

Chapter One

introduction

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1.1Introduction:

computed tomography (x-ray CT) is a technology that uses computer-processed x-rays to produce topographic images (virtual 'slices') of specific areas of the scanned object, allowing the user to see what is inside it without cutting it open. CT combines a series of X-ray views taken from many different angles and computer processing to create cross-sectional images of the bones and soft tissues inside your body. (Hounsfield, 1976) .

Digital geometry processing is used to generate a three-dimensional image of the inside of an object from a large series of two-dimensional radiographic images taken around a single axis of rotation. The resulting images can be compared to looking down at single slices of bread from a loaf. Your doctor will be able to look at each of these slices individually or perform additional visualization to view your body from different angles. In some cases, CT images can be combined to create 3-D images. CT scan images can provide much more information than do plain X-rays. The cross-sectional images generated during a CT scan can be reformatted in multiple planes, and can even generate three-dimensional images. These images can be viewed on a computer monitor, printed on film or transferred to a CD or DVD.(American Association of Physicists in Medicine: AAPM, 2010).

A major advantage of CT is its ability to image bone, soft tissue and blood vessels all at the same time. Unlike conventional x-rays, CT scanning provides very detailed images of many types of tissue as well as the lungs, bones, and blood vessels. CT examinations are fast and simple; in emergency cases, they can reveal internal injuries and bleeding quickly enough to help save lives .CT has been shown to be a cost-effective imaging tool for a wide range of clinical problems. CT is less sensitive to patient movement than MRI.CT can be performed if you have an implanted medical device of any kind, unlike MRI.CT imaging provides real-time imaging, making it a good tool for guiding minimally invasive procedures such as needle biopsies and needle aspirations of many areas of the body, particularly the lungs, abdomen, pelvis and bones. (Beekman and Hutton, 2007; Townsend, 2008).

A diagnosis determined by CT scanning may eliminate the need for exploratory surgery and surgical biopsy. No radiation remains in a patient's body after a CT examination. X-rays used in CT scans should have no immediate side effects.

Medical imaging is the most common application of x-ray CT. Its cross-sectional images are used for diagnostic and therapeutic purposes in various medical disciplines. Since its introduction in the 1970s, CT has become an important tool in medical imaging to supplement x-rays and medical ultrasonography. It has more recently been used for preventive medicine or screening for disease, for example CT colonography for patients with a high risk of colon cancer, or full-motion heart scans for patients with high risk of heart disease. .one of the fastest and most accurate tools for examining the chest, abdomen and pelvis because it provides detailed, cross-sectional views of all

types of tissue.(Almen et al., 2008).

Used to examine patients with injuries from trauma such as a motor vehicle accident. Performed on patients with acute symptoms such as chest or abdominal pain or difficulty breathing.

often the best method for detecting many different cancers, such as lymphoma and cancers of the lung, liver, kidney, ovary and pancreas, since the image allows a physician to confirm the presence of a tumor and measure its size, precise location and the extent of the tumor's involvement with other nearby tissue.

An examination that plays a significant role in the detection, diagnosis and treatment of vascular diseases that can lead to stroke, kidney failure or even death. CT is commonly used to assess for pulmonary embolism (a blood clot in the lung vessels) as well as for aortic aneurysms. (Almen et al., 2008).

invaluable in diagnosing and treating spinal problems and injuries to the hands, feet and other skeletal structures because it can clearly show even very small bones as well as surrounding tissues such as muscle and blood vessels.

In pediatric patients, CT is rarely used to diagnose tumors of the lung or pancreas as well as abdominal aortic aneurysms. For children, CT imaging is more often used to evaluate:

Lymphoma, neuroblastoma, kidney tumors, congenital malformations of the heart,

kidneys and blood vessels.

The CT scan have many type according to number of slits we have 2, 4, 8, 16, 64, 128. We will use dual and 8 CT scanner slices.

