Procalcitonin As An Inflammatory Marker In Comparison Between High-flux And Low-flux Hemodialysis in ESRD patients

Thesis

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By

Sabah Abd Ellah Hammad

M.B.B.Ch.Ain Shams University

Diploma of Internal Medicine Tanta University

Under Supervision of

Prof. Dr. Hesham Mohammed El Sayed

Professor of Internal Medicine and Nephrology Faculty of Medicine – Ain Shams

University

Dr. Hussein Sayed Hussein

Lecturer of Internal Medicine and

Nephrology Faculty of Medicine - Ain Shams

University

Faculty of

Medicine Ain

Shams

University 2017

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Abbreviations

AGEs	Advanced Glycosylated End Products
APR	Acute Phase Reactant
AVG	Arteriovenous graft
BCM	Biocompatible Membrane
BMI	Body mass index
CBC	Complete Blood Count
CIS	Cytokine Inducing Substances
CFUs	Colony Forming Units
CKD	Chronic kidney Disease
C.pneumonia	Colostridium pneumonia
CRF	Chronic renal failure
C-RP	C reactive protein
CVD	Cardiovascular Disease
DM	Diabetes mellitus
eGFR	Estimated Glomerular Filtration rate
ELISA	Enzyme-linked immunosorbent assay
EPO	Erythropoietin
ESR	Erythrocyte Sedimentation Rate
ESRD	End stage renal disease
GFR	Glomerular Filtration rate

Hb	Hemoglobin
HD	Hemodialysis
HDF	Hemodiafiltration
HF	Hemofiltration
HFHD	High Flux Hemodialysis
H.pylori	Helicobacter pylori
HsCRP	High Sensitivity C reactive protein
HTN	Hypertention
Ig	Immunoglobulin
IHD	Ischemic heart disease
IL	Interleukin
Kuf	Ultrafiltration coefficient
LDL	Low Density Lipoprotein
LFHD	Low Flux Hemodialysis
LMW	Low-molecular weight
LPS	Lipopolysaccharides
Mg/dl	Milligram per deciliter
Mg|L	Milligram Per Liter
mmol|l	Millimol per liter
MW	Molecular Weight
ng|ml	Nanogram per milliliter

PCT	Procalcitonin
PD	Peritoneal Dialysis
PEM	Protein-energy malnutrition
PEW	Protein-energy wasting
Pg/ml	Pictogram per milliliter
PTH	Parathyroid hormone
RRT	Renal replacement therapy
SD	Standard deviation
T	Time
TLC	Total Leucocytic Count
TMP	Transmembrane pressure
TNF	Tumour necrosis factor
TRACE	Time Resolved Amplified Cryptate Emission
UF	Ultrafiltration
URR	Urea reduction ratio
USA	United States of America

Abstract

Background Infections account for considerable morbidity and mortality in patients with chronic renal failure maintained on intermittent hemodialysis (HD). Several factors have been implicated in triggering infections, including catheter-related bacteremia or acquired immunity disturbances with impaired activation of T and B lymphocytes. **Research design** To evaluate the changes in the serum levels of PCT and its correlation to the traditional inflammatory marker CRP in hemodialysis patients **Subjects**: This prospective comparative study included 50 adult patients more than 18 years old, clinically stable with end stage renal disease on regular hemodialysis for at least 6 months, selected from hemodialysis unit in (Kom Hamada General Hospital-El Beheira Governorate -Egypt) after exclusion. **Results:** This study included 50 adult patients with ESRD on regular hemodialysis. The patients were divided into two groups according to the type of hemodialysis membrane **Conclusion:** PCT serum level decreased significantly (up to 85%) in hemodialysis patients after dialysis by high-flux membranes than low- flux, so the clinical usefulness of PCT might be limited in patients undergoing HD with high-flux membranes. **Recommendations:** The results from this study suggest that a specific reference range for PCT should be developed in patients with impaired renal function.

Key words: Procalcitonin, Inflammatory, Marker, Comparison, Between, High-flux, Low-flux Hemodialysis, ESRD

Introduction

Infections account for considerable morbidity and mortality in patients with chronic renal failure maintained on intermittent hemodialysis (HD). Several factors have been implicated in triggering infections, including catheter-related bacteremia or acquired immunity disturbances with impaired activation of T and B lymphocytes **(Montagnana et al.,2009).**

In patients on hemodialysis, inflammation is stimulated by acute-phase responses triggered by various patho-physiological mechanisms such as exposure to bacteria, endotoxins or viruses, and immunological phenomenon that occur because of the biocompatibility of the dialysis procedure, or metabolic and immunological disorders due to chronic renal failure per se, although PCT has been described as a new marker of inflammation, it has not been extensively studied in dialysis patients **(Akbulut et al., 2005).**

Diagnosis of infection in HD patients is challenging because the most used laboratory parameters may be non-specifically modified by uremia or HD. Accordingly C-reactive protein (CRP) is reportedly elevated in many patients with renal failure, even in the absence of manifest infections **(Herget-Rosenthal et al.,2001).**

The conventional inflammatory markers such as white blood cell count and erythrocyte sedimentation rate (ESR) levels are often affected by the uremia or by the hemodialysis process. A specific marker of bacterial infection in renal patients should distinguish infection from non infectious inflammatory disorders **(Dahaba et al.,2003)**.

Procalcitonin (PCT) is a 116-amino acid peptide with a low molecular weight of about 13 kDa. The serum PCT level in healthy individuals is under 0.3ng/ml. In the life-threatening septic condition due to severe bacterial infection, the serum PCT level exceeds 0.5 ng/ml, Herget-Rosenthal et al. utilized the cutoff point of 1.5ng/ml for detection of sepsis in hemodialytic patients **(Foushee et al., 2012).**

The principle of hemodialysis involves the clearance of solutes across a semi-permeable membrane through diffusion and ultrafiltration mechanisms. The utilized membranes are classified into two main groups: low-flux which is based on using dialyzers with low permeability for water and high-flux non celluloses membrane with increased permeability which is capable of moderate molecules between 10,000 to 15000 Dalton, including many of the inflammatory proteins, ß2microglobulin and lipoproteins **(Vanholder et al., 2008).**

High-flux dialysis membranes have larger pore sizes that may increase transportation of dialysate impurities or contaminants from the dialysate to the blood stream even when the dialysate quality complies with acceptable standards, although some evidence suggests that high-flux membranes may actively absorb endotoxins and impede their back-transfer from dialysate into the blood stream **(Schiffl, 2011).**

The type of dialysis membrane can affect the PCT levels. Hemodialysis with a high-flux membrane removes 30–80 % of PCT in the serum, and the influence lasts for more than 48 hours, although a low-flux membrane does not dialyze PCT **(Ichihara et al.,2016)**.