بسم الله الرحمن الرحيم

∞∞∞

تم رفع هذه الرسالة بواسطة / مني مغربي أحمد

بقسم التوثيق الإلكتروني بمركز الشبكات وتكنولوجيا المعلومات دون أدنى مسئولية عن محتوى هذه الرسالة.

ملاحظات: لا يوجد

Evaluation of Serum Procalcitonin as a Diagnostic and Prognostic Biomarker for Sepsis in Major Burn Patients: A Prospective Study

Thesis

Submitted for Partial Fulfillment of Master Degree of
Plastic, Burn and Maxillofacial Surgery

By

Mohamed Fathy Fekry
M.B.B.CH, Faculty of Medicine – Ain Shams University

Under supervision of

Prof. Salah Nasser Mohammed
Professor of Plastic, Burn and Maxillofacial Surgery
Faculty of Medicine, Ain Shams University

Prof. Mohamed Abdel-Mohsen Ghanem
Professor of Plastic, Burn and Maxillofacial Surgery
Faculty of Medicine, Ain Shams University

Dr. Mohamed Mamdouh Abd ElHalim
Lecturer of Plastic, Burn and Maxillofacial Surgery
Faculty of Medicine, Ain Shams University

Faculty of Medicine
Ain Shams University
2022

سورة البقرة الآية: ٣٢

Acknowledgment

First and foremost, I feel always indebted to **ALLAH**, *the Most Kind and Most Merciful.*

I'd like to express my respectful thanks and profound gratitude to ***Prof. Salah Nasser Mohammed,*** *Professor of Plastic, Burn and Maxillofacial Surgery, Faculty of Medicine, Ain Shams University for his keen guidance, kind supervision, valuable advice and continuous encouragement, which made possible the completion of this work.*

I am also delighted to express my deepest gratitude and thanks to ***Prof. Mohamed Abdel-Mohsen Ghanem,*** *Professor of Plastic, Burn and Maxillofacial Surgery, Faculty of Medicine, Ain Shams University, for his kind care, continuous supervision, valuable instructions, constant help and great assistance throughout this work.*

I am deeply thankful to ***Dr. Mohamed Mamdouh Abd ElHalim,*** *Lecturer of Plastic, Burn and Maxillofacial Surgery, Faculty of Medicine, Ain Shams University, for his great help, active participation and guidance.*

Mohamed Fathy Fekry

List of Contents

List of Tables

List of Tables (cont...)

List of Figures

List of Figures (cont...)

List of Abbreviations

Abb.	Full term
ABA	*American Burn Association;*
ARDS	*Acute respiratory distress syndrome*
BPM	*Beats per minute*
CGRP	*Calcitonin gene-related peptide*
DAMPs	*Damage-associated molecular patterns*
FiO2	*Fraction of inspired oxygen*
IGF-1	*Insulin-like growth factor 1*
LPS	*Lipopolysaccharide*
MAP	*mean arterial pressure*
MODS	*Multiple organ dysfunction syndrome*
NF-κB	*Nuclear factor kappa B*
NOD	*Nucleotide oligomerization domain*
PAMPs	*Pathogen-associated molecular pattern molecules*
PaO2	*Partial pressure of arterial oxygen*
PARs	*Protease-activated receptors*
PCT	*Procalcitonin*
qSOFA	*Quick SOFA.*
SIRS	*Systemic inflammatory response syndrome*
SOFA	*Sequential Organ Failure Assessment*
SPSS	*Statistical Package for Social Science*
TLRs	*Toll-like receptors*
TNF	*Tumor necrosis factor*

INTRODUCTION

Sepsis in burns worsens the patient's prognosis and increases the risk of organ failure and death. The leading cause of death in burn patients is multiple organ dysfunction syndrome (MODS), which is a direct response to sepsis ***(Greenhalgh, 2017).*** Identifying early sepsis is very important, given that every 6 h delay in the diagnosis of sepsis reduces survival by 10%. Difficulty in diagnosing sepsis in burn is due to the systemic response to the burn itself clinically mimics sepsis ***(Permatasari et al., 2021).***

Blood cultures are still the gold standard to identify sepsis, but it takes 48-72 h and cannot rapidly diagnose sepsis. In addition, because of the usage of high-dose antibiotics at an early stage, the positive detection rate of blood culture is very low, which would delay the diagnosis ***(Chiesa et al., 2004).***

The currently used indicators of early diagnosis of infection like CRP are also affected greatly by many other conditions such as trauma, surgery, tissue necrosis and immune mediated inflammatory disease. Patients with severe burns do have a systemic inflammatory response, therefore, it is very important to develop new methods for differential diagnosis between a pure inflammatory reaction and a true sepsis due to microbiological invasion of the blood stream ***(Barati et al., 2008).***

It is presumed that various sepsis biomarkers originating from the host response to inflammatory stimuli could diagnose sepsis as early as possible so that sepsis treatment can be started early.

Procalcitonin (PCT), a protein that consists of 116 amino acids, is a precursor of calcitonin which participates in the calcium metabolism. PCT is mainly produced by C-cells of the thyroid gland and it is also synthesized in the liver, kidneys, lungs, and adipose tissues in response to endotoxins, cytokines, and other mediators ***(Xu et al., 2018).***

Under normal circumstances, healthy individuals carry very low levels of PCT. However, in the presence of bacterial and fungal infections, dramatically increased levels of PCT may be seen. Previous reviews have shown that procalcitonin (PCT) may be used as an auxiliary index in clinical diagnosis of sepsis and a modality to reduce exposure of antibiotics to critically ill patients ***(Mann et al., 2011)*** and may be the most promising biomarker of burn patients with sepsis ***(Cabral et al., 2017).***

Studies on the evaluation of diagnostic and prognostic value of procalcitonin levels in severe burn sepsis are rare and still show inconsistent results. In 2012 ***Lavrentieva*** and his colleagues stated that PCT is useful as an early indicator of sepsis in severe burn patients. Meanwhile, other study showed

that PCT serum is not superior compared to CRP or blood leukocytes as a marker of sepsis in burn patients. (***Jeschke et al., 2013)***

In 2018 ***Kumar*** and his co-workers stated that PCT is a good sepsis marker, but different populations have difference in validity and predictability of the test. Thus, the present study was designed to find the diagnostic validity and the prognostic value of PCT in our burn population.

AIM OF THE WORK

The aim of this study is:

- To investigate the diagnostic validity of PCT in burn sepsis as an early diagnostic tool
- To identify its prognostic value in major burn patients with sepsis.

Chapter 1

PATHOPHYSIOLOGY OF BURN INJURY

Introduction

Burn injuries are an under-appreciated trauma that can affect anyone, anytime and anywhere.

The injuries can be caused by friction, cold, heat, radiation, chemical or electric sources, but the majority of burn injuries are caused by heat from hot liquids, solids or fire Although all burn injuries involve tissue destruction due to energy transfer, different causes can be associated with different physiological and pathophysiological responses. ***(Nguyen et al., 2020).***

For example, a flame or hot grease can cause an immediate deep burn, whereas scald injuries tend to appear more superficial initially, due to rapid dilution of the source and energy. Alkaline chemicals cause colliquative necrosis (whereby the tissue is transformed into a liquid, viscous mass), whereas acidic burn causes a coagulation necrosis (whereby the architecture of the dead tissue can be preserved). Electrical injuries are entirely different because they can cause deep tissue damage that is greater than the visible skin injury. ***(Lee, 1997)***.