Study of Patient's Exposure to Radiation during Thyroid Scan

Dissertation submitted in

Partial fulfillment of the requirement

For the award of the degree of

Master of Technology

In

By

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CERTIFICATE

This is to certify that the dissertation entitled **"Study of Patient's Exposure to Radiation during Thyroid Scan"** is a bona-fide record of work done by **APARNA BAJPAI, Roll No. 2K15/NSE/02** at Delhi Technological University for partial fulfillment of the requirements for the award of degree of Master of Technology in Nuclear Science and Engineering. This project was carried out under my supervision and has not been submitted elsewhere, either in part or full, for the award of any other degree or diploma to the best of my Knowledge and belief.

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CANDIDATE DECLARATION

I, Aparna Bajpai, Roll No-2K15NSE/02, student of MTech (Nuclear Science and Engineering), hereby declare that the dissertation title "**Study of Patient's Exposure to Radiation during Thyroid Scan**", under the supervision of Prof. Suresh C. Sharma , HOD in Applied Physics Department, Delhi Technological University, in partial fulfillment of the requirement for the award of the degree of **Master of Technology**, has not been submitted elsewhere for the award of any degree.

I hereby solemnly and sincerely affirm that all the particulars stated above by me are true and correct to the best of my knowledge and belief.

This work is original research and has not been submitted, in part or full, to any other university or Institute for the award of any degree.

Place: Delhi Aparna Bajpai

Date: 31 July 2017 2K15/NSE/02

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1.6 Objective

The main primary goal of this examination was to measure patient danger during thyroid scan and to assess the related dangers due to the procedure.

1.7 Thesis outline

This theory is about the evaluation of radiation dosage for patients amid thyroid output strategies. In like manner, it is isolated into the accompanying parts:

Chapter One: is the prologue to this theory. This section exhibits the recorded foundation and radiation dangers, not with standing study issue, goals and extent of the work. It additionally gives a diagrams of the theory.

Chapter Two: it contains the foundation material for the theory. This part likewise incorporates a synopsis of past work performed in this field.

Chapter Three: portrays the materials and techniques that are utilized to quantify measurement for customary radiology systems and clarifies in detail the techniques for computation.

Chapter Four: presents the aftereffects of this investigation and additionally discourse.

Chapter Five: presents conclusion and suggestions.

ABSTRACT

The aim of my study was to measure patient exposure during thyroid scan by using a technetium-99m radioactive isotope.

Technetium-99m is used as a radioactive tracer and it can be detected in the body by gamma camera which is a medical equipment. It is best for this role because, it emits readily detectable gamma rays with photon energy of 140keV.

Thyroid scan uses a small small amounts of radioactive material which is known as radioactive tracer, and a special camera and also a computer is used to provide information about the thyroid size, it's shape, position and function which is unattainable using other medical imaging procedures.

This study was conducted on 35 patients under thyroid scan, measured in
Center, Data collected for the study included, age, sex , height, weight, and the material used in examination and the activity half-life of the material.

In this project the mean age was 41.83 years , while the mean of the Body Mass Index (BMI) was 24.40, and the value of effective dose average 2.65 ±0.24 mSv.

This data collected were analyzed by me in Excel software and statistical analysis program, where the process of analysis category was given such as: age, weight of patient , time of scan, the activity and the effective dose. According to the data values it was found that thyroid scan was more common in female than male patients. According to different research, women are having problems with thyroid gland 3-10 times more, than men. Pregnant women are the most sensitive to iodine deficiency, as during this period the woman's hormonal system undergoes serious challenge. Besides, by 16-17th week the fetus begins to develop its own thyroid gland, and it begins to take iodine from mother.

LIST OF SYMBOLS AND ABBREVIATIONS

Symbols	Abbreviation
PET	Positron Emission Tomography
SPECT	Single Photon Emission Computed Tomography
PMT	Photomultiplier Tube
PHA	Pulse Height Analyzer
LFOV	Large Field of View
CRT	Cathode Ray Tube
CT	Computer Tomography
DRL	Diagnostic Reference Level
LCD	Liquid Crystal Display
R	Roentgen
C/kg	Coulomb/kg
RAIU	Radioactive Iodine Uptake
Gy	Gray
mCi	Milli Curie
NaI	Sodium Iodide
keV	Kilo Electron Volt
Sv	Sievert
ICRP	International Commission for Radiological Protection
MIRD	Medical Internal Radiation Dose
AIT	Amiodarone-Induced Thyrotoxicosis

CFDS	Color Flow Doppler Sonography
RADAR	Radiation Dose Assessment Resource
BMI	Body Mass Index
Sd	Standard Deviation
MBq	Mega Becquerel

Chapter One

Introduction

1.1 Nuclear Medicine Imaging

Researchers over the world have extraordinary commitment in atomic drug in various controls material science, chemistry,engineering and solution. Medication history specialists confronted extraordinary trouble in discovering birth date of atomic pharmaceutical due to multidisciplinary nature of atomic drug. This can likely be best put between the disclosure of fake radioactivity in 1934 and the creation of radionuclide by Oak Ridge National Laboratory for prescription related utilize,in 1946.

