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Central venous-to-arterial carbon dioxide difference as a predictor for mortality and morbidity in septic patient

Thesis

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LIST OF ABBREVIATIONS

Abbreviation	Meaning
ARDS	acute respiratory distress syndrome
C a–mv O2	Arterial - mixed venous O2 contents difference
C a-v O2	Arterio-venous oxygen content difference
C mv–a CO2	Mixed venous to arterial CO2 contents difference
C^o	Celsius
CO2	Carbon dioxide
CVP	Central venous pressure
DIC	Disseminated intravascular coagulopathy
DO2	Oxygen delivery
F	Fahrenheit
HPV	hypoxic pulmonary vasoconstriction
ICU	Intensive care unit
MAP	Mean arterial blood pressure
MODS	multiple organ dysfunction syndrome
O2	Oxygen
P cv- art CO_2 gap	Central Venous–arterial CO2 difference
P mv- art CO_2 gap	Mixed Venous–arterial CO2 difference
$PaCO_2$	Arterial carbon dioxide tension

PaO_2	Arterial oxygen tension
$PcvCO_2$	Central venous carbon dioxide tension
$PcvO_2$	Central venous oxygen tension
PEEP	Positive end-expiratory pressure
qSOFA	quick Sequential Organ Failure Assessment
RQ	Respiratory quotient
SaO_2	Arterial oxygen saturation
SAPS II	Simplified Acute Physiology Score II score
$ScvO_2$	Central venous oxygen saturation
SIRS	Systemic inflammatory response syndrome
SOFA	Sequential Organ Failure Assessment
VCO2	Carbon dioxide production
VO2	Oxygen consumption

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INTRODUCTION

Current guidelines for hemodynamic management of severe sepsis and septic shock recommend the use of global markers of tissue hypoxia as resuscitation endpoints ***(Dellinger et al., 2013).***

In the initial resuscitation period, targeting either central venous oxygen saturation (ScvO2) normalization or lactate clearance, or the combination of both, is accepted ***(Jones et al., 2010).***

However, each one of these two variables have its own limitations. Although the use of ScvO2 seems to provide more real-time information than lactate clearance, the nature of septic conditions, characterized by microcirculatory heterogeneity that generates capillary shunting, is frequently accompanied by elevated ScvO2 values. Indeed, abnormally high ScvO2 values have been associated with increased mortality in septic shock patients ***(Textoris et al., 2011).***

However achievement of the recommended normalized ScvO2 values during the initial resuscitation therefore does not rule out persistent tissue hypoxia, and some authors consider that ScvO2 should be used in combination with other tissue perfusion endpoints ***(Van Beest et al., 2011)***.

On the other hand, despite lactate clearance being proven to be as beneficial as ScvO2 in guiding resuscitation in sepsis, at the bedside the clinician has to face the uncertainty of a high lactate value, without knowing whether this lactate reflects persistence of hypoperfusion or whether its normalization is just a matter of time ***(Andersen et al., 2013)***

On the whole, elevated lactate values could lead to unnecessary interventions, with their potential deleterious effects, such as tissue edema and increased fluid balance, which have consistently been associated with worse outcome ***(Boyd et al., 2011).***

Recently, some authors have advocated that the central venous-to-arterial carbon dioxide difference P (cv-a) CO2 might be complementary tools to identify patients with persistent global hypoperfusion ***(Vallet et al., 2013).***

Certainly, partial pressure of carbon dioxide gap has demonstrated its prognostic value in different conditions, and a cutoff value of 6 mmHg seems to reflect whether global flow is adequate (gap <6 mmHg) or insufficient (gap ≥6 mmHg) ***(Ospina-Tascon et al., 2013).***

Tissue partial pressure of carbon dioxide (PCO2) reflects metabolic alterations due to inadequate perfusion in actively metabolized tissues. The PCO2 gap, which has been shown to be inversely related to cardiac output (CO), is considered as a marker of the ability of the venous blood flow to remove the CO2 excess produced in tissues. Thus, an impaired tissue perfusion during a reduced blood flow is the main determinant of a rise of the PCO2 gap ***(Futier et al., 2010)***

Aim of the work:

The purpose of this study is to evaluate the clinical relevance of high value of the P(cv-a)CO2, and its relationships to other markers of impaired tissue perfusion and oxygenation (blood lactate) and if it can be used as a predictor for mortality and morbidity in septic patients.