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Heart Failure and Pulmonary Congestion in Dialysis Patients

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Heart failure and pulmonary congestion are among the most common and life-threatening cardiovascular complications in dialysis patients. Patients with end-stage renal disease have little to no residual renal fluid excretory function, making fluid balance difficult to maintain; consequently, cardiac dysfunction can rapidly lead to pulmonary congestion. In dialysis patients, pulmonary edema results from the complex interaction of multiple factors, including volume overload, left ventricular dysfunction, chronic hypertension, anemia, hemodynamic stress associated with arteriovenous fistulas, endothelial dysfunction, and uremic inflammation. This lecture reviews the pathophysiology, clinical characteristics, diagnostic approaches, and management strategies of heart failure and pulmonary congestion in dialysis patients. In particular, it focuses on the mechanisms of left ventricular remodeling, elevated filling pressures, and alterations in pulmonary capillary permeability that contribute to pulmonary congestion. Importantly, pulmonary congestion in dialysis patients is often asymptomatic. More than half of patients with significant pulmonary congestion confirmed on imaging studies may not complain of dyspnea or other overt symptoms. Nevertheless, asymptomatic pulmonary congestion is strongly associated with increased mortality, higher cardiovascular risk, and functional decline. This presentation will discuss the limitations of conventional physical examination and chest radiography in the assessment of volume status. It will also highlight the growing role of lung ultrasound in detecting pulmonary congestion through B-line quantification, as well as the role of echocardiography in the integrated assessment of volume status and cardiac function. Management strategies will focus on individualized ultrafiltration, optimization of volume status, modification of dialysis prescriptions, and the careful implementation of guideline-directed heart failure therapies, including beta-blockers, renin–

angiotensin system inhibitors, and angiotensin receptor–neprilysin inhibitors. The importance of dietary sodium restriction, fluid control, and multidisciplinary cardiorenal care will also be emphasized. Early detection and proactive management of both symptomatic and asymptomatic pulmonary congestion are essential for improving survival and quality of life in this high-risk population.

Keywords: Heart failure , pulmonary congestion , dialysis patients