THEEFFECT OF DIAGNOSTIC ULTRASOUND ON KIDNEY FUNCTIONS

Thesis
Submitted in Partial Fulfilment of
The M. S degree in Internal Medicine.
Presented By

Hanem Said Rabie

M. B. B. CH.

Supervised By

Professor Dr. Yehya Mahran

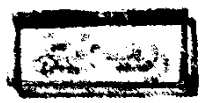
Professor of Internal Medicine

Professor Dr. Wahid El Said

Professor of Internal Medicine

Professor Dr. Sawsan Hosny Hamza

Professor of Clinical Pathology



Dr. Emad Barrakat

Lecturer in Medicine

Faculty of Medicine

Ain Shams University

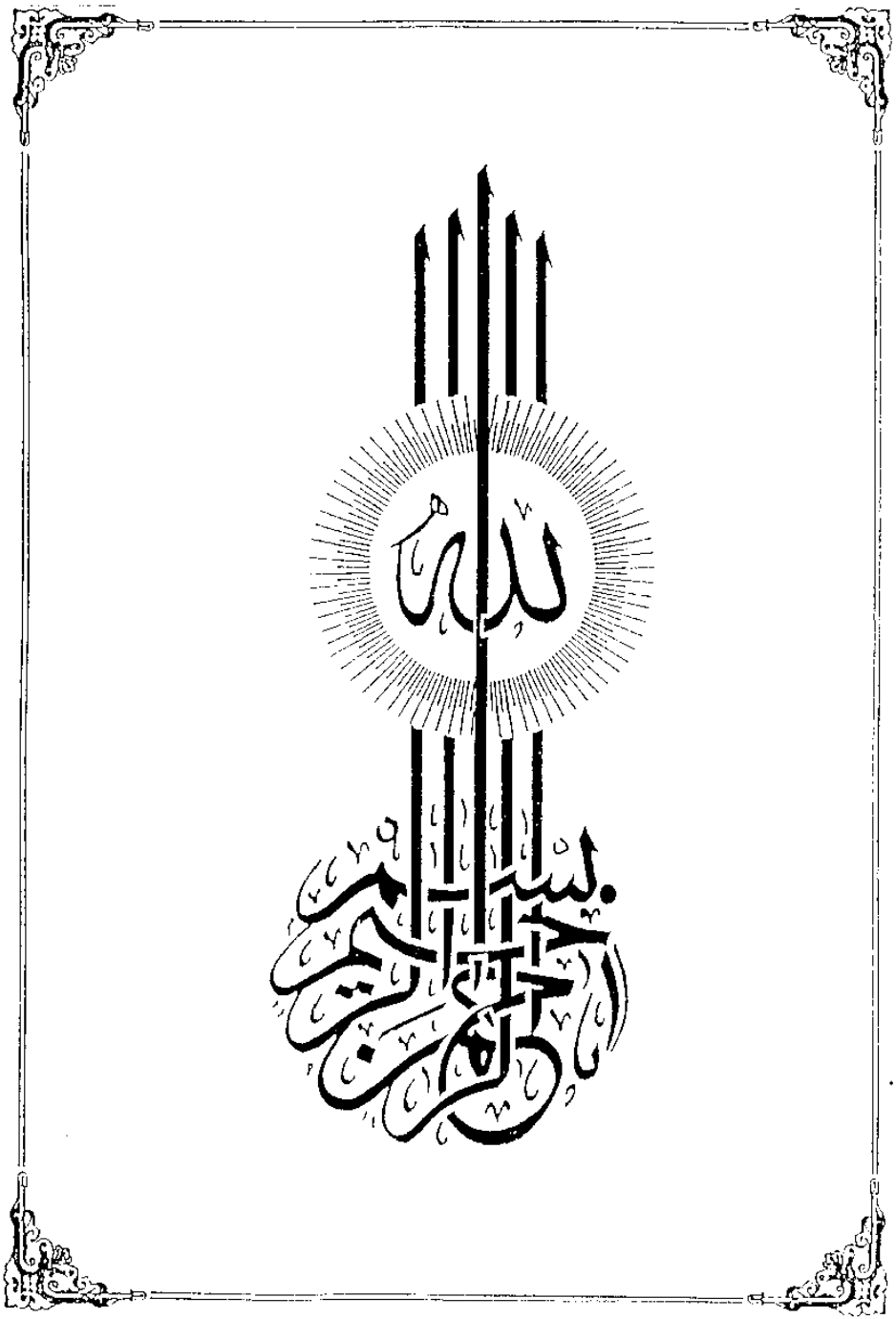
1986

بسم الله الرحمن الرحيم

وقل اعملوا

فسيرى الله عملكم ورسوله والمؤمنون

صدق الله العظيم



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Introduction

I N T R O D U C T I O N

The use of ultrasound devices for medical diagnosis has experienced a phenomenal growth in recent years. Ultrasonic studies have become an accepted and accepted part of medical practice.

