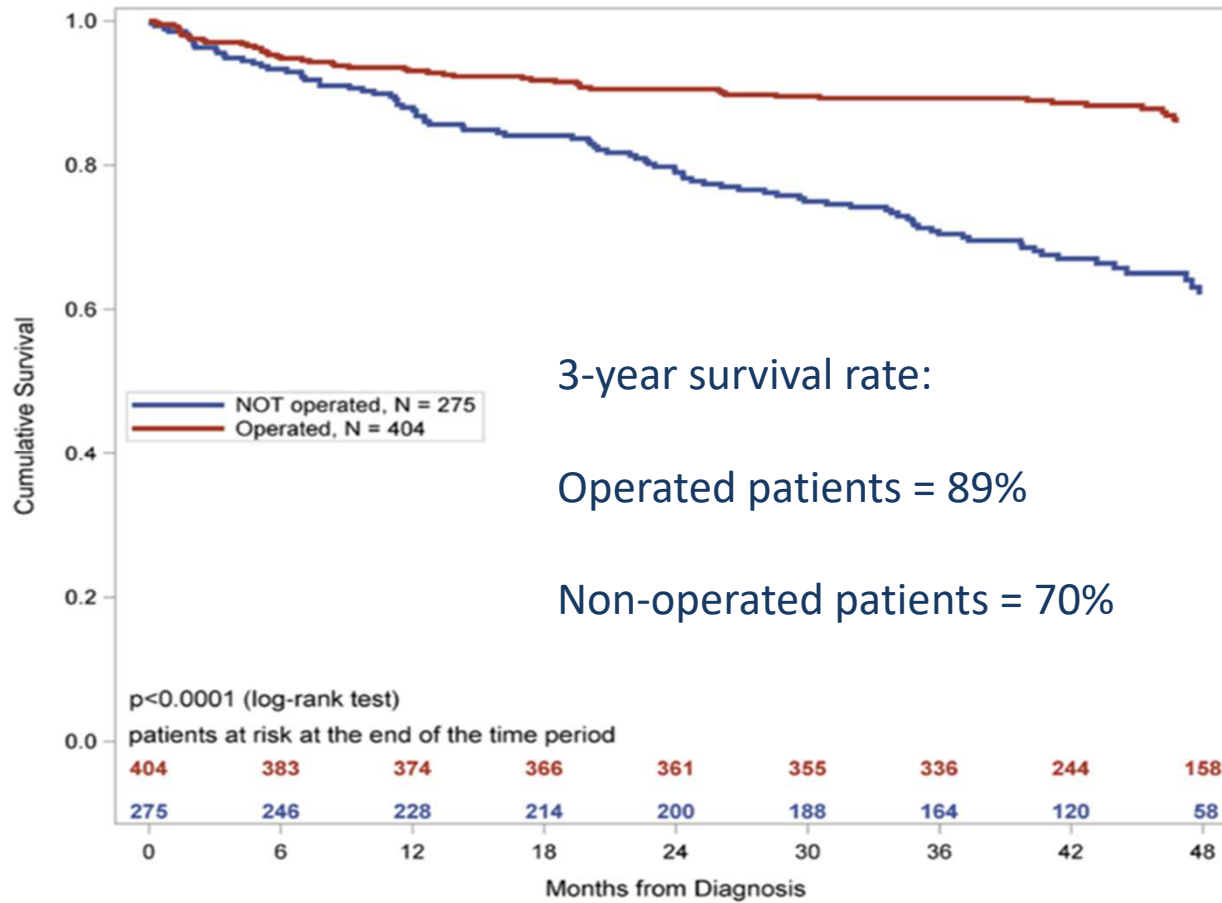
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# TREATMENT MODALITIES FOR CTEPH