Most Significant point of reference in Nuclear Medicine is misleadingly created radioisotope by Frederic Joliot-Curie and Irene Joliot-Curie in 1934. Prior I-131 was utilized as treatment in Thyroid Cancer, however later it was extended to imaging of the Thyroid organ , thyroid capacity evaluation and treatment for **Hyperthyroidism.**

As information spread radionuclide location of radioactivity and utilizing certain radionuclide to follow Biochemical Processes. Clinical utilization of atomic pharmaceutical began in mid 1950's. Gamma camera is otherwise called Anger camera or Scintillation camera this gadget is utilized to

picture gamma radiation transmitting radioisotopes, this procedure is known as Scintigraphy. Atomic Medicine society was shaped in 1954 in Spokane, Washington USA.

A chief logical diary in atomic medication for the teach in America production started in 1960. A mass innovative work in new radionuclide and radio pharmaceuticals for the use with the imaging gadgets. The same number of radionuclide were found in drug for medicinal utilize yet Technetium-99m disclosure was imperative and its improvement.

It was first discovered in **1937** by **C. Perrier and E. Segre** as an artificial element to fill space number **43** in the Periodic Table.

In 1960 a practical technique was created for therapeutic utilization of Technetium-99m. As today Technetium-99m is for the most part utilized as a part of atomic solution for restorative utilize. It is utilized in a wide assortment of atomic solution imaging thinks about. By the 1970s most organs of the body could be envisioned utilizing Nuclear Medicine systems.

Atomic pharmaceutical was perceived by American Medical Association authoritatively as restorative forte in 1971. In 1972, the American Board of Nuclear Medicine was built up, solidifying atomic Medicine as a restorative strength. In the 1980s, radio pharmaceuticals were intended for use in analysis of coronary illness.

Positron Emission Tomography is the recent development in Nuclear Medicine. The concept of emission and transmission tomography, later developed into **Single Photon Emission Computed Tomography** (SPECT), was introduced by David E.

Kuhl and Roy Ewards in the late 1950s. Because of different development prompted combination imaging with SPECT and CT by Bruce Hasegawa from University of California San Francisco (UCSF), and the primary PET/CT model by D. W. Townsend from University of Pittsburgh in 1998. Because of cost of the methodology and necessity for an on location or close-by cyclotron PET and PET/CT imaging experienced slower development. PET/CT is presently a critical and indispensable piece of oncology for finding, arranging and treatment checking.

1.2 Thyroid Scintigraphy

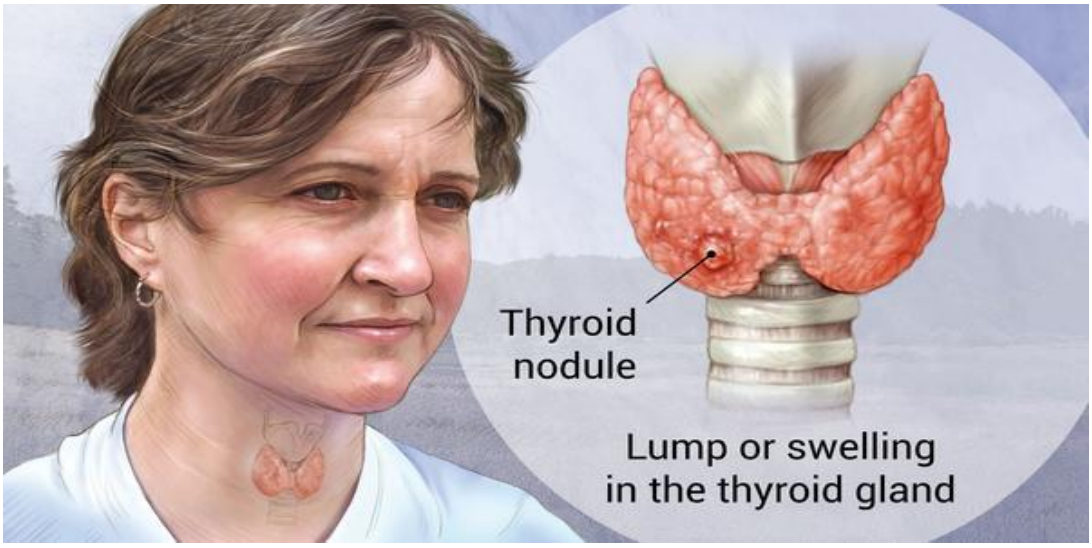
Atomic solution thyroid output is a symptomatic imaging method to assess the thyroid organ, which is an endocrine organ comprising of two projections situated in the front of the neck foremost to the trachea. The two flaps are associated by a thin band of tissue called the isthmus. Body digestion is administered by thyroid organ which is fortified by hormones. In examining a radio tracer that is specifically picked and consumed by thyroid and is controlled either orally or intravenously.

To measure the concentration of the radioactive tracer special equipment in the thyroid gland and equipment that can detect radioactive emissions from the thyroid is used to image the gland.

The data collected is then interpreted to evaluate thyroid function and thyroid disease diagnose.

1.2.1 Thyroid Scan Advantages

A Thyroid Scan is an nuclear medicine test which gives data about the capacity also, structure of the thyroid organ. This kind of scan includes infusion of radio pharmaceutical in to the vein in your arm and imaging with a gamma camera.