More information is needed on the effects of low intensity ultrasound, the effects of pulsed ultrasound, the relationship between peak intensities and average intensities of pulsed ultrasound, the possibility of cumulative effects, and the possibility of long - term effects. Although there is presently no evidence to indicate that diagnostic ultrasound involves a significant risk, the evidence is insufficient to justify an unqualified claim of safety. The potential of acute adverse effects has been systematically explored, and the potential for long - term effects has been virtually ignored. In the meantime, prudent public health policy calls for judicious use of diagnostic ultrasound as low as practicable, consistent with its intended

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Review of Literature

Ultrasonography : Introduction

Ultrasound [illegible]

Introduction:

Definition:

It is one of the imaging procedures utilizing high frequency sound waves (more than 20,000 Hertz) (Carlsen, 1975). It provides a unique method for visualization of soft tissue anatomic structures (Zaczebski, 1983).

To understand the definition and the principles of ultrasound, we have to know some aspects of its physics.

Frequency of sound:

The sound frequency is the number of oscillations per second that the particles in the medium make as they vibrate about their rest position. The unit for frequency is cycles per second or Hertz. One Hertz= one cycle per second. The human ear can detect sound waves with a frequency ranging from 20 to 20,000 Hertz. Sound waves with a frequency of more than 20,000 Hertz are known as ultrasound (Carlsen, 1975).

Piezoelectric effect:

Piezo is derived from the Greek word to press and substance possessing piezoelectric qualities (such as

quartz crystal) change their size and shape under the effect of an electric current. It is this expansion and contraction of the crystal which results in generation of ultrasound waves. The reverse effect occurs when the waves are directed against a crystal leading to the production of an electric current (Hassani, 1976).

Pressure amplitude was defined as the maximum increase or decrease in the pressure relative to ambient conditions in the absence of sound wave.

A coustic impedence:

The acoustic impedence of a medium is the product of the density of a material and the speed of sound in that material. The significance of this quantity is its role in determining the amplitude of reflected and transmitted waves at an interface.

Reflection:

Whenever an ultrasound beam is incident on an interface formed by two materials having different acoustic impedences, some of the energy in the beam will be reflected and the remainder transmitted. The amplitude of the reflected wave depend on the difference between the acou-

stic impedence of the materials forming the interface. Complete reflection occurs at air interfaces which explain the need for a coupling medium, such as gel or oil, between the ultrasound transducer and the patient during ultrasound examination. This coupling material ensures that no air is trapped between the trasducer and the skin surface, thereaby providing good sound transmission into the patient. Interfaces characterized by a large difference in acoustic impedences reflect more of the incident beam energy than do interfaces where the acoustic impedence difference is small.

Attenuation of ultrasound beams in tissue:

As a sound beam traverses tissue, its amplitude and intensity are reduced as a function of distance. This reduction in amplitude (or intensity) with distance is referred to as attenuation. Sources of attenuation may be reflection and scatter of sound at tissue interfaces or absorption, whereby acoustic energy is converted to heat energy. Attenuation in soft tissues is highly dependent on the ultrasound frequency. In most cases attenuation is nearly proportional to the frequency (Zagzebski, 1983).

Construction of an ultrasound apparatus:

The principle of an ultrasound apparatus is to reflect a fine beam of high frequency sound when impinging on substances of different densities. The echoes which penetrate into the body. These are collected and recorded as electrical charges (Sherlock, 1981).

Blitz (1971), reported that when a pulse of high frequency sound wave is transmitted into the body, as the wave front advances, reflections of sound occur at the tissue interfaces and the returning echoes can be recorded by the same transducer that generated the sonic wave. The reflected echoes are recorded on a cathode-ray oscilloscope as pulses of varying amplitudes (A-mode) for analysis. The A-mode technique was replaced by the B (brightness) mode by introduction of intensity modulation limited to two dimensional display with the use of [illegible] scanning arm. B-scan ultrasound diagnosis was [illegible] as a non-invasive imaging method for [illegible].

The basic parts of an ultrasound apparatus are (Hassani, 1976):