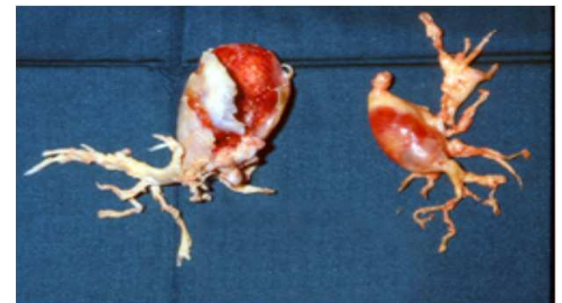
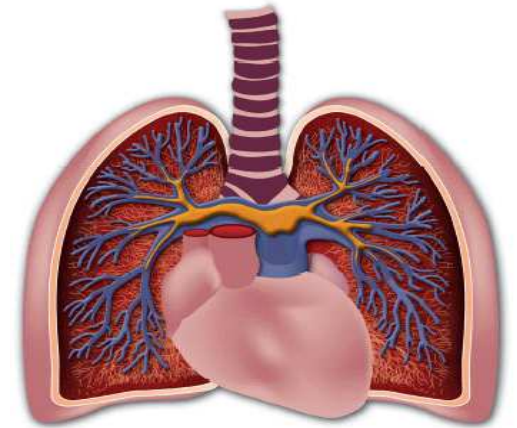
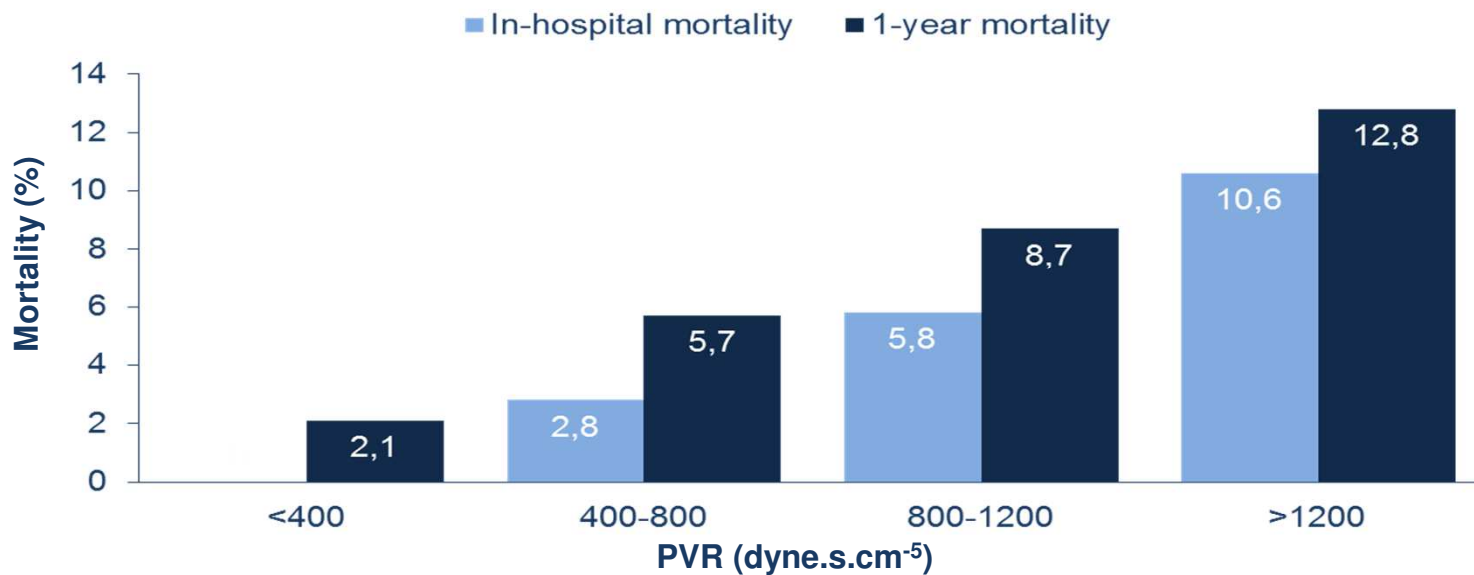
1. Jaïs X et al. *J Am Coll Cardiol* 2008; 2. Suntharalingam J et al. *Chest* 2008; 3. Ghofrani HA et al. *NEJM* 2013; 4. Ghofrani HA et al. *Lancet Respir Med* 2017; 5. Sadushi-Kolici R, et al. *Lancet Respir Med* 2018; Ogo T, et al. *Eur Respir J* 2021.

# PEA – Pulmonary endarterectomy



# PEA

Perioperative mortality is less than 5% in experienced centers, but there is an increase in mortality when preoperative PVR is  $>800-1200$  dyn.s.cm<sup>-5</sup> (1,2)



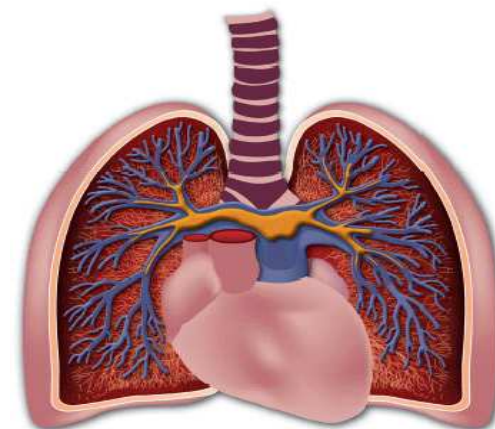
(1) Darteville P, et al. *Eur Respir J* 2004; (2) Mayer E, et al. *J Thorac Cardiovasc Surg* 2011.

# PEA

Using medical therapy in patients with high pre-operative PVR to improve pulmonary haemodynamics before PEA is common practice but still controversial...

