COMPUTARISED TOMOGRAPHY IN THE DIAGNOSIS OF HEAD INJURIES

Thesis submitted for partial fullfilment

for Degree of M.D. Radiodiagnosis

By

Ismail Mohamed Ibrahim

(M.B.B.Ch., M.S. Radiodiagnosis)

SUPERVISED BY

Major General Dr. Ahmed Fouad Elnady
Prof. Consultant Radiodiagnosis
Medical Military Academy

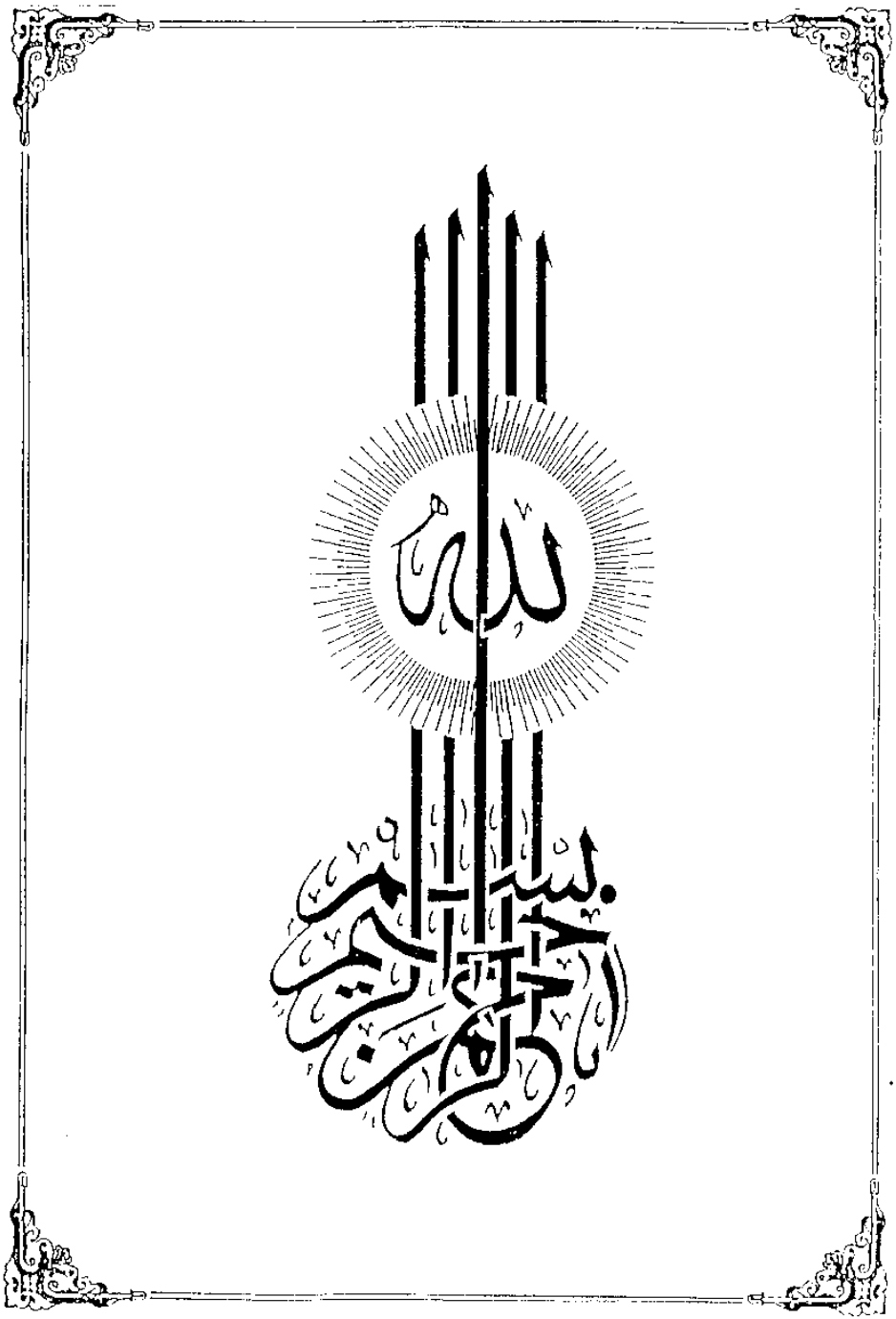
Prof. Dr. Gamal A. Kader Youssif
Prof. of Radiodiagnosis,
Faculty of Medicine,
Ain Shams University

