Hemodynamic and tissue oxygenation parameters to guide fluid therapy

An essay
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بسم الله الرحمن الرحيم

" قَالُوا سُبْحَانَكَ لا عِلْمَ لَنَا إِلا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ العَلِيمُ الحَكِيم"

صدق الله العظيم

(البقرة – الآية 32)

Acknowledgment

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Amr Sayed

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LIST OF ABBREVIATIONS

2D	Two- Dimensional
ADH	Antidiuretic Hormone
ATLS	Advanced Trauma and Life Support
CI	Cardiac Index
CO	Cardiac Output
COP	Colloid Osmotic Pressure
CVCs	Central Venous Cannulae
CVP	Central Venous Pressure
DIC	Disseminated Intravascular Coagulation
DO_2	Oxygen Delivery
ERO_2	Oxygen Extraction Ratio
Hb	Hemoglobin
HES	Hydroxyethyl Starch
IPPV	Intermittent Positive Pressure Ventilation
Mw	Molecular Weight
PA	Pulmonary Artery
PAC	Pulmonary Artery Catheters
PAOP	Pulmonary Artery Occlusion Pressure
PEEP	Positive End Expiratory Pressure
POP	Pulse Oximeter Plethysmography
PPV	Pulse Pressure Variation

RAP	Right Atrial Pressure
RBC's	Red Blood Cells
RES	Reticulo-endothelial System
ROC	Receiver Operator Characteristic
SAFE	Saline versus Albumin Fluid Evaluation
$ScVO_2$	Central Venous Oxygen Saturation at the level of SVC
SOAP	Sepsis Occurrence in Acutely ill Patients
SPV	Systolic Pressure Variation
SV	Stroke Volume
SVC	Superior Vena Cava
SVO_2	Central Venous Oxygen Saturation at level of PA
SVV	Stroke Volume Variation
TBW	Total Body Water
TEE	Trans Esophageal Echocardiogram
TTE	Trans Thoracic Echocardiogram
VO_2	Oxygen Consumption
vWF	Von Willebrand Factor
CaO_2	Arterial Oxygen Content

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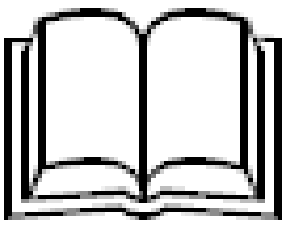
Introduction



Introduction

Emerging data suggest that early aggressive resuscitation of critically ill patients may limit and/or reverse tissue hypoxia, progression to organ failure and improve outcome **(Levy et al., 2004)**. Fluid therapy is considered the first step in the resuscitation of most patients with hypotension and shock. Uncorrected hypovolemia, leading to inappropriate infusions of vasopressor agents, may increase organ hypoperfusion and ischemia **(Murakawa and Kobayashi 1988)**.

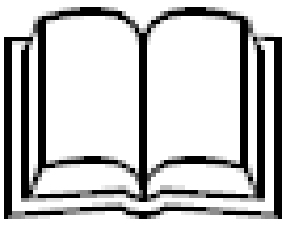
The first step in the hemodynamic management of critically ill patients is to determine the adequacy of tissue/organ perfusion **(Hayes et al., 1994).** However, clinical studies have consistently demonstrated that only about 50% of hemodynamically unstable critically ill patients are volume responsive **(Marik et al., 2009)**.The resuscitation of the critically ill patient therefore requires an accurate assessment of the patients' intravascular volume status (cardiac preload) and the ability to predict the hemodynamic response following a fluid challenge (volume responsiveness) **(Braunwald et al., 1988)**.

Numerous experimental and clinical studies have clearly demonstrated that static variables, such as central venous pressure and pulmonary artery occlusion pressure reflecting cardiac filling pressures, can't adequately indicate changes in preload or reliably predict fluid responsiveness **(Charron et al., 2006)**. An increasing number of publications has underlined the superiority of dynamic variables of fluid responsiveness, such as systolic pressure variation, pulse

pressure variation, stroke volume variation, plethysmographic waveform variations and other variables which are based on the concept of heart-lung interaction compared to static variables in the decision making process of whether the patient needs fluids or not **(Renner et al., 2008)**.

Optimization of oxygen delivery using either or both fluid loading and inotropic support, to prevent tissue hypoxia in relation to increased oxygen consumption, could improve outcome. In this context, the use of central venous oxygen saturation which reflects important changes in the oxygen delivery/oxygen consumption relationship to address adequacy of oxygen utilization, has shown promising results **(Vallet et al., 2011).**

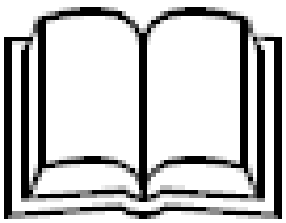
Aim of the Work



Aim of the work

This work aims to discuss the role of fluid therapy in management of critically ill patient and hemodynamic and tissue oxygenation parameters to guide fluid therapy.

Review of Literatur



Chapter (1)

Physiology of Fluid Therapy