No randomized controlled trial.

| Studies                           | N   | Before PEA<br>PVR (dyn.s.cm <sup>-5</sup> ) | After PEA<br>RVP (dyn.s.cm <sup>-5</sup> ) | Efficacy |
|-----------------------------------|-----|---|--|----------|
| Corsico AG, et al.<br>AJRCCM 2008 | 157 | 1140  | 349  | -69%     |
| Freed DH<br>JTCVS 2011            | 314 | 805   | 301  | -63%     |
| Madani MM<br>Ann Thorac Surg 2012 | 500 | 719   | 253  | -65%     |
| Mayer E<br>JTCVS 2012             | 386 | 698   | 235  | -66%     |
| Skoro-Sajer N<br>Thorax 2014      | 110 | 770   | 280  | -64%     |
| Cannon JE<br>Circulation 2016     | 880 | 830   | 317  | -62%     |





# PEA

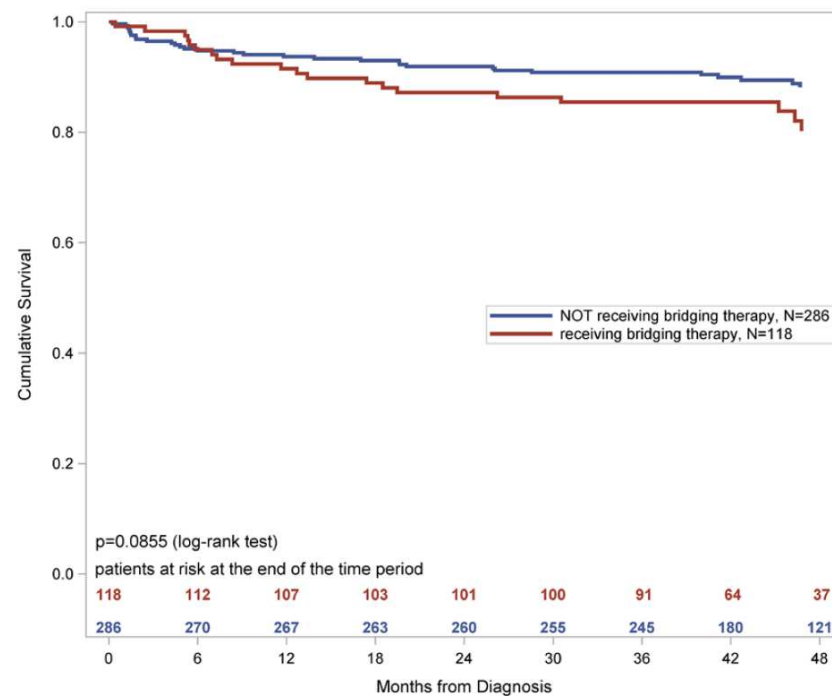
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No randomized controlled trial.

## Significant delay for referral

|                                   | PHT Group<br>(n=111) | Control Group<br>(n=244) | P     |
|-----------------------------------|----------------------|--------------------------|-------|
| Median age, y (IQR)               | 51 (39–62.5)         | 52 (37–64)               | 0.84  |
| Sex, M/F                          | 52/59                | 121/123                  | 0.63  |
| Median time to referral, mo (IQR) | 8.9 (4–13)           | 4.4 (2.5–7)              | <0.01 |
| Anticoagulation                   | 110 (99.1)           | 240 (98.4)               | 0.89  |
| Diuretic                          | 65 (58.6)            | 114 (46.7)               | 0.04  |
| Spironolactone                    | 24 (21.6)            | 18 (7.4)                 | <0.01 |
| Digoxin                           | 16 (14.4)            | 15 (6.1)                 | 0.01  |
| Dopamine                          | 3 (2.7)              | 2 (0.8)                  | 0.16  |

Jensen KW, et al. *Circulation* 2009;120:1248-54.



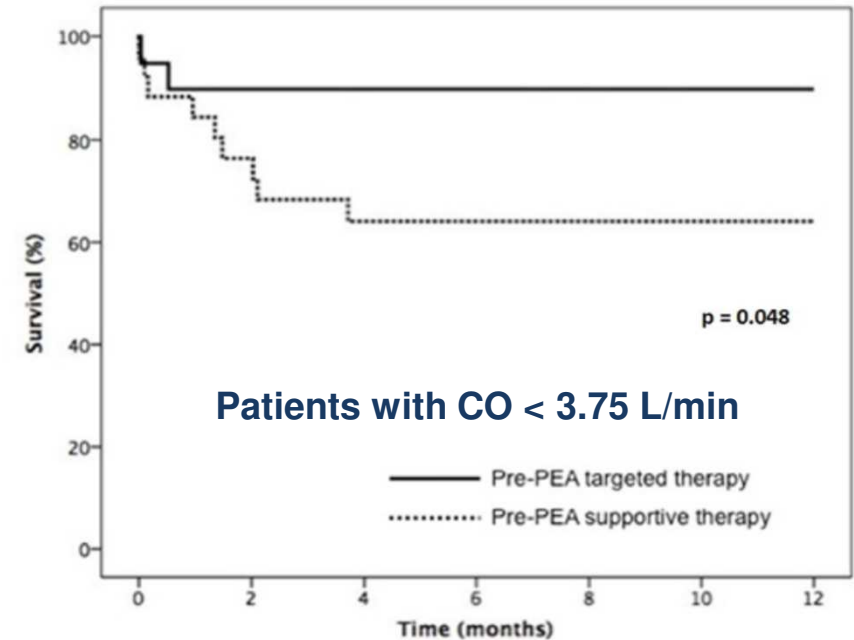
Delcroix M, et al. *Circulation* 2016;133:859-71.

