



Ain shams University  
Faculty of Science  
Microbiology Department



# **Real Time PCR and Serological Assays for diagnosis and monitoring of Human Cytomegalovirus Infection in Immunocompromised Pediatric Cancer Patient**

**A Thesis**

Submitted In the partial fulfillment of the requirements for the degree of  
Master of Science (M.Sc.) In Microbiology

By

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

اقْرَأْ بِاسْمِ رَبِّكَ الَّذِي خَلَقَ ١

خَلَقَ الْإِنْسَانَ مِنْ عَلَقٍ ٢

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(صدق الله العظيم)



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## Approval Sheet

### Real Time PCR and Serological Assays for diagnosis and monitoring of Human Cytomegalovirus Infection in Immunocompromised Pediatric Cancer Patient

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## DEDICATION

رب أوزعني أن أشكر نعمتك التي أنعمت علي و علي والدي  
و ان أعمل صالحا ترضاه و أدخلني برحمتك في عبادك الصالحين

*My work is dedicated to:*

*Allah and I hope to accept it from me and to my father and my*

*mother to whom I owe my life.*

*Also I dedicate this work to my sisters and my brothers.*

*Nasra fathy Abd el fattah*

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*Thank you*

*Nasra fathy Abd el fattah*

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## LIST OF ABBREVEATIONS

<b>AB</b>	<b>Antibody</b>
<b>AL</b>	Acute leukemia
<b>ALC</b>	Absolute lymphocytic count
<b>ALL</b>	acute lymphoblastic leukemia
<b>ALT</b>	Alanine aminotransferase
<b>AMC</b>	Absolute Monocytic Count
<b>AML</b>	acute myeloid leukemia
<b>ANC</b>	Absolute neutrophil count
<b>AST</b>	Aspartate aminotransferase
<b>AUC</b>	Area Under Curve
<b>AVE</b>	Viral elution buffer
<b>AVL</b>	Viral lysis buffer
<b>AW1</b>	Wash buffer 1
<b>AW2</b>	Wash buffer 2
<b>BFM</b>	(German Berlin-Frankfurt-Muenster 95) Treatment protocol
<b>BMA</b>	Bone marrow aspirate
<b>BMT</b>	bone marrow transplantation
<b>CBC</b>	Complete blood count
<b>CD13</b>	Cluster of Differentiation 13
<b>CD33</b>	Cluster of Differentiation 33
<b>CI</b>	Confidence Interval
<b>CNS</b>	Central Nerves Sytem
<b>CSF</b>	Cerebrospinal Fluid
<b>CT</b>	Cycle Threshold
<b>DFN</b>	Duration of febrile neutropenia

<b>DFS</b>	Disease free survival
<b>DI</b>	Delayed Intensification
<b>DNA</b>	Dexoyribonucleic acid
<b><math>\Delta Rn</math></b>	Delta of normalized reporter value is the fluorescent signal from SYBR Green
<b>DS</b>	Down syndrome
<b>EBV</b>	Epstein-Barr virus
<b>EDTA</b>	Ethylene Diamine Tetra Acetic acid
<b>EG</b>	Early gene
<b>ELB</b>	Erythrocyte Lysis Buffer
<b>ELIZA</b>	enzyme-linked immune sorbent assay
<b>ESR</b>	Erythrocyte sedimentation rate
<b>et al</b>	et alter
<b>FN</b>	Febrile Neutropenia
<b>GCV</b>	Ganciclovir
<b>g/dl</b>	gram per deciliter
<b>Gp</b>	Glycoproteins
<b>HCMV</b>	human Cytomegalovirus
<b>HGC</b>	Hemoglobin concentration
<b>HHV5</b>	human herpes virus type 5
<b>HHV7</b>	human herpes type 7 virus
<b>HIV</b>	human immunodeficiency virus
<b>HSV1</b>	Herpes simplex type1
<b>HSV2</b>	Herpes simplex type2
<b>IE</b>	Immediate early gene
<b>IG</b>	Immunoglobulin
<b>IGF</b>	Insulin Growth Factor
<b>IgG</b>	Immunoglobulin G

<b>IgM</b>	Immunoglobulin M
<b>IPT</b>	Immunophenotyping
<b>IU/L</b>	International unit per liter
<b>Kbp</b>	kilobase pairs
<b>KFT</b>	kidney function test
<b>KSHV</b>	Kaposi's sarcoma virus(herpes virus type 8 )
<b>LDH</b>	lactic dehydrogenase
<b>LFT</b>	liver function test
<b>Log CO</b>	Logarithm of Concentration
<b>MDACC</b>	The university of Texas M.D.Anderson Cancer Center
<b>mg/dl</b>	milligram per deciliter
<b>MRD</b>	Minimal Residual Disease
<b>mRNA</b>	messenger ribonucleic acid
<b>NC</b>	Negative control
<b>NPV</b>	Negative Predictive Value
<b>OS</b>	Overall survival
<b>PBS</b>	phosphate buffer saline
<b>PC</b>	Positive control
<b>PCR</b>	Polymerase chain reaction
<b>PLT</b>	Platelet
<b>PPV</b>	Positive Predictive Value
<b>Pp65</b>	phosphoprotein 65
<b>RBCs</b>	Red blood cells
<b>ROC</b>	Receiver Operating Characteristic Curve
<b>RTQ-PCR</b>	Real-time quantitative polymerase chain reaction
<b>SCT</b>	Stem Cell Transplantation
<b>St. error</b>	Statistic error

<b>SGOT</b>	Serum Glutamic Oxaloacetic Transaminase
<b>SGPT</b>	Serum Glutamic Pyruvic Transaminase
<b>TAE</b>	Tris-Acetate EDTA buffer
<b>T. Bil</b>	Total bilirubin
<b>TLC</b>	Total Leukocyte count
<b>TMB</b>	Tetra methyl Benzidine
<b>VZV</b>	varicellazoster virus
<b>WBCS</b>	White Blood Cells
<b>WHO</b>	World Health Organization