This butterfly formed organ situated in the base of the neck is Thyroid Gland. This organ discharges hormones that control digestion which utilizes vitality. The thyroid organ comprises

of two projections (adjusted parts or divisions) and is situated in the lower some portion of the front of the neck. The thyroid organ is around 2 inches long and lies before throat. Iodine is taken up from the circulatory system by thyroid organ. Iodine is for the most part found in nourishment we eat like egg , drain , iodized salt. It stores the iodine and makes thyroid hormones. Body digestion (where sustenance is changed over into vitality) and development is controlled by thyroid hormones. Thyroid hormones have a vital part in body which keeps up a wide range of elements of the body by handling and modifying the levels of specific hormones.

A thyroid output is performed with the goal that specialists can recognize which parts of the thyroid organ are working legitimately and whether the thyroid organ is over-dynamic (hyperthyroidism) or under-dynamic (hypothyroidism). It can undoubtedly distinguish the contrast between benevolent (non-carcinogenic) and dangerous (destructive) thyroid knobs or protuberances. Size And state of thyroid organ can likewise be resolved in thyroid scan.

1.3 Radiation exposure during Thyroid scan

As radio pharmaceutical is injected called **sodium pertechnetate**, It goes through the circulation system and is gathered in the thyroid organ. You won't feel any unique after the infusion in the body. Tolerant needs to sit tight for 15-20 minutes before the sweep, to permit the radioactive substance to be taken up by the thyroid organ.

The radio tracer is either injected into the body, depending on the type of nuclear medicine exam. It is swallowed or inhaled as a gas and eventually accumulates in the organ or area of the body being examined.

Radio tracer emits radioactive emissions which are detected by a special camera or imaging device that produces pictures and detailed molecular information. Thyroid scan determine the size, shape and position of the thyroid gland. Person suffering from thyroid cancer are undergone through thyroid scan of whole body. After thyroid scan function and structure of thyroid is determined.

The thyroid is a gland in the neck that controls metabolism, a chemical process that regulates the rate at which the body converts food to energy. For thyroid scan patient has to lie on the scanning bed.

A gamma camera is positioned in such a way that it is very close over your head but will not touch you. Jaw and head is kept still in same position. Several images are taken after lying on bed lasting about 5 minutes each and the camera may be placed at several different angles when taking the images.

A nuclear medicine specialist examine your neck, to feel for any thyroid nodules or gland enlargement. This scan takes about 40 minutes in total of the examination. After 15-20 minutes wait after the injection of radio pharmaceutical and then there will be 15 minutes of scanning time.

Then the images are checked properly to make sure that they provide the required information, and then you will leave the hospital or the radiology practice done. The report of thyroid scan is then send to the doctor for the check. Since some of the thyroid scan are painless.

But, patients feel uncomfortable when lying on the bed completely still with your head extended backward while the gamma camera is taking images in the scan.

Patient will feel a slight pin prick when the radio tracer is given intravenously as needle is inserted into your vein for the intravenous line. Patient feel a cold sensation moving up your arm when the radioactive material is injected into your arm but there is no side effects.

Radio tracer can also be swallowed but it has no taste. When inhaled, you should feel no differently than when breathing room air or holding your breath. It is important that you remain still while the images are being recorded. Since nuclear medicine imaging does not cause any kind of pain , but there may be some discomfort from having to remain still or to stay in one particular position during imaging.

After the scan patient can continue the regular activities. If any extra instructions are required nuclear technologist nurse or physician will inform the patient before you leave the nuclear medicine department.

As according to the natural process of radioactive decay radio tracer in your body will lose its radioactivity over time. Radio tracer may also pass out of your body through your urine or stool during the first few hours. Patient has to drink plenty of water to help flush the radioactive material out of your body as soon as possible.

1.4 Radiation Risk to Thyroid

As the doses of radio tracer administered are small, diagnostic nuclear medicine procedures result in low radiation exposure, acceptable for diagnostic exams. Potential benefits are higher as compared to radiation risk. Nuclear Medicine therapeutic procedures are always weighed against the potential benefits.

Patient can always ask questions about the risk factor prior to the treatment. Radio pharmaceuticals may cause allergic reactions but are extremely rare and are usually mild. Radio tracer is used it may cause slight pain and redness which rapidly resolve due to any allergies in past medicine exam. Women patients are required to inform their physician or radiology technologist about possibility of being pregnant.

If patient is normal a normal scan will show a thyroid of normal size, shape, and position if the if patient is normal. An area of increased radionuclide uptake may be called a hot nodule or "hot spot." This means that a benign growth is overactive. Despite the name, hot nodules are unlikely to be caused by cancer,

An area of decreased radionuclide uptake may be called a cold nodule or "cold spot." This indicates that this area of the thyroid gland is under active. A variety of conditions, including cysts, non functioning benign growths, localized inflammation, or cancer may produce a cold spot.

1.5 Problem of Study

In nuclear medicine thyroid scan there is a risk of exposing the fetus to radiation so thyroid scan and thyroid uptake are not performed on patients who are pregnant . Thyroid medicine scan also not recommended for breastfeeding women, As the scanning process consume a lot amount of time.