# PEA

Using medical therapy in patients with high pre-operative PVR to improve pulmonary haemodynamics before PEA is common practice but still controversial...

No randomized controlled trial.

- 108 patients who underwent PEA (2013-2017)



Number at Risk

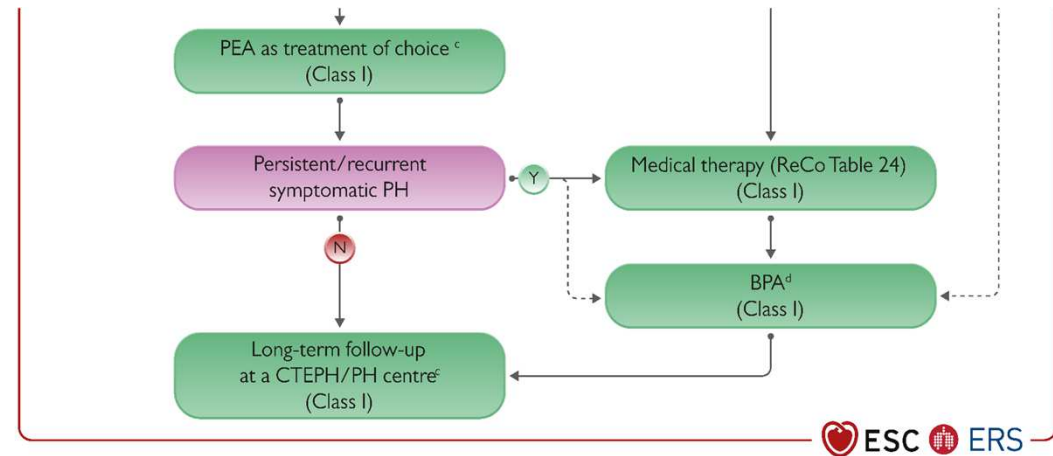
|                            |    |    |    |    |    |    |    |
|----------------------------|----|----|----|----|----|----|----|
| Pre-PEA targeted therapy   | 20 | 18 | 17 | 17 | 16 | 14 | 14 |
| Pre-PEA supportive therapy | 26 | 19 | 15 | 15 | 12 | 11 | 10 |

Castro MA, et al. PLoS One 2020.

## PEA – persistent / recurrent PH post PEA

On 880 operated patients in England

|               |                        |
|---------------|------------------------|
| 28 % Patients | < 20 mmHg after PEA    |
| 21 % Patients | 21 – 24 mmHg after PEA |
| 51 % Patients | > 25 mmHg after PEA    |



### Time point of measurement

- 3-6 months after surgery

### Haemodynamic criteria

- mPAP  $\geq 30$  mmHg  
*associated with initiation of medical therapy*
- mPAP  $\geq 38$  mmHg and PVR  $\geq 425$  dyn.s.cm<sup>-5</sup>  
*predict worse long-term survival*

**Follow-up necessary!!!**

Cannon JE *et al.* *Circulation* 2016

# MULTIMODAL APPROACH IN OPERABLE FORMS

## Medical therapy after PEA in patients with persistent PH

|   |     |
|---|-----|
| Riociguat is recommended for symptomatic patients with persistent/recurrent PH after PEA                    | I   |
| Treprostinil s.c. may be considered in patients in WHO-FC III–IV who have persistent/recurrent PH after PEA | IIb |

