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Myocardial Necrosis in ICU Patients with Severe Hemodynamic Disturbances

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Osama Abdella Mohammed

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List of Abbreviations

LA	Left atrium
RA	Right atrium
LV	Left ventricle
RV	Right ventricle
LCA	Left coronary artery
RCA	Right coronary artery
LAD	Left anterior descending artery
LCX	Left circumflex artery
PDA	Posterior descending artery
AV	Atrioventricular
SA	Sinoatrial
SL	Semilunar
LVH	Left ventricular hypertrophy
GI	Gastrointestinal
DM	Diabetes mellitus
CRF	Coronary reserve flow
MI	Myocardial infarction
ECG	Electrocardiogram
ICU	Intensive care unit
ADH	Antidiuretic hormone
BP	Blood pressure
BUN	Blood urea nitrogen
ABG	Arterial blood gas test
CT	Computed tomography
IV	Intravenous
ESICM	The European Society of Intensive Care Medicine
HES	Hydroxyethyl starch
FFP	Fresh frozen plasma

SOFA	Total sequential organ failure assessment
SIRS	Systemic inflammatory response syndrome
MODS	Multiple organ dysfunction
GU	Genitourinary
PT	Prothrombin time
aPTT	activated partial thromboplastin time
CNS	Central Nervous System
GCS	Glasgow Coma Scale
Sepsis-3	The Third International Consensus Definition for Sepsis
ARDS	Adult Respiratory Distress Syndrome
Psyst	Systolic pressure
CVP	Central venous pressure
US	United State of America
AMI	Acute myocardial infarction
cTnI	Cardiac troponin I
CK-MB	Creatine kinase MB
AST	Aspartate aminotransferase
ALT	Alanine aminotransferase
CBC	Complete blood count
WBCs	White blood cells
RBCs	Red blood cells
Hb	Hemoglobin
HCT	Hematocrit
$ScvO_2$	Central oxygen saturation
HR	Heart rate
MAP	Mean arterial pressure
ECHO	Echocardiography
EF	Ejection Fraction
RWMA	Regional wall motion abnormality
ACS	Acute coronary syndrome

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Introduction

Shock is a life-threatening condition of circulatory failure which commonly presents with hypotension. The effects of shock are initially reversible but can rapidly become irreversible, resulting in multi-organ failure and death. Thus, when a patient present with undifferentiated hypotension and is suspected of having shock, it is important that the clinician rapidly identify the etiology so that appropriate therapy can be administered to prevent multi-organ failure and death**(Vincent& De Backer, 2013).**

Shock results from different pathophysiological mechanisms, hypovolemia from internal or external fluid loss, or distributive factors e.g., septic shock or anaphylaxis from the release of inflammatory mediators. Hypovolemic shock is characterized by low cardiac output and, inadequate oxygen transport. In distributive shock, the main deficit lies in the periphery, with decreased systemic vascular resistance and altered oxygen extraction. Typically, in such cases cardiac output is high, although it may be low as a result of associated myocardial depression **(De Backer et al., 2010).**

In patients admitted to the Intensive Care Unit (ICU) for reasons different from cardiac disease, several clinical events can cause myocardial ischemia and acute myocardial infarction both of which can be hard to be diagnosed. However, they can be diagnosed by increasing of serum markers of myocardial damage associated with suggestive symptoms and electrocardiographic (ECG) changes **(Alpert et al., 2000).**

Actually, in the critically ill patients the diagnosis can be particularly challenging since acute myocardial infarction induced abnormalities, including hemodynamic instability, a reduced level of consciousness, ECG changes and elevated blood levels of cardiac enzymes can be caused also by non-cardiac events **(Landesberg et al., 2005).**

Critically ill patients are exposed to a high degree of non-cardiac stress, which increases myocardial oxygen consumption. At the same time, the myocardial oxygen supply may be reduced by hypotension, tachycardia, hypoxemia, anemia, and intrinsic coronary artery disease. An unexpectedly high incidence of clinically unrecognized myocardial injury, according to elevated levels of cardiac troponin I (cTnI), has been reported in the critically ill patients **(Noble et al., 2002).**

During septic shock the coronary circulation displays abnormalities similar to those of the systemic circulation. A maldistribution of nutritive blood flow and a disturbance in diffusive oxygen delivery, as reflected by abnormally high coronary sinus oxygen content and low oxygen extraction, have been reported in both human and animal studies **(Groeneveld et al., 2008).**

Aim of the work

To compare the incidence of myocardial injury in patients with hypovolemic shock versus septic shock.

Review of literature

Anatomy of the Heart:

The normal human heart varies with height and weight, it's located in the chest, directly above the diaphragm in the region of the thorax called mediastinum, specifically the middle mediastinum. The tip (apex) of the heart is pointed forward, downward, and toward the left, the (inferior) diaphragmatic surface lies directly on the diaphragm **(Edwards et al., 2001)**.

The heart lies in a double walled fibroserous sac called the pericardial sac, which is divided into fibrous pericardium, and serous pericardium, the fibrous pericardium envelops the heart and attaches onto the great vessels, the serous pericardium is a closed sac consisting of two layers: A visceral layer or epicardium forming the outer lining of the great vessels and the heart, and parietal layer forming an inner lining of the fibrous pericardium. The two layers of the serous pericardium contain the pericardial fluid, which prevents friction between the heart and the pericardium **(Boulpaep, 2005)**.

The wall of the heart is composed of three layers: epicardium; myocardium; & endocardium. The epicardium