

INFLUENCE OF VENTILATION MODE ON BLOOD OXYGENATION - INVESTIGATION WITH POLISH VIRTUAL LUNGS AND ITALIAN MODEL OF CIRCULATION

Tomasz Gólczewski¹, Krzysztof Zieliński¹,
Gianfranco Ferrari², Krzysztof J. Pałko¹, Marek Darowski¹

¹ *Institute of Biocybernetics and Biomedical Engineering, Polish Academy of Sciences,
Warsaw, Poland*

² *Institute of Clinical Physiology, Section of Rome, CNR, Rome, Italy*

Abstract

Positive alveolar (PA) and thoracic (Pr) pressures during artificial ventilation disturb pulmonary circulation, and might influence arterial blood oxygenation (PaO_2). Initial analysis of such influence of different artificial ventilation modes is the goal of this paper. Previously elaborated virtual respiratory system (IBIB PAS, Warsaw, Poland) and cardiovascular system model (ICP CNR, Rome, Italy) were connected with two files-buffers to work as one virtual cardio-pulmonary system. Dependence of PaO_2 on two methods (continuous inspiratory airflow (VCV) or pressure (PCV)), two ventilatory frequencies ($jV = 15$ or $7.5/\text{min}$), and two values of the minute ventilation ($V_{min} = 6$ or $8\text{L}/\text{min}$) was investigated. Perfusion dependence on gravity was neglected as the virtual patient was in the supine position. Simulations showed that when $jV = 15/\text{min}$, neither the used method nor V_{min} influence pulmonary blood flow significantly, whereas they influence the flow during expiration when $jV = 7.5$ (blood flow falls more for PCV and $V_{min} = 8\text{L}/\text{min}$). V_{min} more significantly influences alveolar partial pressure of oxygen (PO_2) when $jV = 15/\text{min}$. PO_2 was greater for PCV. As effects on the flow and PO_2 were contradictory, PaO_2 was almost independent of the used method and jV . It depended on V_{min} more significantly if $jV = 15/\text{min}$.

Keywords: virtual physiological human, respiratory system, cardio-pulmonary interaction