## Additional BPA after PEA in patients with persistent PH

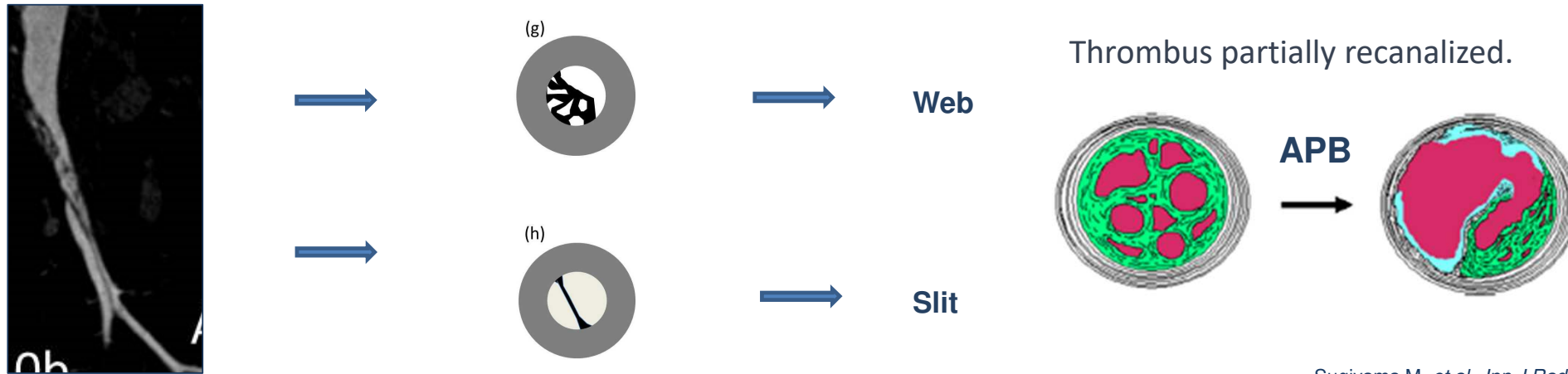
| Author       | Year | Patients (n) | Time from PEA to BPA (months) | Medical treatment before BPA | Before BPA PVR (dyn.s.cm <sup>-5</sup> ) | After BPA PVR (dyn.s.cm <sup>-5</sup> ) | Treatment effect |
|--------------|------|--------------|-------------------------------|------------------------------|--|---|------------------|
| Shimura      | 2015 | 9            | 49.2 (2.7-7.9)                | ?                            | 1250 (624-1512)                          | 448 (280-520)                           | -64%             |
| Yanaka       | 2018 | 10           | 7.3±2.3                       | 20%                          | 386±42                                   | 242±39                                  | -37%             |
| Araszkievicz | 2019 | 15           | 28.1±25.8                     | 100%                         | 552±185                                  | 344±124                                 | -38%             |

|   |   |
|---|---|
| BPA is recommended in patients who have residual PH after PEA and distal obstructions amenable to BPA | I |
|---|---|

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

Shimura N *et al. Int J Cardiol* 2015; Yanaka K *et al. J Am Heart Assoc* 2018; Araszkievicz A *et al. Int J Cardiol* 2019; Humbert M *et al. Eur Respir J* 2022.

# BPA – Baloon pulmonary angioplasty



Sugiyama M, et al. *Jpn J Radiol* 2014

## Hemodynamic effects of APB and mortality.

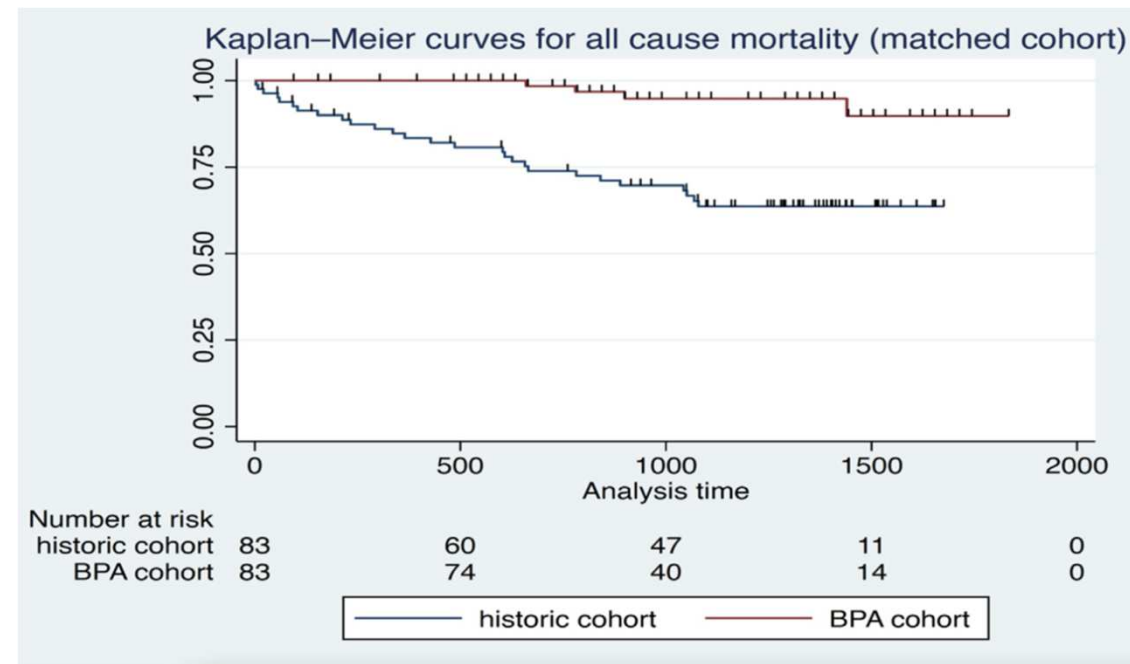
|              | N   | Before BPA<br>PVR (dyn.s.cm <sup>-5</sup> ) | After BPA<br>PVR (dyn.s.cm <sup>-5</sup> ) | Treatment<br>effect | 30-day mortality |
|--------------|-----|---|--|---------------------|------------------|
| Ogo, 2017    | 80  | 880±424                                     | 408±184                                    | -54%                | 0%               |
| Ogawa, 2017  | 249 | 854±451                                     | 360±223                                    | -58%                | 3%               |
| Olsson, 2017 | 56  | 591±286                                     | 440±279                                    | -26%                | 1.8%             |
| Brenot, 2018 | 184 | 604±226                                     | 329±177                                    | -43%                | 2.2%             |

