

**Neutrophil CD64 as an Early  
Diagnostic Marker in Neonatal Sepsis**  
**Protocol of Thesis**

*Submitted for Partial Fulfillment of Master Degree  
In Clinical and Chemical Pathology*

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قَالَ

سَبَّحَانَكَ لَا إِلَهَ إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ  
الْعَلِيمُ الْعَظِيمُ

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# List of Abbreviations

<b>Abbreviations</b>	<b>Full term</b>
<b>AAP</b> .....	American Academy of Pediatric
<b>ADC</b> .....	Analogue-to-Digital Conversion
<b>AKF</b> .....	Acute kidney Failure
<b>ALT</b> .....	Alanine Transferase
<b>ANC</b> .....	Absolute Neutrophil Count
<b>APRs</b> .....	Acute Phase Reactants
<b>APTT</b> .....	Activated Partial Thromboplastein Time
<b>ASUH</b> .....	Ain Shams University Hospital
<b>ASUSH</b> .....	Ain Shams University Specialized Hospital
<b>AUC</b> .....	Area Under the Curve
<b>C. albicans</b> ...	Candida albicans
<b>C3</b> .....	Complement 3
<b>CBC</b> .....	Complete Blood Count
<b>CD11b</b> .....	Cluster of Designation 11b
<b>CD14</b> .....	Cluster of Designation 14
<b>CD163</b> .....	Cluster of Designation 163
<b>CD64</b> .....	Cluster of Designation 64
<b>CDC</b> .....	Centre of Disease Prevention and Control
<b>CLSI</b> .....	Clinical and Laboratory Standards Institute
<b>CMV</b> .....	Cytomegalovirus
<b>CNS</b> .....	Central Nervous System
<b>CoNS</b> .....	Coagulase-Negative <i>Staphylococci</i>
<b>CPAP</b> .....	Continuous Positive Airway Pressure
<b>CR3A</b> .....	complement receptor 3 A
<b>CRP</b> .....	C-Reactive Protein
<b>CSF</b> .....	Cerebrospinal Fluid
<b>CSFs</b> .....	Colony stimulating factors
<b>CVP</b> .....	central venous pressure
<b>dC</b> .....	Delta Change
<b>DIC</b> .....	Disseminated Intravascular Coagulopathy
<b>DNA</b> .....	Deoxyribonucleic Acid
<b>E. coli</b> .....	<i>Escherichia Coli</i>
<b>EDTA</b> .....	Ethyl- Enediamine Tetraacetate
<b>EFF.</b> .....	Efficacy
<b>EOS</b> .....	Early Onset Sepsis

<b>ETT.....</b>	Endotracheal Tube
<b>FcγRI.....</b>	Fc-gamma receptor 1
<b>FISH.....</b>	Fluorescence In-Situ Hybridization
<b>FITC .....</b>	Fluorescein Isothiocyanate
<b>FN.....</b>	False Negative
<b>FP.....</b>	False Positive
<b>FSC.....</b>	Forward Scatter
<b>GA.....</b>	Gestational Age
<b>GBS.....</b>	Group B <i>Streptococcus</i>
<b>G-CSF.....</b>	Granulocyte Colony Stimulating Factor
<b>GIT.....</b>	Gastrointestinal Tract
<b>HAIs.....</b>	Healthcare Associated Infections
<b>HDL.....</b>	High Density Lipoprotein
<b>Hg.....</b>	Hemoglobin
<b>HIV .....</b>	Human Immunodeficiency Virus
<b>Hs-CRP.....</b>	Highly Sensitive C-Reactive Protein
<b>HSS.....</b>	Hematological Scoring System
<b>HTN.....</b>	Hypertension
<b>I/M ratio.....</b>	Immature/Mature ratio
<b>I: T ratio.....</b>	Immature: Total ratio
<b>IAP.....</b>	Intrapartum Antibiotic Prophylaxis
<b>ICAM-1.....</b>	Intercellular Adhesion Molecule 1
<b>IF-γ.....</b>	Interferon - Gamma
<b>IL-1.....</b>	Interlukin-1
<b>IL-3.....</b>	Interlukin-3
<b>IL-6.....</b>	Interleukin-6
<b>IL-8.....</b>	Interleukin-8
<b>ILO.....</b>	International Labor Organization
<b>IQR.....</b>	Interquartile Range
<b>ITGAM.....</b>	Integrin alpha M
<b>ITS.....</b>	Internal Transcribed Spacer
<b>LBW.....</b>	Low Birth Weight
<b>LDL.....</b>	Low Density Lipoprotein
<b>LOH.....</b>	Length Of Hospitalization
<b>LOS.....</b>	Late Onset Sepsis
<b>LPS.....</b>	Lipopolysaccharide
<b>MCV.....</b>	Mean Corpuscular Volume
<b>MDR.....</b>	Multidrug Resistant
<b>MFI.....</b>	Mean Fluorescent Intensity



