Early Neurological Deterioration in Acute Ischemic Stroke: potential Predictors, causes and relation to infarct growth

Thesis

Submitted for Partial Fulfillment of MD Degree of Neurology

By

Ehab AbdElbaset Abdulsamad

M.B.B.Ch., M.Sc. Neuropsychiatry

Supervised by

Prof. Dr. Samia Ashour Mohamed Helal

Professor of Neurology

Faculty of Medicine - Ain Shams University

Prof. Dr. Hany Amin Aref

Professor of neurology

Faculty of medicine- Ain Shams University

Prof. Dr. Ayman Mohammed Nassef

Professor of neurology

Faculty of medicine- Ain Shams University

Prof. Dr. Ramez Reda Moustafa

Assistant Professor of Neurology

Faculty of Medicine-Ain Shams University

Prof. Dr. Mohammed Amir Tork

Assistant professor of Neurology

Faculty of Medicine - Ain Shams University

2019

بسم الله الرحمن الرحيم

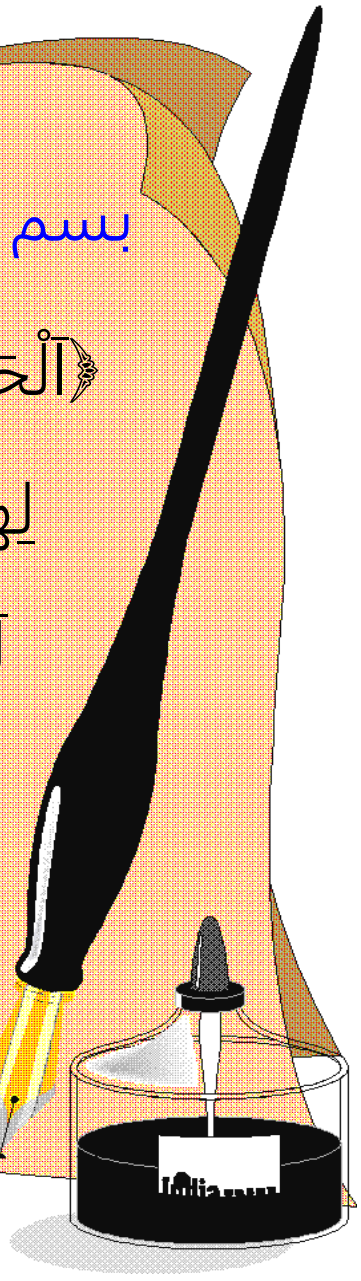
﴿اَلْحَمْدُ للّهِ الَّذي هَدانا

لِهذا وَما كُنّا لِنَهْتَدِيَ

لَوْلا اَنْ هَدانَا اللّهُ﴾

صدق الله العظيم

(سورة الأعراف: ايه ٤٣)



ACKNOWLEDGMENT

First and foremost, thanks to "***Allah***, whose magnificent help is the first factor in every thing we can do in our life.

I would like to express my deep gratitude and sincere thanks to ***Prof. Dr. Samia Ashour Mohamed Helal***, Professor of neurology, Ain Shams University, for great help offered to me and endless scientific support all through this work.

My warmest thanks to ***Prof. Dr. Hany Amin Aref***, Professor of neurology, Ain Shams University, for submitting his effort and skill to the conduction of this work along with the generous provision of his vast experience.

Also, my profound gratitude to ***Prof***. ***Dr***. ***Ayman Mohamed Nassef***, Professor of neurology, Ain Shams University, for continuous guidance and support.

I am really thanks to ***Prof. Dr. Ramez Reda Moustafa***, Professor of neurology, Ain Shams University, for his advice, scientific support and continuous effort sincere.

I would like to thank ***Prof. Dr. Mohammed Amir Tork,*** Professor of neurology, Ain Shams University, for scientific support and continuous effort.

My great thanks and gratitude to all patients who were sharing in this work.

Lastly but not least, my deepest gratitude to my family especially ***Father and Mother*** for their unflagging love and support throughout my life. I owe my loving thanks to my ***wife***, without their encouragement it has been impossible to me to finish this work, my lovely kissing to my kids ***(Mohammed, Hager and Mariam)***.

Finally, I can't forget all the favors of ***Prof. Gamal Youssof,*** *(Professor of Neurology, KFS general hospital)* for his help and support greatly guided me all through my work

Contents

List of Abbreviations

ACA	Anterior Cerebral Artery
ACWSI	Anterior Cortical Watershed infarction
AF	Atrial Fibrillation
AIS	Acute Ischemic Stroke
ALT	Alanine Transaminase
AST	Aspartate Transaminase
BA	Basilar Artery
BBB	Blood Brain Barrier
BP	Blood Pressure
BUN	Blood Urea Nitrogen
CA	Calcium
CCA	Common Carotid Artery
CPP	Cerebral Perfusion Pressure
CT	Computed Tomography
DBP	Diastolic Blood Pressure
DM	Diabetes Mellitus
DNA	Deoxyribo Nucleic Acid
DVT	Deep Venous Thrombosis
DWI	Diffusion-Weighted Imaging
DWI	Diffusion-Weighted Image