Ogo T, et al. *Eur J Radiol* 2017 ; Ogawa A et al. *Circ Cardiovasc Qual Outcomes* 2017; Olsson KM et al. *Eur Respir J* 2017; Brenot P et al. *Eur Respir J* 2019.

# BPA - Multimodal treatment in non operable CTEPH

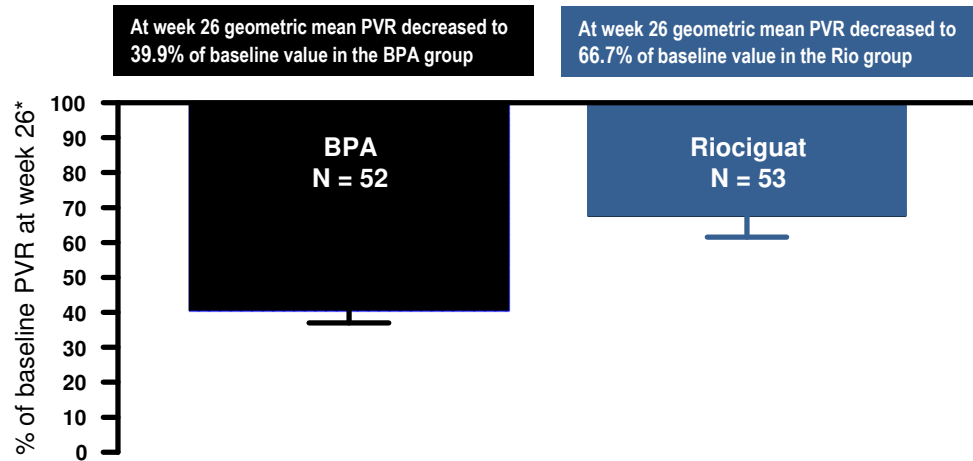
Evaluation of the impact of sequential combination of riociguat/angioplasty on prognosis.

83 patients treated with riociguat/angioplasty compared to a historical cohort of 83 matched patients from an international registry (51.5% receiving targeted therapy for PAH).



