Comparative Study between Femoral Arterial Doppler and Echocardiography in fluid responsiveness assessment in Septic Shock Patients

Thesis

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بسم الله الرحمن الرحيم

قالوا سبحانك لا علم لنا إلا ما علمتنا إنك أنت العليم الحكيم

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Contents

Subjects	Page
List of abbreviations	III
List of figures	IX
List of tables	XI
• **Introduction**	1
• **Aim of the work**	5
• **Review of Literature**	
♦ Definitions	6
♦ Initial resuscitation	7
♦ Screening for sepsis and performance improvement	13
♦ Diagnosis	15
♦ Antimicrobial therapy	19
♦ Source control	25
♦ Fluid therapy	28
♦ Vasoactive medication	30
♦ Corticosteroids	35
♦ Blood products	37
♦ Immunoglobulins	39
♦ Blood purification	39

- ♦ Anticoagulants 40
- ♦ Mechanical ventilation 40
- ♦ Sedation and analgesia 47
- ♦ Glucose control 48
- ♦ Renal replacement therapy 50
- ♦ Bicarbonate therapy 51
- ♦ Venous thromboembolism prophylaxis 52
- ♦ Stress ulcer prophylaxis 53
- ♦ Nutrition 54
- ♦ Fluids responsiveness monitoring parameters 57
- ♦ Echocardiographic Assessment of Preload Responsiveness in Critically Ill Patients 76
- ♦ Doppler echocardiography 77

- **Patients and Methods** 83
- **Results** 90
- **Discussion** 110
- **Recommendations** 117
- **Conclusion** 118
- **Summary** 119
- **References** 123
- **Arabic Summary**

List of Abbreviations

%Vfmax	: Maximal systolic velocity variation
%VTIf	: Velocity time integral variation femoral dopler
ΔPOP	: Plethysmographic waveform variations
ACTH	: Adrenocorticotrophic hormone
APACH	: Acute physiologic and chronic Health Evaluation
CI	: Cardiac index
CPFA	: Coupled plasma filtration adsorption
CRRT	: Continues renal replacement therapy
CVP	: Central venous pressure
DIC	: Disseminated intravascular coagulopathy
DSI	: Daily sedation interruption
EGDT	: Early goal-directed therapy
FC	: Fluid challenge
FR	: Fluid responsiveness
GEDV	: Global end diastolic volume
GRVs	: Gastric residual volumes
HFOV	: High-frequency oscillatory ventilation
ICU	: Intensive care unit
ITBV	: Intrathoracic blood volume
IVC	: Inferior vena caval
LMWH	: Low-molecular-weight heparin
LOS	: Length of stay

LVEDA	: Left ventricular end-diastolic volume or area
LVOT	: Left ventricular outflow tract
LVOT VTI	: Left ventricular outflow tract velocity time integral
MAP	: Mean arterial pressure
MIC	: Minimum inhibitory concentration
MRSA	: Methicillin resistant staphylococcus aureus
NIV	: Noninvasive ventilation
NMBAs	: Neuromuscular blocking agents
PA	: Pulmonary artery
PBW	: Predicted body weight
PCWP	: Pulmonary capillary wedge pressure
PICCO	: Pulse index Continuous Cardiac Output
PLR	: Passive leg raising
PP	: Pulse pressure
PPV	: Pulse pressure variation
PPV	: Pulse pressure variation
RAP	: Right atrial pressure
RBC	: Red blood cell
RCTs	: Randomized controlled trials
RRT	: Renal replacement therapy
RV	: Right ventricle
SAP	: Systolic arterial pressure
Scvo2	: Central venous oxygen saturation
SOFA	: Sequential Organ Failure Assessment Score

SP	: Systolic pressure
SPV	: Systolic pressure variation
SSC	: Staff selection commission
SV	: Stroke volume
SVC	: Superior vena caval
SVV	: Stroke volume variation
SVV	: Stroke volume variation
TEE	: Transesophageal echocardiography
U.S	: United States
UFH	: Unfractionated heparin
VAP	: Ventilator-associated pneumonia
VTE	: Venous thromboembolism

List of Figures

No.	Figure	Page
1	Heart-lung interactions: Hemodynamic effects of mechanical ventilation. The cyclic changes in left ventricular (LV) stroke volume are mainly related to the expiratory decrease in LV preload due to the inspiratory decrease in right ventricular (RV) filling.	66
2	Measurement of respiratory variation in the diameter of the IVC from a frozen M-mode image.	73
3	The Doppler equation	78
4	Velocity time integral VTI (cm/s) = area under the velocity curve: sum of velocities (cm/s) during the ejection time (sec); t_1 = time one, t_2 = time two,	79
5	Left Ventricular Outflow Tract diameter ($LVOT_D$) measurement LV: left ventricle, LA: left atrium, Ao: ascending Aorta. (Right) Velocity Time Integral (VTI) measurement.	82
6	Mean arterial pressure before and after fluid administration of 30 ml/kg of NaCl 0.9% in responder and non-responder patients	93
7	Heart rate before and after fluid administration of 30 ml/kg of NaCl 0.9% in responder and non-responder patients.	95
8	Respiratory rate before and after fluid administration of 30 ml/kg of NaCl 0.9 % in responder and non-responder patients.	97