Radio tracer takes hours to days to accumulate in the part of the body under study and imaging may take up to several hours to perform.

But in fewer there are chances for newer equipment which are available that can substantially shorten the procedure time. There are chances that small risk that you may be allergic to the chemicals used for the scanning. Patients may suffer nausea, vomiting and headaches can occur due to sensitivity to chemicals.

Chapter Two

Theoretical Background

2.1 Gamma Cameras

The principles of nuclear medicine studies are based on the assessment of radionuclide distribution in different parts of a given organ after in vivo administration of a radio pharmaceutical to distinguish between the normal and abnormal tissues. Such appraisal of radionuclide dispersion is performed by gamma cameras that basically contain Nal(Tl) locator's and the related hardware.

The gamma cameras allow the dynamic securing of the pictures with better spatial determination, and can be arranged toward any path around the patient. Various feature of gamma cameras are discussed below.

The gamma or scintillation camera is an imaging device that is most commonly used innuclear medicine. It is additionally called the Anger camera, Various outlines of gamma cameras have been proposed and made accessible, yet the Anger camera with a solitary precious stone is by far the most broadly utilized.

Although many sophisticated improvements and modern upgrades have been made on the gamma cameras throughout the years, the fundamental standards of the operation have basically continued as before.

2.1.1 Principles of Operation

The gamma camera as a rule comprises of a few parts: an identifier, a collimator. PM tubes, a preamplifier, an enhancer, a beat stature analyzer (PHA), a X-. f-situating circuit, and a show or recording gadget.

A schematic diagram of a gamma camera is illustrated in Figure 2.3, and a commercial gamma camera is shown in Figure 2.1. The indicator, PM tubes, and enhancers are housed in a unit called the Detector Head, which is ascend on a stand.

The head can be climbed or down and turned with electrical changes to position it in the field of view on the patient. The X-, F-situating circuits, PHA, and some recording gadgets are mounted on a console. In the past, the cameras were operated by switches and dials on the console. As of now, a significant part of the operation of the camera is performed by a PC worked in it.

The PC is controlled by fitting programming in conjunction with a console, a mouse, and a video screen. High voltage, window, and photograph crests are good to go by the administrator's selection of parameters. Securing of the information and preparing of the information are done by the PC.

Though stationary cameras are for all time introduced at coveted areas, compact gamma cameras are mounted on wheels for use in circumstances requiring development of the camera from space to room,

for example, to the patient's bedside. Portable cameras are introduced in wheeled vans such that they can be moved to places where gamma cameras are not accessible for atomic drug thinks about nuclear medicine studies.

The operational principles of a gamma camera are identical to those of solid scintillation counters. Basically, g-rays from a source interact with the Nal(Tl)detector, and light photons are emitted.

The last strike the photograph cathode of PM tubes,and a pulse is generated, which is then amplified by an amplifier and sorted out by a PHA. At long last, the beat is situated by a X-, F-situating circuit on the recording gadget or put away in the PC, relating to the area of g-beam collaboration in the finder.

2.1.2 Detector

Indicators utilized as a part of gamma cameras are normally roundabout Nal(Tl) identifiers, which have measurements of 25-50 cm in distance across and 0.64-1.84 cm in thickness.

The most widely recognized thickness is 0.95cm. The 0.64-cm thick indicators are utilized as a part of versatile gamma cameras and are valuable for 201T1, 99mTc, and 1231 radio nuclide. Bigger locator's (-40cm in breadth) are utilized as a part of expansive field of view (LFOV) cameras.

Rectangular Nal(Tl) locator's (38.7-61cm or 45 -66cm) are likewise accessible in gamma cameras.

Expanding the thickness of a locater builds the likelihood of finish retention of g-beams and subsequently the affect ability of the camera. Nonetheless, the likelihood of various Compton dissipating additionally increments in thicker locator's, and in this manner the X, Y organizes of the purpose of g-beam cooperation can be lost.

This results in poor resolution of the image of the area of interest. Thus, thin Nal(Tl) identifiers are utilized as a part of gamma cameras, yet this declines the affect ability of the camera, on the grounds that numerous g-beams may escape from the locater without cooperation.

2.1.3 Collimator

In gamma cameras, a collimator is connected to the substance of the Nal(Tl) indicator to restrain the field of view so g-radiations from outside the field of view are kept from achieving the indicator.

Collimator are ordinarily made of material with high nuclear number and ceasing power, for example, tungsten, lead, and platinum, among which lead is 12the material of financial decision in atomic prescription. They are outlined in various sizes what's more, shapes and contain one or many gaps to see the zone of intrigue.

Collimator are fundamentally arranged by the sort of centering, different characterizations are likewise made in view of septal thickness and alternate groupings are likewise made in light of septal thickness and the quantity of openings.

Contingent upon the sort of centering, collimator are named parallel-gap, pinhole, focalizing, and veering sorts; Pinhole collimator are made fit as a fiddle with a solitary opening and are utilized as a part of imaging little organs,

for example, the thyroid organs to give amplified pictures. Uniting collimator are made with decreased openings joining to an outside point and are utilized to give amplified pictures when the organ of interest is littler than the extent of the detector.