# BPA – Randomized control trials

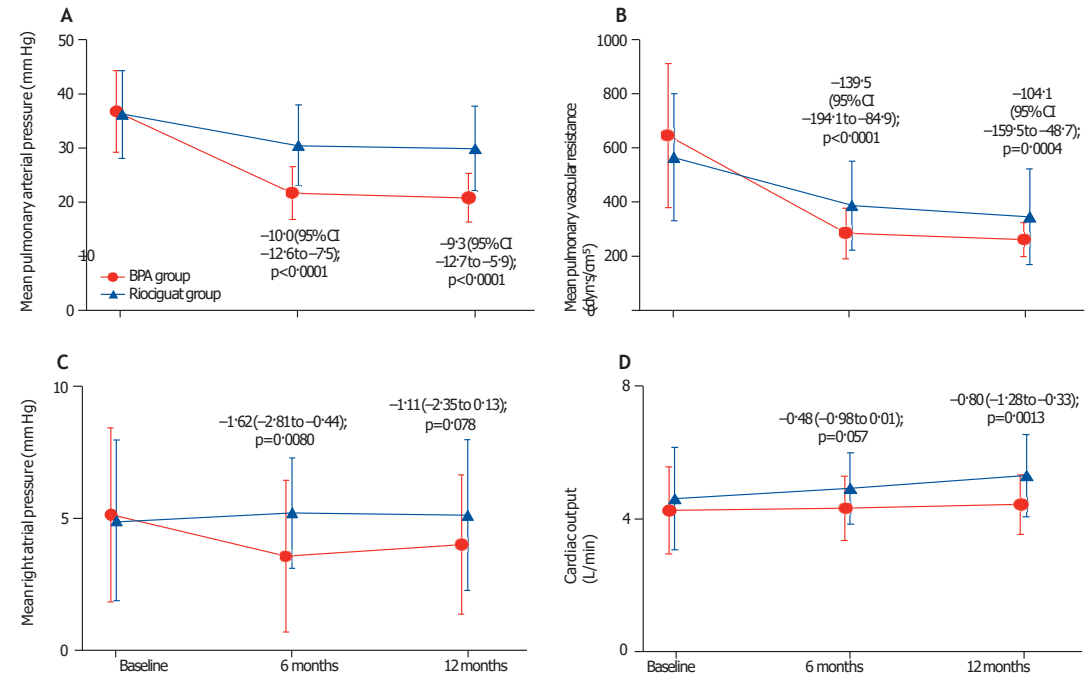
## Etude RACE



|  | Riociguat<br>(N = 53) | BPA<br>(N = 52) |
|--|-----------------------|-----------------|
| Patients with ≥1 AE – n (%)                    | 38 (72)               | 33 (63)         |
| Patients with ≥1 SAE – n (%)                   | 14 (26)               | 26 (50)         |
| Patients with ≥1 treatment-related SAE – n (%) | 5 (9)                 | 22 (42)         |

Jaïs X et al. *Lancet Respir Med* 2022

## Etude MR BPA



Adverse events (haemoptysis or pulmonary haemorrhage)  
 14/32 patients (44%) in the BPA group  
 1/29 patients (4%) in the riociguat

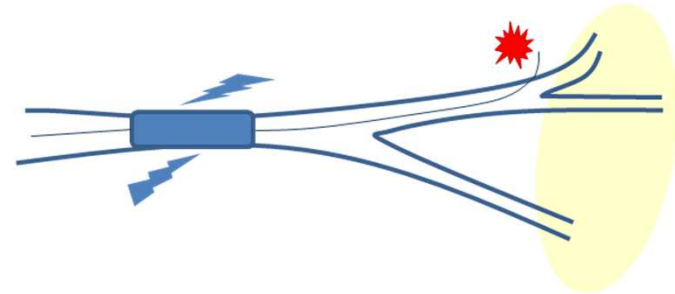
Kawakami T et al. *Lancet Respir Med* 2022

# BPA - Complications

## Vascular lesions:

- Perforation of the pulmonary artery
- Dissection of the pulmonary artery
- Rupture of the pulmonary artery

## Complications related to hemodynamic severity (1,2)



| RACE STUDY  | First-line Riociguat then BPA (N = 36) | First-line BPA (N = 52) | P value |
|---|--|-------------------------|---------|
| Patients with $\geq 1$ SAE related to BPA– n (%)                        | 5 (14)                                 | 22 (42)                 | 0.0045  |
| Patients with $\geq 1$ severe BPA procedure-related complication– n (%) | 3 (8)                                  | 18 (35)                 | 0.0045  |

**Predictive variables for complications related to BPA (multivariate analysis) :**  
meanPAP>45 mmHg (OR 1.202, 95% CI 1.048-1.378; p=0.0084)

