Cardiopulmonary interaction in heart or lung disease: physiology, disturbances, and their clinical implications

Diseases of the heart and lungs are both frequent, and their co-existence has a fundamental impact on patients' morbidity and mortality. The proper interplay between cardiac and pulmonary function is of utmost importance for maintaining a normal hemodynamic state as well as for sufficient tissue oxygenation. Disturbed function of one of these organ systems may partly be compensated by the other, although cardiac disease mostly impairs pulmonary function, and vice versa [1, 2]. The co-existence of heart and lung disease is generally associated with exaggerated symptoms and diminished survival. For instance, extensive work has recently highlighted that chronic heart failure (HF) and chronic obstructive pulmonary disease (COPD) coincide in a significant number of patients, which carries a deleterious prognostic impact [3–5]. In addition to shared risk factors and mechanisms (i.e., aging, unhealthy lifestyle), both conditions may result in a chronic inflammatory burden, which may worsen the disease course, weaken the patients' functional status, and perturb the hemodynamics of the cardiopulmonary vascular system [1]. Further to diagnostic and therapeutic gaps in treating patients with both heart and lung disease, targeted therapies (e.g., HF and COPD medications) may either be underused and/or may have an impact on the other respective organ system [1, 2]. In this context, beta-blockers are frequently underused or underdosed in patients with HF and COPD [1, 2, 5]. Intriguingly, increasing evidence in the field of res-

piratory medicine indicates the potential beneficial effects of beta-blockers in COPD patients by preventing exacerbations, regardless of the presence of cardiovascular conditions for which they are indicated [6]. Furthermore, pulmonary hypertension (PH) may complicate left heart diseases including HF and left-sided valvular heart disease, representing an increased right ventricular (RV) afterload that may thus lead to RV dysfunction and diminished RV/PA (pulmonary artery) coupling [7–9].

This issue of *Herz—Cardiovascular Diseases* focusses in particular on cardiopulmonary interaction in the context of heart or lung disease and highlights the pathophysiology, potential disturbances, and their clinical implications. Struß and colleagues report on the influence of lung hyperinflation on left heart function in COPD patients, and comment on recent evidence indicating that dual bronchodilator therapy in COPD reverses the detrimental lung–heart imbalance by increasing pulmonary blood flow, left ventricular end-diastolic volume, and stroke volume [10, 11]. The relevance of PH in patients with Heart Failure with preserved Ejection Fraction (HFpEF) or Heart Failure with reduced Ejection Fraction (HFrEF) and potential treatment strategies in patients with combined post- and pre-capillary PH are highlighted in the article by Rosenkranz et al. Tichelbäcker et al. report on the underestimated problem of PH in the context of left-sided valvular heart disease, which represents a strong predictor

of poor long-term outcome after surgical or catheter-based repair of aortic stenosis, mitral stenosis, and mitral regurgitation. Furthermore, the article highlights the importance of hemodynamic assessment prior to interventional therapy for tricuspid regurgitation. Güder and Störk focus on HF and COPD as the most important differential diagnoses of dyspnea in elderly individuals. They emphasize that despite fundamental differences in the pathophysiology of both disorders, clinical presentation may be similar, and coincident disease is common, highlighting strategies that help to avoid misdiagnosis and mistreatment. Tello and colleagues describe mechanisms and consequences of maladaptive RV remodeling in response to pulmonary (arterial) hypertension due to various underlying causes, which is crucial as the RV represents the main determinant of prognosis in PH. Finally, Kovacs et al. review clinically relevant interactions between pulmonary and cardiac drugs. This article also highlights the impact of HF and COPD therapies on the respective other organ system.

Altogether, this issue summarizes recent advances in knowledge about cardiopulmonary interactions, the coincidence of heart and lung disease, and the effects of cardiac and pulmonary medications, but also points out gaps in evidence and shines a light on areas of potential improvement and future perspectives. All articles were put together as joint efforts between cardiologists and respiratory physicians, an approach that

should also be offered to our patients with dyspnea and heart and/or lung disease.

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Lesetipp

Lunge unter Extrembedingungen

Neue Erkenntnisse vertiefen unser Verständnis über das „Wunderwerk“ Lunge. Gesundheitliche Risiken, welche insbesondere für Ausdauersportarten mit hohem Ventilationsbedarf assoziiert sind, oder auch die beim Tauchen auftretenden physiologischen Änderungen sind unbestritten faszinierend. Aber auch die Problematik der Lungentransplantation bei Lungenkarzinom gehört in diesen Themenkomplex. In *Der Pneumologe* 03/2019 können Sie sich über verschiedene Aspekte der Lunge unter Extrembedingungen informieren. Sie erhalten zudem eine Erklärung geltender Dopingregeln für im Wettkampf stehende Athleten. Aus einer beträchtlichen Auswahl von Szenarien, welche das Verhalten der Lunge unter Extrembedingungen beschreiben, wurden in diesem Themenheft einige spezifische Konstellationen herausgegriffen.

— Lunge, (Sommer), Ausdauersport – Extreme in der Leichtathletik

— Lunge und Tauchen

— Pneumothorax und Fliegen

— Lungenkrankheiten durch akzidentelle Schadstoffinhalationen

— Lungentransplantation bei Lungenkarzinom

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