Heart failure and pulmonary hypertension: 
how to access, how to manage?

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Introduction

• Pulmonary hypertension is a common hemodynamic complication of heart failure.
• Among the various PH groups, heart failure (HF) represents by far the most common form of PH—65–80%.
• When PH and RV dysfunction accompany HF, the impact on functional capacity and prognosis are ominous.
WHO Classification of Pulmonary Hypertension

1. Pulmonary Arterial Hypertension
2. Left Heart Disease
3. Chronic Hypoxemia
4. Thromboembolic
5. Miscellaneous
   - Sarcoid, fibrosing mediastinitis

Pulmonary hypertension (PH)

- PH: mean pulmonary artery pressure
  \[(mPAP) \geq 25 \text{ mmHg}\].
- Based on the left-sided filling pressure [LVEDP, LAP, PAWP], the haemodynamic definition further distinguishes
  - pre-capillary PH (PAWP \leq 15 \text{ mmHg}),
  - post-capillary PH (PAWP > 15 \text{ mmHg}).
Relationship of HF and PH

- Passive Congestion (Elevated PAWP)

Classification of PH due to left heart disease.

- **Heart failure with preserved EF (HFPEF)**
  - Hypertensive heart disease
  - Diabetic CMP
  - Hypertrophic [-obstructive] CMP
  - Restrictive/infiltrative CMP
  - Ischemic diastolic dysfunction

- **Heart failure with reduced EF (HREF)**
  - Ischemic CMP
  - Dilatative CMP

- **Valvular heart disease**
  - Mitral valve stenosis/insufficiency
  - Aortic valve stenosis/insufficiency

- **Others**
  - Constrictive pericarditis
  - Tri-atrial heart
Prevalence and significance of PH - heart failure

• In HFrEF: 40 and 75%.
• In HFpEF: 36 and 83%.
• The presence and extent of PH and RV dysfunction are associated with disease progression, decreased exercise tolerance, and an unfavorable outcome.

Prevalence and significance of PH - heart failure

• Pulmonary artery systolic pressure (PASP) estimated by echocardiography strongly predicted all-cause and cardiovascular mortality independently of known predictors of outcome.
• Haemodynamic predictors of poor survival in HF include an increased PAWP, mean PAP, and PVR, and a reduced PA compliance/capacitance.
Pathobiology of PH_ heart failure

- The pathobiology of PH in left HF is complex and highly heterogeneous, and remains incompletely understood.
- Pulmonary hypertension primarily results from the passive backward transmission of elevated left-sided filling pressures, which occur as a consequence of systolic or diastolic LV dysfunction.
- Functional mitral regurgitation (MR) will result in elevations of LAP and PAP, which usually worsen during exercise.
Pathobiology of PH_ heart failure

• LA dysfunction relates to symptom onset in patients with HFP EF.
• In addition to its pathophysiological significance, LA dysfunction may also determine treatment responses to targeted PH therapies in patients with LHD, since lowering of PVR and increased pulmonary blood flow may lead to increased PAWP and pulmonary oedema in patients with reduced LA compliance.
Pathobiology of PH _ heart failure

- In the systemic circulation, vascular compliance is mainly determined by the aorta.
- In pulmonary circulation, arterial compliance in the lung is distributed over the entire pulmonary vascular bed, so that resistance (R) and compliance (C) are predominantly determined by the small resistance vessels.
- Hence, pulmonary arteriolar remodeling mainly contributes to the increase in PVR and reduced PA compliance in Cpc-PH.
• Why some patients develop severe PH and RV dysfunction whereas others do not, remains limited.
  – (i) the susceptibility for pulmonary vascular disease (due to genetic factors and/or environmental stressors and/or comorbidities)
  – (ii) the factor ‘time’
Pulmonary hypertension (PH)

- The diastolic pressure gradient (DPG) = diastolic PAP – PAWP
  - less dependent of stroke volume and loading conditions,
  - correlate with pulmonary vascular remodeling in PH-LHD.
- Isolated post-capillary PH (Ipc-PH): DPG is < 7 mmHg
- Combined post- & pre-capillary PH (Cpc-PH): DPG is ≥ 7 mmHg
Treatment of pulmonary hypertension in heart failure
I- Treatment of left heart disease

• Optimized treatment of the underlying LHD including medical treatments (reaching the target dosages) and interventional therapies (e.g. CRT, ICD, LVAD, MitraClip) usually helps to lower left-sided filling pressure and is always the primary aim in HF patients.

Repair of mitral regurgitation in HF

• In patients with HFrEF, functional MR is common, may represent the main cause of PH, and leads to increased mortality.

• Repair of the mitral valve: Mitral Clipping or Cardio-Band lead to substantial improvement of pulmonary haemodynamics, including ↓mean PAP and PAWP & ↑cardiac index

• Percutaneous mitral valve repair: improve clinical symptoms, exercise capacity, quality of life, and HF-associated hospitalizations in HF patients.
II- Targeted treatment of PH_ heart failure

- Targeted therapies approved for the treatment of PAH include endothelin receptor antagonists (ERAs), prostanoids, phosphodiesterase type 5 inhibitors (PDE5i), and stimulators of soluble guanylate cyclase (sGC).

- None of these compounds are approved for the treatment of PH-LHD.
Conclusion

- PH associated with left heart failure (HF) represents by far the most common form of PH.
- It is important to establish a precise diagnosis and classification of PH before treatment decisions are made.
- PH and RV dysfunction are worse prognostic factors in patients with heart disease.
- The efficacy and safety of targeted PH therapies in HF remain unproven.
Thank you...