Images are magnified by converging collimator. Separating collimator are developed with decreased gaps that are dissimilar from the indicator confront and are utilized as a part of imaging organs, for example, lungs that are bigger than the measure of the indicator. The images are minified with these collimator .

Parallel-opening collimator are made with gaps that are parallel to each other furthermore, opposite to the finder confront and have in the vicinity of 4000 and 46,000 gaps contingent upon the collimator outline.

These collimator are most ordinarily utilized as a part of atomic medication strategies and outfit a coordinated picture. Since pinhole what's more, uniting collimator amplify and the diverging collimator minify the picture of the protest, some twisting happens in pictures acquired with these collimator.

Since LFOV cameras are promptly accessible now, diverging collimator are not utilized as a part of schedule atomic pharmaceutical investigations.

Parallel-gap collimator are delegated high-determination, all reason, and high-affect ability sort, or low-vitality, medium-vitality, or high-vitality sort,contingent upon the determination and affect ability they give in imaging High-affect ability collimator are made with littler thickness than universally handy collimator,

while high-determination collimator are thickest of all. Right now, ultra-high-vitality collimator helpful for 511-keV photons are monetarily accessible and utilized for single photon emission computed tomography (SPECT) imaging with 18F-fluorodeoxyglucose.

Fan-beam collimator are planned with openings that unite in one Several collimator are accessible that are intended for some particular purposes, measurement yet are parallel to each other in the other measurement.

These collimator are fundamentally utilized for imaging smaller objects and thus amplify the pictures. Cone-bar collimator are like fan-shaft collimator and amplify the pictures but that the gaps are outlined with the end goal that they focalize in two measurements.

In prior collimators, the gaps were initially roundabout, however current outlines have square, hexagonal, or even triangular gaps with uniform thickness of lead around the opening.

These collimators provide better spatial resolution than the circular-hole ones.

2.1.5 Photomultiplier Tube

As in scintillation counters, PM tubes are basic in gamma cameras for changing over the light photons in the Nal(Tl) detector to a pulse. Rather than one PM tube, a variety of PM tubes (19 to 107) are mounted in a hexagonal manner to the back of the detector with optical oil, or in a few occurrences, utilizing Lucite light pipes between the detector and the PM tubes.

In current gamma cameras, square or hexagonal PM tubes are utilized for better pressing. The yield of every PM tube is utilized to characterize the X, Y directions of the purpose of interaction of the g-ray in the indicator by the utilization of a X-,7-situating circuit and furthermore is summed up by a summing circuit to shape a pulse known as the Z pulse.

The Z pulse is then subjected to pulse-height examination and is acknowledged on the off chance that it falls inside the scope of chosen energies.

2.1.6 Pulse-Height Analyzer

After the Z pulses are formed by the summing circuit, the PHA analyzes down their abundancy what's more, chooses just those of wanted vitality by the utilization of appropriate peak and window settings.

In numerous gamma cameras, the energy selection is made consequently by push-button- type isotope selectors assigned for various radionuclide, for example, 99mTc. In modem cameras, isotope pinnacle and window settings are chosen by the mouse-driven menu on a PC screen interfaced with the camera.

In some gamma cameras, a few PHAs are utilized to choose all the while a few g-rays of diverse energies. These sorts of cameras are valuable in imaging with 111 In and 67Ga that have a few transcendent g-rays.

The window settings are given in rates of the peak energy by a control handle. For most examinations, a 15% to 20% window centered symmetrically on the photo peak is utilized. It

ought to be noticed that X furthermore, Y beats are acknowledged if the Z pulse is inside the vitality extend chose by the PHA. In the event that the Z pulse is outside this range, at that point A and Y pulse are removed.

2.1.7 Display and Storage

Computer memories are used by camera systems memories for storage of image data. The subtle elements of capacity in PCs In more established frameworks, images were for the most part shown on cathode beam tube (CRT) screens and at present, all frameworks usually utilize LCD 15(liquid crystal show) video screens for better show of pictures.

The PC control of picture differentiate on LCD screens gives a superior perspective of pictures prompting more exact analysis of diseases, and the Z energy signal.

The Z signal goes to a pulse height analyzer and, on the off chance that it falls inside the foreordained scope of worthy vitality esteems, produces a flag which educates the show framework to record a gamma beam as having been accurately identified at the X and Y area.

2.2 Digital Cameras

It is seen from the above depiction that the X-and Y-pulse are acquired in simple shape also, are anticipated on various show and recording frameworks. Such simple handling instability in beat arrangement and results in picture non linearity and non consistency. These are caused by variances in PM tube yield because of high voltage (HV) varieties, float in pre intensifier yield, and varieties in PH and X-, Y-situating investigations.

To amend for these impacts and furthermore for the control of information at a later time, simple information are digitized to be put away in a grid outline a PC.

Digitization of the analog signal is performed by an electronic circuit, called the simple to-computerized converter (ADC).The digitized information are later recovered for additionally handling to show on video screens.

In present day cameras every PM tube yield is digitized by the ADC before PH furthermore, X-, T-situating examinations. These cameras are called “all-digital” cameras. In these cameras, the

increases of all PM tubes are at first improved by putting a tight light emission radioactive source before every PM tube and deciding the focal point of the photo peak by altering the high voltage of the PM tube with an advanced PC.