<b>MHA</b> .....	Mueller-Hinton Agar
<b>MODS</b> .....	Multi-Organ Dysfunction Syndrome
<b>MPV</b> .....	Mean Platelet Volume
<b>MRI</b> .....	Magnetic Resonance Image
<b>MRSA</b> .....	Methicillin-Resistant <i>Staphylococcus</i> Aureus
<b>MSSA</b> .....	Methicillin-Susceptible <i>Staphylococcus</i> Aureus
<b>NEC</b> .....	Necrotizing Enterocolitis
<b>NICU</b> .....	Neonatal Intensive Care Unit
<b>NPV</b> .....	Negative Predictive Value
<b>NS</b> .....	Neonatal Sepsis
<b>OGD</b> .....	Obstetrics and Gynecology Department
<b>P value</b> .....	Probability value
<b>PAI-1</b> .....	Plasminogen activator inhibitor-1
<b>PBS</b> .....	Phosphate buffered saline
<b>PCR</b> .....	Polymerase Chain Reaction
<b>PCT</b> .....	Procalcitonin
<b>PDW</b> .....	Platelet Distribution Width
<b>PLT</b> .....	Platelet count
<b>PMNL</b> .....	Polymorph Nuclear Leukocyte
<b>POC</b> .....	Point Of Care
<b>PPHN</b> .....	Persistent Pulmonary Hypertension
<b>PPV</b> .....	Positive Predictive Value
<b>PROM</b> .....	Premature Rupture Of Membrane
<b>PT</b> .....	Prothrombin Time
<b>RBCs</b> .....	Red Blood Cells
<b>RDS</b> .....	Respiratory Distress Syndrome
<b>ROC</b> .....	Receiver Operating Characteristic
<b>ROM</b> .....	Rupture Of Membrane
<b>S. agalactiae</b> ....	<i>Streptococcus agalactiae</i>
<b>S. aureus</b> .....	<i>Staphylococcus</i> Aureus
<b>SIRS</b> .....	Systemic Inflammatory Response Syndrome.
<b>Spp</b> .....	Species
<b>SPS</b> .....	Sodium-polyanetholesulphonate
<b>SPSS</b> .....	Statistical Package for Special Sciences
<b>SSC</b> .....	Side Scatter
<b>T<sub>1</sub></b> .....	total ranks
<b>TAT</b> .....	Thrombin-antithrombin III complex
<b>TAT</b> .....	Turnaround Time
<b>TC</b> .....	Total Cholesterol

<b>TG.....</b>	Triglyseride
<b>TLC.....</b>	Total Leukocyte Count
<b>TN.....</b>	True Negative
<b>TNF-<math>\alpha</math>.....</b>	Tumor Necrosis Factor- $\alpha$
<b>TP.....</b>	True Positive
<b>tPA.....</b>	tissue Plasminogen Activator
<b>TPN.....</b>	Total Parenteral Nutrition
<b>TSA.....</b>	Trypticase Soya Agar
<b>TSB.....</b>	Tryptone Soya Broth
<b>UN.....</b>	United Nations
<b>USA.....</b>	United States of America
<b>UTI.....</b>	Urinary Tract Infection
<b>VLBW .....</b>	Very Low Birth Weight
<b>WBCs.....</b>	White Blood Cells
<b>WHO.....</b>	World Health Organization

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## INTRODUCTION

Sepsis in newborns is a common fatal disorder affecting 1.1-2.7% of all newborns (*Stoll et al., 2011*). In spite of extensive research and development in understanding and treatment of neonatal sepsis, sepsis continues to be a major source of morbidity and mortality in the neonatal population (*Lawn et al., 2006*).

Neonatal sepsis (NS) remains a diagnostic burden problem by showing minimal initial symptoms of subtle character, nonspecific manifestations, and diagnostic pitfalls. The clinical course can be fulminate and fatal if treatment is not commenced promptly. It is therefore crucial to establish early diagnosis and initiate adequate therapy (*Volker et al., 2013*).

Neonatal sepsis is classified into early-onset sepsis (EOS) within the first 72 hours of life and late-onset sepsis (LOS) afterwards (*Stoll et al., 2011*). Early-onset sepsis is most often related to perinatal factors including prolonged rupture of amniotic membranes, maternal colonization with group B  $\beta$  streptococcus (GBS) and maternal chorioamnionitis (*Ganatra et al., 2010*). Late-onset sepsis, diagnosed >72 hours after birth, is primarily hospital acquired and occurs more commonly in preterm infants (*Bizzarro et al., 2005*).