No.	Figure	Page
9	Temperature before and after fluid administration of 30 ml/kg of NaCl 0.9% in responder and non-responder patients.	99
10	Serum lactate level before and after fluid administration of 30 ml/kg of NaCl 0.9% in responder and non-responder patients.	101
11	Percentage of patients who respond hemodynamically to fluid resuscitation and patients who didn't respond hemodynamically to fluids.	102
12	Velocity time integral – left ventricle outflow tract (VTI-LV) before and after fluid administration of 30 ml/kg of NaCl 0.9% in responder and non-responder patients.	104
13	Velocity time integral – left ventricle outflow tract (VTI-LV) before and after fluid administration of 30 ml/kg of NaCl 0.9% in responder and non-responder patients.	106
14	Maximal systolic velocity variation - femoral doppler (VFMX) before and after fluid administration of 30 ml/kg of NaCl 0.9% in responder and non-responder patients.	108
15	Numbers of patients who responded to fluid resuscitation as diagnosed by Echo and femoral doppler	109

List of Tables

No.	Table	Page
1	Antimicrobial therapy in septic patients.	22
2	Static variables of preload and fluid responsiveness: Cardiac filling pressures	59
3	Dynamic variables of fluid responsiveness.	67
4	Sequential Organ Failure Assessment (SOFA) Score.	84
5	Demographic distribution	91
6	Age distribution	92
7	Mean arterial pressure before and after fluid administration of 30 ml/kg of NaCl 0.9% in responder and non-responder patients.	93
8	Heart rate before and after fluid administration of 30 ml/kg of NaCl 0.9% in responder and non-responder patients.	95
9	Respiratory rate before and after fluid administration of 30 ml/kg of NaCl 0.9% in responder and non-responder patients.	97
10	Temperature before and after fluid administration of 30 ml/kg of NaCl 0.9% in responder and non-responder patients.	99
11	Serum lactate level before and after fluid administration of 30 ml/kg of NaCl 0.9% in responder and non-responder patients.	101
12	Velocity time integral – left ventricle outflow tract (VTI-LV) before and after fluid administration of 30 ml/kg of NaCl 0.9% in	104

No.	Table	Page
	responder and non-responder patients.	
13	Velocity time integral – left ventricle outflow tract (VTI-LV) before and after fluid administration of 30 ml/kg of NaCl 0.9% in responder and non-responder patients.	106
14	Maximal systolic velocity variation - femoral doppler (VFMX) before and after fluid administration of 30 ml/kg of NaCl 0.9% in responder and non-responder patients.	108
15	Numbers of patients who responded to fluid resuscitation as diagnosed by Echo and femoral doppler	109

Introduction

Fluid replacement is considered the cornerstone of resuscitation in critically ill patients especially in patients with septic shock. However, only about 50 % of critically ill hemodynamically unstable patients are responsive to fluids. Furthermore, both under resuscitation and overzealous fluid administration adversely affect the outcome. Consequently, the resuscitation of critically ill patients requires an accurate assessment of the patients' intravascular volume status and their volume responsiveness ***(Brennan -JM., 2007).***

Moreover, myocardial depression plays a significant role in the pathophysiology of shock in up to 60% of septic patients and can develop at an early stage. Hence, it is vital that resuscitation in septic shock should be guided by accurate assessment and monitoring of hemodynamic status of individual patients' therapy ***(Brennan -JM., 2007).***

Traditional methods of determining the adequacy of volume resuscitation have relied on preload measures, there are central venous pressure (CVP), pulmonary artery wedge pressure (PAWP), right ventricular end-diastolic volume index (RVEDVI), left ventricular end-diastolic area index (LVEDVAI), and global end-diastolic volume

(GEDV) also known as static parameters of volume status. However, none of these is accurate in predicting preload responsiveness ***(Murphy CV et al., 2009)***.

Both pressure and volume measures of preload are affected by multiple factors other than the volume of blood, for example, vascular tone, intrathoracic pressure, and ventricular compliance. Moreover, the Frank-Starling relationship depends upon preload as well as ventricular function. Therefore, it is physiologically impossible to accurately predict

Preload responsiveness by assessing preload alone. Preload responsiveness can be determined by performing a volume challenge maneuver or by making use of the respiratory variation in the venous or arterial circulation also known as dynamic parameters of volume status ***(Tiedemann HP et al., 2006)***.

It is important to realize that stroke volume (SV) or cardiac output (CO), or its surrogate, for example, pulse pressure (PP) or arterial blood flow velocity, is the preferred end-point because a preload responsive heart may not be recognized otherwise ***(Mari PE et al., 2009)***.

Dynamic parameters of volume status outperform the static ones in predicting preload responsiveness and should be used to optimize preload in septic shock patients:

1. **Respiratory variation in:**
    a) Central venous pressure (CVP).
    b) Vena cava diameter:
        1. Inferior vena cava (IVC).
        2. Superior vena cava (SVC).
    c) Arterial blood pressure waveform-derived variables:
        1. Pulse pressure variation (PPV).
        2. Stroke volume variation (SVV).
    d) Pulse oximeter plethysmographic (POP) waveform amplitude.
    e) Arterial blood flow velocity:
        1. Aortic.
        2. Brachial artery.
2. **Passive leg raising (PLR) maneuver.**
3. **Actual fluid challenge** ***(Michard F and Teboul JL, 2002)***

Many recent data underlined misinterpretation conditions observed in most of critically ill patients. Transthoracic echocardiography (TTE) allows a noninvasive bedside assessment of cardiac response to volume expansion by measuring aortic velocity time