Next, the camera is aligned, in which a source of intrigue is situated before every PM tube, and yield from every PM tube is examined, coordinated, and digitized by a fast ADC in the PC.

Each signal is then normalized by dividing it with the sum of all digital signals arising from the same scintillation event. In a two-dimensional array of PM tubes, the normalized digital output Zi(X, Y) .corresponds to the X, Y location of the PM tube. To decide the area of each signal Zi, a weighting factor is ascertained from the opposite of the instabilities of X and Y positions, i.e., 1/DX and 1/DT, that are identified with the spatial circulation of Zi values around the focal point of the PM tube.

The X, Y areas and weighting factors are mapped and put away in reference tables as elements of Zi values for all PM tubes for positional and Z-beat investigations of a scintillation event in later imaging examinations.

In consequent patient imaging considers, the output signal of every PM tube from a scintillation events is inspected, coordinated, digitized lastly standardized to give Zi. The area (X., Y) of the events of scintillation is then computed by utilizing the fitting valuesof areas and weighting factors in the reference tables in the memory.

The digitized Zi(X, Y) is put away in the X, Y area of the picture network, if the pulse discrimination does not dismiss the signal. Since the location of each event is signals is greatly improved.

For these reasons, the advanced controlled by digitizing and breaking down the individual signal from every PM tube, the exactness of situating of the Digital Cameras 115 cameras give brilliant inherent linearity and consequently prevalent spatial determination in picture arrangement.

2.3 Radionuclide Used In Thyroid Scan

A radionuclide examine is a method for imaging bones, organs and different parts of the body by utilizing a little measurements of a radioactive substance. There are different types of radionuclide materials.

The one utilized relies upon which organ or part of the body is to be checked.

A radionuclide (sometimes called a radioisotope or isotope) is a chemical which emits a type of radioactivity called gamma rays. A little measure of radionuclide is put into the body, generally by an infusion into a vein. (Some of the time it is inhaled in,or swallowed,depending on the test.

There are different types of radionuclides. Different ones tend to collect or concentrate in different organs or tissues. Along these lines, the radionuclide utilized relies upon which part of the body is to be filtered. For example, if radioactive iodine is injected into a vein it is quickly taken up into the tissues of the thyroid gland.

So, it is used to scan the thyroid gland. Cells which are most "dynamic" in the objective tissue or organ will take up a greater amount of the radionuclide. So, active parts of the tissue will emit more gamma rays than less active or inactive parts. Gamma beams are like X-beams and are distinguished by a equipment called a gamma camera.

The gamma beams which are transmitted from inside the body are identified by the gamma camera, are changed over into an electrical signal, and sent to a PC. The PC assembles a photo by changing over the contrasting powers of radioactivity produced into various colors or shades of dark. For example, areas of the target organ or tissue which emit lots of gamma rays may be shown as red spots ('hot spots') on the picture on the computer monitor.

Areas which emit low levels of gamma rays may be shown as blue ('cold spots'). Different colors may be utilized for 'in the middle of' levels of gamma beams transmitted.

The radionuclides that are used commonly in thyroid scans are two isotopes of iodine, 1-131 and 1-123, and an isotope of technetium known as 99m Tc. Technetium examining is favored for some demonstrative workups since it is generally quick and does not require the patient to quick here to fore.

A few experts want to save I-131 for follow-up assessments of cancer patients, and utilize I-123 for thyroid take-up tests and routine thyroid outputs.

2.3.1 Iodine-131

Radioactive isotopes of iodine are physiologically vague from the normally happening iodine-127 . Iodine-131 (physical half-life 8.1 days; gamma discharge 364keV) has been utilized as a part of thyroid scintigraphy for a considerable length of time. Its advantages include wide availability and relatively low cost. Its real detriment is its high radiation retained measurements because of its long physical half-life and betaparticle outflow.

These features make I-131 inappropriate for routine scintigraphy in pediatric patients but useful for the therapeutic follicular cells.

2.3.2 Iodine-123

Due to its short half-life and the absence of beta radiation,compared to I-131, I-123 , delivers only 1% of radiation to the thyroid per millicurie administered.

The vitality of its primary gamma beam is perfect for recognition by gamma cameras, thus it is routinely utilized for thyroid take-up and checks. Later information propose that I-131 it is likewise better than for symptomatic entire body checks in patients with separated thyroid tumor. Disadvantages include more limited availability and high expense.

A tracer amount of inorganic radioiodine (I-123 or I-131) is managed orally and afterward quickly equilibrates with the endogenous I-127 in the extracellular liquid.

Plasma levels of radioiodine fall exponentially with over 90% of the regulated dosage expelled by the thyroid and kidneys toward the finish of 24 hours.

2.3.3 Technetium-99m Pertechnetate(99mTc-Na04-)

99m-Tc-pertechnetate (Tc-Na04) (physical halflife of 6 hours; gamma emission 140keV) is a monovalent anion that, similar to iodine, is effectively transported by the sodium-iodine symporter (NalS) and can in this manner be utilized to quantify thyroid take-up.