FACULTY OF MEDICINE
AIN SHAMS UNIVERSITY
CAIRO
1985

2

TO MY LOVELY FAMILY

Sonia and Mohamed



ACKNOWLEDGEMENT

Several persons are involved in the process and completion of this thesis; they provided either scientific or moral support. To all those I bear true feelings of sincere obligation.

Special mention of acknowledgement should be given to those who are directly concerned.

I would like to express my deepest gratitude to Prof. Dr. ***Gamal A. Kader Youssif,*** *Professor of Diagnostic Radiology, Ain Shams University, Cairo, Egypt, for his guidance, supervision and true advice during the preparation of this thesis.*

My thanks are due to Major General Dr. ***Ahmed Fouad Elnady,*** *Prof. Consultant Radiodiagnosis, Meldical Military Academy for his genuine advice and choosing this subject for research.*

Genuine gratitude is due to my godfather and godfearing freind and life guide Prof. Dr. ***Anas El Naggar*** *Professor of Medical Radiation Biology, Egyptian Atomic Energy Establishment; for his meticulous revision of this work.*

My much appreciation and thanks is forward to Dr. **M. medhat El Shafei** Assistant Professor of Medicine, Ain Shams University, for his unfailing encouragement to finish this thesis.

I am greatly indebted to Dr. **Hosam Bassiyouni,** Head of Diagnostic Radiology Department, Dr. **M. Erfan** General Hospital in Jeddah, S.A. for his endless advices and facilities to complete this work.

My deepest gratitude go to Dr. **M. Narmar Azzam** Consultant and Head of Neurosurgical Department, Dr. **M. Erfan** General Hospital in Jeddah, S.A. for paving my way to do this research.

My warmest thanks are due to staff radiographer of C.T. Unit, Dr. **M. Erfan** General Hospital in Jeddah, S.A. for helping me to collect the cases of my research.

Finally, and most importantly, I would like to acknowledge the immeasurable debt of gratitude I ow to Dr. **M. Erfan** Consultant and Head of Psychiatry Department and the Director of the hospital, for giving me the facilities to be an attendant in his hospital and to do my thesis there.

TABLE OF CONTENTS

Introduction

INTRODUCTION AND AIM OF WORK

The advent of computarised tomography and it's application in radiodiagnosis started in the early seventies. Initially it involved brain scanning, and was further developed to be applicable to the whole body.

Computarised tomography is a relatively non-invasive technique in comparison with other methods of investigation such as angiography and air contrast studies; it is easy to perform with minimal patient handling. It has therefore become widely accepted as a major tool in the field of radiodiagnosis inspite of it's high cost.

Computarised tomography has revolutionized the diagnostic evaluation of intracranial disorders, particularly in head trauma (32). Due to it's unique capability for detecting the subtle differences in soft tissue density, computarised tomography has proven valuable in the detection as well as differentiation of the various traumatic intracranial lesions, separating intra-from extra-cerebral hematomas, and differentiating

post-traumatic oedema from infarction and areas of contusion (32, 45).

The incidence of detection of abnormal findings by computarised tomography in patients with head trauma has varied ranging from 37% (5) to 73% (32). However, these figures do not retract the usefulness of computarised tomography in evaluating head trauma, since the incidence of computarised tomography abnormalities detected depends upon the easy accessibility of computarised tomography scanner, the patient population selected, and the severity of head trauma.

Considering that the above figures were based on studies performed on older scanners, with 4 minutes scanning time and fixed section thickness of 13 mm.; the yield of useful information with the present generation of scanners should be significantly higher. More recent scanners have a variety of improvements, such as better spatial and contrast resolution, variable section thickness to about 2 mm., and the ability to reconstruct images in sagittal and coronal planes. Subsequent larger series of reports have shown that

the incidence of abnormal C.T. findings in patients with severe head injury and neurological deficits ranges between 50% and 70% (17, 31, 34, 45).