In Dual Source CT Moving beyond the simple adding of detector rows, dual Source scanners use two X-ray sources and two detectors at the same time. use to color coding of contrast material/Virtual non-contrast Images , pulmonary perfusion and ventilation Imaging , differentiation of tendons and ligaments , differentiation of kidney stones , in angiography , but in 4slice CT scanner that offers you multi-detector CT capabilities. This system has been designed with the Nightspeed VCT technology that will allow you to perform your scans with applications that are not possible with a single-slice CT scanner. (Beekman and Hutton, 2007; Townsend),

2008)

1.1.1 The Dose:

A dose of medical radiation is not like a dose of medicine. When it comes to radiation dose, there are different types of and units of measurement.

The first type is **absorbed dose**: it is the concentration of energy deposited in tissue as a result of an exposure to ionizing radiation. Note: In this case, it means the energy absorbed by human tissue.

X-rays, unlike sunlight, can penetrate deep into the body and deposit energy in internal organs. X-rays can even pass through a person's body.

Absorbed dose describes the intensity of the energy deposited in any small amount of

tissue located anywhere in the body.

The unit of measurement for absorbed dose is the milligram (mGY).

If you have a CT of your upper abdomen, the absorbed dose to your chest is very low, because it has only been exposed to a small amount of scattered radiation. The absorbed dose to your stomach, pancreas, liver and other organs is greatest, because they have been directly exposed. (Leitz et al., 1995).

The sound type is **Equivalent dose**: it is an amount that takes the damaging properties of different types of radiation into account. (Not all radiation is alike.)

The difference between absorbed dose in tissue and equivalent dose: in Absorbed dose tells us the energy deposit in a small volume of tissue. but Equivalent dose addresses the impact that the type of radiation has on that tissue.

Because all radiation used in diagnostic medicine has the same low-harm potential, the absorbed dose and the equivalent dose are numerically the same. Only the units are different. For diagnostic radiation: The equivalent dose in milliSievert (mSv) = the absorbed dose in mGy.

The thirdly type is **Effective dose**: it is a calculated value, measured in mSv that takes three factors into account:

The absorbed dose to all organs of the body, the relative harm level of the radiation, and the sensitivities of each organ to radiation.

Effective dose: The quantity of effective dose helps us take into account sensitivity. Different body parts have different sensitivities to radiation. For example, the head is

less sensitive than the chest.

Effective dose relates to the overall long-term risk to a person from a procedure and is useful for comparing risks from different procedures.

Effective dose is not intended to apply to a specific patient .The actual risk to a patient might be higher or lower, depending on the size of the patient and the type of procedure.

Example of absorbed dose, equivalent dose and effective dose. If you have a CT of the abdomen, what is the dose to the abdomen?

Typical absorbed dose: 20 mGy

Typical equivalent dose: 20 mSv

Typical effective dose: 15 mSv

Absorbed dose and equivalent dose measurements can be used to assess short-term risk to tissues. (Short term is weeks to months.) . For properly performed diagnostic examinations, there will be no short-term effects from the radiation exposure, so absorbed dose and equivalent dose are not very useful. For patients, the most important dose quantity is effective dose, because it allows for simple comparisons of long-term risks. (Hsieh, 2009).

1.2The Problem:

Image quality in CT improve with radiation dose the Medical image we make it to obtain high details for the pation body but without or with low risk for pation, but we found **allot** amount of pations receive high amount of radiation whit low image quality for that we will show in CT scanner if the amount of slices increase that take us to low dose with high image quality.

1.3 Objectives:

- * To measure the amount of dose in CT 8 slices and 64 slices.
- * To measure the signal to noise ratio (SNR).
- * To **compeer** the signal to noise ratio (SNR) and radiation dose.

1.4 Overview of the Study:

This study falls into five chapters, Chapter one, which is an introduction, deals with theoretical frame work of the study and (Literature review). It presents the statement of the study problems, objectives of the study, chapter two deals with radiological physics and back ground. Chapter three deal with material and method, Chapter fours deals with results and discussions. Chapter five conclusions , recommendations and references.