Not at all like iodine, it experiences immaterial natural binding and quickly diffuses out of the thyroid as its plasma fixation falls. Tc-99m-pertechnetate is managed by intravenous infusion with scintigraphy performed inside 30 minutes of organization amid crest thyroid action.

Points of interest incorporate its wide accessibility, minimal effort, low radiation introduction, and the short interim required for scintigraphy. Also, as " 99mTc-pertechnetate only measures uptake, outputs can be performed amid antithyroid treatment with thionamides.

Detriments incorporate its generally low thyroid take-up (4.0% 20 minutes after administration) its susceptibility to background artifact from salivary and vascular ac tivity, and its lowsensitivity in the detection of hypo functioning thyroid nodules.

Table 2.3 indicates most regularly utilized radioisotopes in Nuclear Medicine and their particular decay mode, energy and half-life.

2.4 Radiation Quantities and Units

2.4.1 Exposure

Exposue is a measure of the quality of a radiation field sooner or later. It is a measure of the ionization of the atoms in a mass of air. It is generally characterized as the measure of charge (i.e. the entirety of all particles of a similar sign) created in a unit mass of air when the associating photons are totally caught up in that mass.

The most commonly used unit of exposure is the Roentgen (R). , a Roentgen is the amount of photon energy required to produce 1.610 x 10 ion pairs in one gram of dry air at 0°C. A radiation field of one Roentgen will store 2.58 x 10‘ coulombs of charge in one kilogram of dry air.

The fundamental favorable position of this unit is that it is anything but difficult to specifically quantify with a study meter. The primary restriction is that it is legitimate for statement in air.

2.4.2 Dose or Absorbed Dose

While introduction is characterized for air, the ingested measurement is the measure of vitality that ionizing radiation confers to a given mass of issue.The retained measurement is utilized to relate the measure of ionization that x-beams or gamma beams cause in air to the level of natural harm that would be caused in living tissue put in the radiation field.

The most ordinarily utilized unit for absorbed dose is the "rad" (Radiation Absorbed Dose). A rad is characterized as a dosage of 100 ergs of energy for every gram of the given material. The SI unit for absorbed dosage is the dim (Gy), which is characterized as a measurements of one joule

for every kilogram. Since one joule equals 10 ergs, and since one kilogram equals 1000 grams, 1 Gray equals 100 rads.

The measure of the assimilated dosage is needy upon the force (or movement) of the radiation source, the separation from the source to the irradiated material, what's more, the time over which the material is irradiated.

The action of the source will decide the dosage rate which can be communicated in rad/hr, mr/hr, mGy/sec etc. The absorbed dose can be computed by utilizing the accompanying relationship: where, D is the absorbed dose E is the energym is the mass of the absorbing material

2.4.3 Equivalent dose

While considering radiation collaborating with living tissue, it is essential to likewise consider the kind of radiation. In spite of the fact that the natural impacts of radiation are reliant upon the consumed dosage, a few sorts of radiation create more prominent impacts than others for the same measure of energy bestowed.

For instance, for break even with absorbed doses , alpha particles may be 20 times as harming as beta particle. To represent these varieties when portraying human well being dangers from radiation presentation, the amount called "dosage equal" is utilized.

This is the absorbed dose increased by certain "quality" or "modification" factors characteristic of the relative organic harm capability of the specific kind of radiation.The quality factor (Q) is a calculate utilized radiation assurance to measure the consumed dosage with respect to its assumed organic viability.

Radiation with higher Q elements will make more noteworthy harm tissue. The rem is a term used to portray an exceptional unit of dosage proportionate. Rem is a shortened form for roentgen proportionate in man.

The SI unit is the sievert (SV); one rem is equivalent to 0.01 SV. Measurements of radiation got by specialists are recorded in rems, be that as it may, sieverts are being required as the industry transitions to the SI unit framework. Equivalent dosage is the result of ingested measurements and radiation weighting factor. The condition can be composed as:

Where:

H is the equivalent dose

D is the absorbed dose

WR is the radiation weighting factor

2.4.4 Organ dose

It is an amount characterized in ICRP Publication 60 in connection to the likelihood of stochastic impacts (for the most part disease acceptance) as the ingested measurement arrived at the midpoint of over an organ that is the remainder of the aggregate energy granted to the organ and the aggregate mass of the organ. The unit is the joule per kilogram and is given the uncommon name gray (Gy) [11].

2.4.5 Effective dose

It is an amount characterized in ICRP Publication 60 as a weighted aggregate of identical measurements to all pertinent tissues and organ with the reason "to demonstrate the blend of various dosages to a few distinct tissues in a way that is probably going to correspond well with the aggregate of the stochastic impacts".

This is, along these lines, appropriate regardless of the absorbed dose distribution possibility that the over the human body is not homogeneous. he unit is the joule per kilogram (J kg'1) and is given the special name sievert (Sv)

The utilization of effective dose for patients must be finished with alert, as showed in the UNSCEAR 2000 answer to the UN, "successful dosage ought not be utilized specifically to estimate inconvenience from restorative presentation by utilization of the nominal fatality probability coefficients.

