

ABSTRACT

OXYGEN CARRYING CAPACITY OF ERYTHROCYTES IN CRITICALLY ILL PATIENTS OF DR. SARDJITO GENERAL HOSPITAL

Background: Critical illness is a state of ill health with vital organ dysfunction, a high risk of imminent death if care is not provided and the potential for reversibility. Commonly found in critically ill patients is hypoxia, a state in which oxygen is not available in sufficient amounts at the tissue level to maintain adequate homeostasis, which can result from inadequate oxygen delivery to the tissues. The most important clinical test in assessing the efficacy of oxygen transportation is the oxygen carrying capacity of arterial blood, also known as total concentration of oxygen in arterial blood (CaO_2). And while there have been literatures describing the oxygen saturation and partial pressure of oxygen in critically ill patients, few to no literature has discussed the oxygen carrying capacity of erythrocytes, particularly on an individual erythrocyte level.

Objective: To determine the oxygen carrying capacity of individual erythrocytes in critically ill patients and to observe the correlation between critically ill patient characteristics with the oxygen carrying capacity of blood and erythrocytes.

Methods: This study is a cross-sectional, retrospective study with data collected from medical records of patients in the Surgical Intensive Care Unit (SICU) of Dr. Sardjito General Hospital, particularly the blood gas analysis (BGA) and complete blood count (CBC) results. The data were then used to determine the oxygen carrying capacity of arterial blood and erythrocytes in critically ill patients. The correlation between individual characteristics observed from the tests as well as survival outcome with oxygen carrying capacity of arterial blood and erythrocytes were also analyzed.

Results: 99 medical records were consecutively sampled using the inclusion and exclusion criteria. The mean \pm SD of the laboratory measurements was found to be within their respective normal limit, excluding normal-to-low Hb values and increased PaO_2 values. The mean \pm SD of CaO_2 was found to be 15.48 ± 2.95 ml/dL of arterial blood. Using the values of CaO_2 , the oxygen carrying capacity of erythrocytes were obtained by dividing CaO_2 with red blood cell count, resulting in a mean \pm SD of $(37.75 \pm 3.76) \times 10^{-12}$ ml per erythrocyte.

Conclusion: Critical illness was found to reduce the oxygen carrying capacity of blood and erythrocytes. The oxygen carrying capacity of blood (CaO_2) in critically ill patients was found to be under the normal limit of 16 to 22 ml. In correlation with individual characteristics, CaO_2 in the critically ill was found to increase with pH, SaO_2 , RBC count, hemoglobin, and survival rate, while it was also found to decrease along with an increase of PaCO_2 . Meanwhile, according to a proposed normal CaO_2 of erythrocytes range of 33.89×10^{-12} ml to 57.14×10^{-12} ml, the CaO_2 of erythrocytes in critically ill patients measured between normal to low. In correlation with individual characteristics, the CaO_2 of erythrocytes in critically ill patients was found to increase with pH, PaO_2 , and SaO_2 , while it was also found to decrease along with an increase of RBC count and PaCO_2 .

Keywords: oxygen carrying capacity, arterial oxygen content, critical illness, blood gas analysis, ICU