Assessment of Hemodynamic Status and Perfusion Markers in Critically Ill Children with Septic Shock

Thesis

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List of Abbreviations

Abbr.	Full-term
ACCM	**:** American College of Critical Care Medicine
AIDS	**:** Acquired immune-deficiency syndrome
ALT	**:** Alanine transaminase
BP	**:** Blood pressure
COPD	**:** Chronic Obstructive Pulmonary Disease
CRP	**:** C-reactive protein
CT	**:** Computed Tomography
CVP	**:** Central venous pressure
ECG	**:** Electrocardiogram
ED	**:** Emergency Department
EF	**:** Ejection fraction (EF
ESR	**:** Erythrocyte Sedimentation Rate
GIT	**:** Gastrointestinal tract
ICU	**:** Intensive care unit
ILs	**:** Interleukins
iNOS	**:** Inducible NOS
MAP	**:** Mean arterial pressure
NO	**:** Nitric oxide

PAF **:** Platelet-Activating Factor

PALS **:** Pediatric Advanced Life Support

PICUs **:** Pediatric intensive care units

Pmx B **:** Polymyxin B

PSCC **:** Pediatric Sepsis Consensus Congress

RCTs **:** Randomized control studies

SD **:** Standard deviation

SIMD **:** Sepsis-induced myocardial dysfunction

SPSS **:** Statistical Package for Social Sciences

SvO2 **:** Venous oxygen saturation

TNF **:** Tumor Necrosis Factor

WHO **:** World Health Organization

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Abstract

Abstract

Background: Severe sepsis causes release of inflammatory mediators and an associated redistribution of intravascular volume together with depression of myocardial function which manifests as hemodynamic pattern of low cardiac output, low systemic vascular resistance, hypotension, hyperlactatemia and signs of altered tissue perfusion such as oliguria and prolonged capillary refill time. **Aim of the Work:** To assess hemodynamic status together with the perfusion markers (lactate) in critically ill children with septic shock. **Patients and Methods:** This single cohort study was conducted on 40 patients recruited from the pediatric intensive care units (PICU) at: Ain Shams university hospital, Al-Galaa Military medical complex and Ghamra Military hospital From December 2017 to August 2018. **Results:** Only four cases of cases with septic shock developed ejection fraction below 55% denoting myocardial dysfunction during the duration of assessment (first 24 hours of diagnosis). There was negative correlation between cardiac functions represented by hemodynamic measures on one side and SOFA score, PIM 2 score and serum lactate levels on the other side. However, by studying the performance of the parameters included in our study in predicting death; only lactate-24 ≥2.0 (mmoL/L) had statistically significant moderate diagnostic performance, other studied measurements had weak diagnostic performance. **Conclusion:** Myocardial dysfunction was found to be common in children having septic shock. Close monitoring and hemodynamic assessment is important to avoid missing these cases. In addition, serum blood lactate level is an important biomarker that should be carefully monitored as it is a good prognostic tool that can predict outcome in pediatric sepsis and septic shock.

Key words: hemodynamic status, perfusion, critically ill children, septic shock

Introduction

Sepsis is defined as life-threatening organ dysfunction due to dysregulated host response to infection ***(Abraham, 2016).*** Severe sepsis causes release of inflammatory mediators and an associated redistribution of intravascular volume together with depression of myocardial function which manifests as hemodynamic pattern of low cardiac output, low systemic vascular resistance, hypotension refractory to vasopressors, hyperlactemia and signs of altered tissue perfusion such as oliguria and prolonged capillary refill time which considered significant cause of pediatric morbidity and mortality ***(Mickiewicz et al., 2015).***

The rapid determination of hemodynamic status would allow tailoring of vaso-active drugs in what is known to be dynamic situation. Determination of hemodynamic status is the best discriminator of survivors from non survivors in childhood sepsis ***(Proulx et al., 2011).***

Hence, determination of hemodynamic status includes monitoring of cardiac output and markers of perfusion. Cardiac output assessment is essential for

assessment of cardiac function to maintain adequate tissue perfusion ***(Nusmeier et al., 2010)*.**

The technology for cardiac output assessment should be non-invasive, accurate, rapid and compatible so, echocardiography has been widely used for cardiac output assessment due to its ability to provide non-invasive measurement with minimal discomfort or risk together with its portability, immediate availability and repeatability ***(Larsen et al., 2011).***

As regards perfusion markers, the inflammatory mediators of sepsis may worsen tissue hypoxia by increasing cellular oxygen demand, thereby altering the oxygen extraction and reducing myocardial contractility. Thus, an interrelation between sepsis and hypoxia may occur ***(Jat et al., 2011)***.

Blood lactate levels supposed to reflect the magnitude of anaerobic metabolism related to cellular hypoxia. Blood lactate levels have been well correlated to survival forms of acute circulatory failure ***(Munde et al., 2014).*** Blood lactate levels is the earliest discriminator of survival, survivors had an early reduction of lactate level and better lactate clearance ***(Bai et al., 2014).***

Aim of the Study

To assess hemodynamic status together with the perfusion markers (lactate) in critically ill children with septic shock.