1. Ejiri K et al. *Circ Cardiovasc Interv* 2018. 2. Jaïs X et al. *Lancet Respir Med* 2022



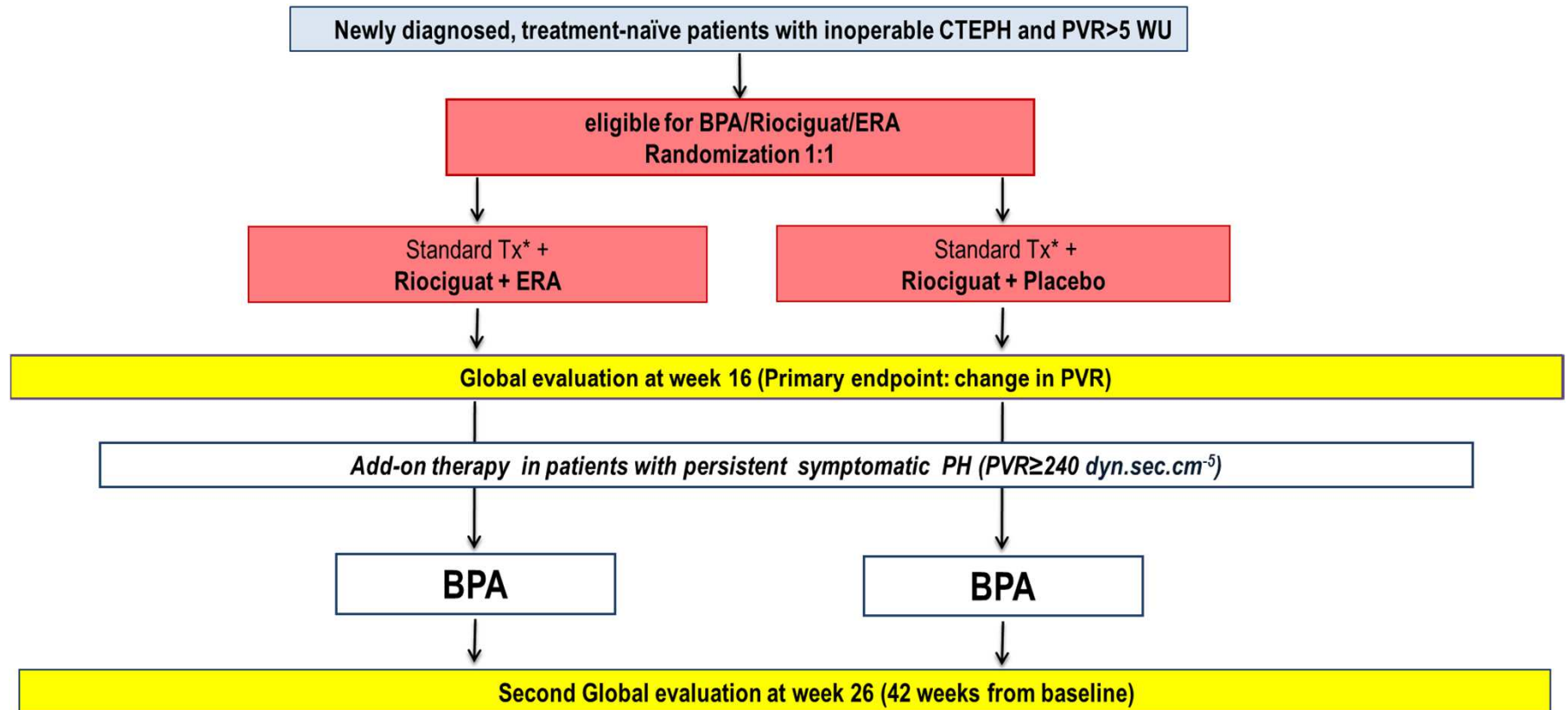
## BPA – Multimodal treatment in non operable CTEPH

Impact of riociguat treatment prior to angioplasty on angioplasty-related complications in patients with PVR > 4 UW

| Recommendations   | Quality of evidence | Strength of recommendation | Class      | Level    |
|---|---------------------|----------------------------|------------|----------|
| In patients with CTEPH who are candidates for BPA, medical therapy should be considered prior to the intervention | Very low            | Conditional                | <b>Ila</b> | <b>B</b> |

# BPA - Multimodal treatment in non operable CTEPH

## Initial dual oral combination therapy vs initial oral monotherapy prior to BPA (IMPACT-CTEPH)



\*Standard Tx: standard treatment including VKA±diuretics±oxygen; PEA= pulmonary endarterectomy; BPA= balloon pulmonary angioplasty

## MULTIMODAL APPROACH, THERAPEUTIC GOALS AND FOLLOW-UP

A multi-modality approach should be considered for patients with persistent PH after PEA and for patients with inoperable CTEPH

**IIa**

Long-term follow-up is recommended after PEA and BPA, as well as for patients with CTEPH established on medical therapy

**I**

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

- No data or consensus on what is the therapeutic target after PEA/BPA or medical therapy in CTEPH.
- Most experts accept achieving a good FC (WHO FC I-II) and/or normalization or near normalization of haemodynamics at rest, obtained 3-6 months post-procedure, and improvement in quality of life.
- Follow-up should include RHC 3-6 months after intervention (PEA or last BPA)

## THERAPEUTIC GOALS AND FOLLOW-UP

- No data or consensus on what is the therapeutic target after PEA/BPA or medical therapy in CTEPH.
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- Follow-up should include RHC 3-6 months after intervention (PEA or last BPA)

# THE KEY MESSAGES

## **1. Consider CTEPH if:**

1. Experiencing persistent symptoms after a PE.
2. Signs of chronic PE on CTPA.
3. Having risk factors of CTEPH.

## **2. Follow the algorithm for CTEPH diagnosis**

## **3. Refer to a CTEPH/PH Center for a Multimodal Approach**

## **4. CTEPH is a potentially curable condition**

**Merci de l'attention !**

**COUP  
DE SANG  
A LA SPIF !**

*N'oubliez pas  
les vaisseaux pulmonaires*

Samedi 7 octobre 2023  
Espace Chaptal (PARIS 9<sup>e</sup>)