DWSI	Deep Watershed Infarction
ECAS	Extracranial Arterial Stenosis
EEG	Electroencephalogram
EF	Ejection Fraction
END	Early Neurological Deterioration
EPSS	European Progressing Stroke Study
SSS	Scandinavian Stroke Scale
NIHSS	National Institute of Health Stroke Scale
EVT	Endovascular Treatment
EXPRESS	Existing Preventive Stroke Study
FLAIR	Fluid Attenuated Inversion Recovery
FSE	Fast Spin Echo
GCS	Glasgow Coma Scale
HB	Hemoglobin
HbA_{1C}	Glycosylated Hemoglobin
HDL	High Density Lipoprotein
HS	Highly Significant
HTN	Hypertension
IAT	Intra Arterial Thrombolysis
ICA	Internal Carotid Artery
ICAS	Intracranial arterial Stenosis
ICU	Intensive Care Unit
IHD	Ischaemic Heart Disease

INR	International Normalized Ratio
IQR	Inter-Quartile Range
K	Potassium
LAD	Left Arial Diameter
LDL	Low Density Lipoprotein
LT	Left
MCA	Middle Cerebral Artery
MI	Myocardial Infarction
MRA	Magnetic Resonance Angiography
MRI	Magnetic Resonance Imaging
MRS	Modified Rankin Scale
MT	Mechanical Thrombectomy
MTT	Mean Transit Time
NA	Sodium
NADPH	Nicotinamide Adenine Dinucleotide Phosphate
NCSE	Non Convulsive Status Epileptics
ND	No Deterioration
NS	Non Significant
PCA	Posterior Cerebral Artery
PCWSI	Posterior Cortical Watershed
PLT	Platelets
PSV	Peak Systolic Velocity

PVEEG	Prolonged Video EEG
PWI	Perfusion Weighted Image
RBS	Random Blood Sugar
RNA	Ribo Nucleic Acid
ROS	Reactive Oxygen Species
RT	Right
rT-PA	Recombinant Tissue Plasminogen Activator
S	Significant
SAP	Stroke Associated Pneumonia
SBP	Systolic Blood Pressure
SD	Standard Deviation
SE	Status Epilepticus
sICH	Symptomatic Intracerebral Hemorrhage
TCD	Transcranial Doppler
TG	Triglycerides
TIA	Transient Ischemic Attack
TLC	Total Leucocytic Count.
TOF	Time-Of-Flight
TTP	Time To Peak
UTI	Urinary Tract Infection
VA	Vertebral Artery
WSI	Watershed Infarction

List of Tables

List of Figures

Early Neurological Deterioration in Acute Ischemic Stroke: potential Predictors, causes and relation to infarct growth

Abstract

Background: Worsening of acute stroke early in its course (within 48–72 h of its onset) is a common occurrence and has potentially serious short term and long term consequences. The incidence of early neurological deterioration (END) among hospitalized patients varies widely in different studies between 13% and 38%.

Aim of the Work: To define incidence and timing of END in relation to acute ischemic stroke (AIS) onset. To identify possible causes and predictors associated with END. To assess the relation between END and the patient functional level at three months post stroke.

Patients and Methods: Three hundred patients were recruited into this hospital prospective comparative study. Clinical history, laboratory indices, structural brain imaging, Magnetic Resonance Angiography (MRA) and Carotid Duplex ultrasonography were done. Patients were examined on NIHSS and Glasgow Coma Scale (GCS) in day 1, 2, 3 and patients with END did a follow up (MRI diffusion film or CT brain) at day4 or 5 and all patients were followed up by Modified Rankin scale (MRs) at three-month post stroke.

Results: Of the Three hundred patients included in the study, the incidence of END was 16.7%. The median NIHSS on admission was 9.25. END was associated with long duration of DM (P 0.012), IHD (p 0.015), AF (p 0.048), severe stroke (p 0.0044), low blood pressure on admission (p 0.0079), high uric acid (p 0.033) and MCA occlusion (p 0.0007). END was associated with significant increase in MRS at 3 month ($p<0.0001$) and mortality rate (44% vs 4.4). Patients with END are more prone for aspiration pneumonia (p 0.0001) and hemorrhagic transformation.

Conclusion: Early neurological deterioration is a frequent complication after acute stroke, with a poor short-term prognosis. This study provides that hyperglycemia, hyperuricemia and cardiac disease (IHD and AF) may increase the risk of END.

Keywords: Early Neurological Deterioration, Acute Ischemic Stroke.

Worsening of acute stroke early in its course (within 48–72 h of its onset) is common and has potentially serious short term and long term consequences for the patient ***(Thanvi et al., 2008)***. Various terms, such as ‘‘progressive stroke’’, ‘‘stroke in evolution’’, and ‘‘stroke in progression’’ have been used **to** describe this worsening **(Sumer et al., 2003)**. Now most commonly termed early neurological deterioration (END) ***(Helleberg et al., 2014)***.

In one of the earlier studies, neurologic worsening was determined to be present if worsening of the neurologic condition, including consciousness level, was observed by trained neurologists and nurses at and after admission to the stroke unit ***(Yamamoto et al., 1998)***.

END was defined in the European progressing stroke study (EPSS) as any significant neurological deterioration from baseline to 72 hours ***(Brichel et al., 2004)***.

A significant neurological deterioration was primarily defined as a decrease in the Scandinavian stroke scale (SSS) items score for consciousness, speech, gaze, arm, or leg by at least 2 points. Consciousness was given precedence over the other signs ***(Brichel et al., 2004)***.