Computarised tomography of the head allows rapid evalution of patients with acute head injuries. Moreover, computarised tomography aids in surgical planning, prognosticating the outcome and recovery time, and monitoring non-surgical injuries.

The management of acute head injury offers diagnostic and therapeutic challenges to neurosurgeons. The treatment of these patients should consist of logical, thorough procedures that are organized and expediently executed (37). The procedures should be flexible enough to allow sound clinical decision-making, specially if other organ systems are involved. It is well accepted that the primary objectives in treating acute head injury include immediate resuscitation and stabilization of the patient and early recognition and surgical treatment of expanding intracranial mass lesion (8, 10, 29). Computarised tomography of the head greatly assists in achieving these objectives.

Patients who sustain a head injury have a clinical status of not following commands, or worse, have a 25% or greater incidence of a major intracranial mass lesion (10, 22, 29, 35). This means that the burden is on the neurosurgeon to deal properly with these lesions. Furthermore, the management should be done as rapidly as possible, since, if a mass lesion is present, the patient is subject to the potential danger of sudden clinical deterioration.

There is no doubt that computarised tomography is the diagnostic procedure of choice for identifying such lesions. Any patient with head trauma who presents upon admittance to hospital signs of neurological dysfunction should undergo computarised tomogrphy. Neurological dysfunction includes any alteration in mental status (disorientation, drowziness, etc.), as well as localising or lateralising signs (hemiparesis, pupillary dilatation, etc.). Any patient who will not speak, follow commands, open eyes to voice, or move purposefully to pain should also undergo computarised tomography, examination without question.

The time of performance of computarised tomography depends on the patient's stability in respect to other body system injuries, as well as on his neurologic condition. if the patient has no other associated injuries and is comatose or has lateralizing neurologic signs consistent with a unilateral mass lesion, the patient should be scanned immediately after initial resuscitation. If the patient has no other associated injuries and his neurologic condition is also stlable (i.e., the patient is awake, but with altered mental status), there is less urgency for an emergency scan.

The patient may undergo complete evaluation in the admission area so long as frequent neurologic checks are done every 15 minutes. Computarised tomography scans should be obtained within 1-1½ hours of admission. This same plan applies to patients who have other body system injuries and are neurologically stable.

In the multitrauma victim, it may be necessary to control any associated problems before the patient

is transported to the radiology department. The biggest dilemma is the patient who suffers both life-threatening associated injuries (i.e. haemo-and/or pneumothorax, rigid distended abdomen; etc.) as well as a critical neurological status (comatose; unilateral decerebration; dilated fixed pupil or pupils; etc.). The ideal solution is to have the computarised tomography scanner in the admission area, where stabilization of the patient can be continued while the patient is being scanned. Howelver, this is luxury and rarley accessible. In such cases, one of two things can be done. First, one can wait until the immediate threat of cardiovascular or cardiopulmonary danger is under control and then perform a computarised tomography. This line of management is usually not desirable nor in the patient's best interest. The other alternative is to resort to another form of immediate diagnostic procedure of intracranial lesions as percutaneous (direct) one-shot carotid angiography. This second line of management is done in patients who are too critically injured to move from the resuscitation area and may have an intracranial lesion that could cause a neurological death in a short period of time.

The reasons for preferring computarised tomography over any other available diagnostic test are evident. Computarised tomography is rapid, non invasive and safe to perform. Computarised tomography gives an actual picture of the intracranial pathology, thus avoiding some of the "guess work" involved with other diagnostic tests. Computarised tomography differentiates between intraparenchymal blood and brain swelling or oedema.

Consequent upon all previous considerations regarding the various merits and advantages of computarised tomography; the need for an evaluative study of this technique in the diagnosis of head injuries become very demanding. The present study is therefore an attempt to evaluate the technique of computarised tomography in the diagnosis of a highly selected emergency type of traumatology, namely head injuries.

In the text of the thesis, elaborate consideration will be given to the various aspects underlying the scientific and medical rationale for the evaluation of the application of computarised tomography as a diagnostic facility in the radiology of head injuries.

Review of Literature