Pulmonary Vascular Diseases in the Elderly

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KEYWORDS

• Pulmonary vascular disease • Elderly • Pulmonary hypertension
• Pulmonary arterial hypertension

KEY POINTS

- Pulmonary hypertension is a pathologic hemodynamic condition defined by a mean pulmonary arterial pressure 25 mm Hg or greater at rest.
- Because of age-associated stiffening of the heart and the pulmonary vasculature and the higher prevalence in the elderly of comorbidities associated with its development, pulmonary hypertension is an increasingly common finding in this patient population.
- The proper characterization of patients' pulmonary hypertension is crucial to determine the optimal therapeutic strategy. Elderly patients will often have multiple reasons for the development of pulmonary hypertension.
- Treatment of pulmonary hypertension in the elderly must be done with particular care because of the presence of cardiopulmonary comorbidities in this patient population.

INTRODUCTION

Pulmonary hypertension (PH) refers to a pathologic hemodynamic disorder characterized by elevated pressure in the pulmonary vasculature. It can be a progressive, fatal disease if untreated. Because of the normal alterations in the heart and lungs that occur with aging and its association with diseases that affect older patients, PH is a common condition in the elderly. Early identification and treatment is generally suggested as advanced disease may be less responsive to therapy. Treatment of PH in the elderly must be done with close vigilance because of the presence of cardiopulmonary comorbidities and lower physiologic reserve.

NORMAL PULMONARY VASCULATURE

To understand the underlying causes of PH and its effect on the circulatory system, it is important to review the physiology of the normal pulmonary vasculature. The

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pulmonary circulation can be modeled in a manner similar to an electric circuit using Ohm's law (Fig. 1). Ohm's law states that the voltage difference (V) across a resistor is equal to the current of electrons (I) multiplied by the resistance (R). The pressure difference between the pulmonary artery (PA) (P_{PA}) and the left atrium (P_{LA}) in the pulmonary circulation is analogous to the V in the circuit. The cardiac output (CO), which is the flow of blood through the pulmonary circulation, is analogous to the I in the circuit. The pulmonary vascular resistance (PVR) is analogous to the R in the circuit. The equation can then be rearranged to solve for P_{PA}. Composed of thin-walled and distensible vessels, the pulmonary vasculature is characterized by a low PVR under normal conditions, resulting in a low-pressure circuit.[1] A normal mean PA pressure is 14 mm Hg, and the upper limit of normal is 20 mm Hg; however, PH is defined as a mean PA pressure of 25 mm Hg or greater at rest.[2] The right ventricle (RV), a relatively weak muscle

Ohm's Law: $V = I \times R$

Physiologic Correlate for Pulmonary Circulation:

$P_{PA} - P_{LA} = CO \times PVR$ $\qquad$ $P_{PA} = (CO \times PVR) + P_{LA}$

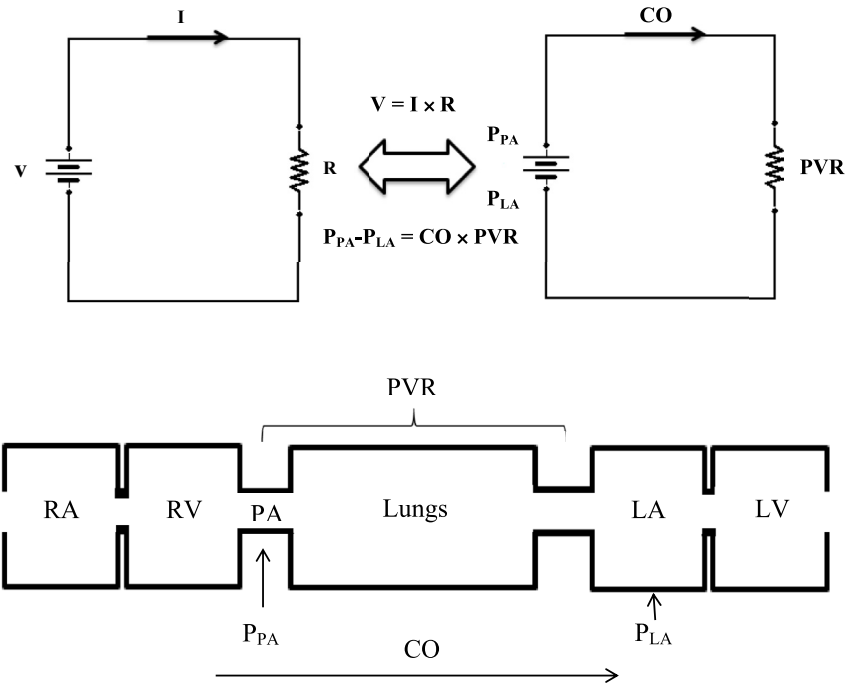

Fig. 1. Circuit diagram of the pulmonary circulation. CO, cardiac output; I, current; LA, left atrium; LV, left ventricle; PA, pulmonary artery; P_{LA}, left atrial pressure; P_{PA}, mean pulmonary artery pressure; PVR, pulmonary vascular resistance; R, resistance; RA, right atrium; RV, right ventricle; V, voltage.