Such evaluations would be wrong and fill no need in perspective of the instabilities emerging from potential statistic contrasts (in terms of health status, age and sex), between specific populace of patients and those from overall communities for whom ICRP inferred the chance coefficients compelling measurements could comprehensively think little of the weakness from

indicative exposures of youthful patients by a factor of 2 and, alternately, could overestimate the impediment from old patients by a factor of no less than 5.

In any case the above admonition ... rehearse in indicative radiology is outlined for similar reason, primarily as far as powerful measurement to the uncovered people taking into account the quantity of techniques, collective effective dose over exposed populations .

It is conceivable, thusly, to utilize effective dose and even aggregate dosage for restorative symptomatic introduction as long as this is done just for relative purposes and for the same or comparable patient populaces, and it would require extra contemplations or noteworthy adjustments on the off chance that we endeavor to utilize them to contrast and other populations.

E = t W t .H t

Where :

E is the viable measurement to the whole living being

WT is the comparable measurement consumed by tissue T

H t is the tissue weighting factor characterized by control

2.4.6 Kerma

It is the whole of the underlying dynamic energies of all the charged particles freed by uncharged ionizing radiation (i.e., by implication ionizing radiation, for example, photons and neutrons) in a specimen of issue, partitioned by the mass of the example. It is characterized by the remainder:

Where: K is the kerma

dEtris the kinetic energy

dm is mass of material

2.5 Thyroid : Factors Affecting Sensitivity

2.5.1 Description

The thyroid organ is a horseshoe-formed, ductless endocrine organ that lies before the upper bit of the trachea. It secretes thyroid hormone and calcitonin.

2.5.2 Normal Size Range

As per endocrinologist ordinary measurements for the thyroid organ are 4 to 4.8 x 1.0 to 1.8 x 0.8 to 1.6 cm. In any case, measurements that fall outside of this range don't really mean unusual pathology.

2.5.3 Factors Affecting Size

Individuals who live and experienced childhood in nations where iodine is pervasive in the eating regimen, for example, the United States, Britain, Japan and Iceland, will all in all have thyroids that are littler. Amid pregnancy, ladies frequently encounter a briefly bigger thyroid. Also, when all is said in done, the thyroids of smokers are bigger than normal.

2.5.4 Scan

While manual palpitation might be in charge of starting recognizable proof of a possibly expanded thyroid, a thyroid sweep is a more exact approach to imagine its size and shape. Since the thyroid organ is a delicate tissue, it won't appear on a X-beam. The standard technique for survey the organ is by thyroid ultrasound—a effortless, non-obtrusive method performed at a radiology lab.

2.5.5 Goiter

A developed thyroid organ is alluded to as a goiter. Goiters are regularly endemic in populaces where soil, subsequently abstains from food, are low in iodine.

2.6 Methods of dose calculation in thyroid scan

2.6.1 MIRD Calculations

The immediate estimation of the retained measurements to organs of the body from atomic prescription systems is once in a while conceivable.Most estimates depend on Monte Carlo simulation.

To register a measurement appropriation, a huge number of thousands of virtual gamma beams beginning in various source organs must be followed through the body as they associate with tissues by Compton diffusing and photoelectric assimilation. Commitments to the dosage from Auger electrons, inner change electrons and beta decays should likewise be incorporated This last piece of the reenactment is normally very straight forward since these radiations can be thought to be invested in the organ they begin in.

The Medical Internal Radiation Dose (MIRD) Committee in the USA has given a significant assemblage of information to aid measurements estimation. The MIRD strategy for computation enables estimation of the measurement to organs of essentialness from radioactivity dispersed homogeneously all through a specific source organ.

The technique can be divided into two parts:

1. Initially, a few suppositions are made about or estimations are taken of the natural appropriation of radioactivity all through the body.

2. Considering both the organic and physical half-existence of the marked radionuclide.

3. The cumulated action, as in a specific source organ is ascertained by coordinating the immediate action after some time. This information may be acquired from hypothetical

displaying, (for example, Compartmental Analysis) or from estimations utilizing a gamma camera to quantify the consider rate an element of time in the organ of intrigue

The Medical Internal Radiation Dose (MIRD) Committee in the USA has provided a substantial body of data to assist in dose estimation. The Medical Internal Radiation Dose (MIRD) Committee in the USA has given a significant assemblage of information to aid measurements estimation.

Estimation of the cumulated movement. The bend in this case could for instance speak to the movement in part of the skeleton after organization of " 99Tc-MDP. Numerically, this sort of action/time bend can be spoken to by the condition: where As(t) is the activity in the source organ, s at time, t.Secondly, the absorbed dose to a target organ, Dt, is calculated from:

where the summation over s is expected to represent commitments from all source organs to the objective organ.

The S-factor, S(t,s) is the mean consumed measurements to the objective organ, t, from unit action of the pertinent radioisotope conveyed homogeneously inside the source organ, s. Note that its workable for the source also, target organ to be a similar substance.

2.6.2 The S-Factor

The testing some portion of the MIRD strategy is the count of the S-factor since it relies upon precise learning of the radiations produced by the radionuclide.

In spite of the fact that the MIRD distributions help by giving agent estimations of S-factors for most organs and for an assortment of radionuclides, it is imperative to comprehend the strategy what's more, henceforth the confinements of this procedure.

1. D is a measure of the aggregate vitality related with the specific radiation sort and is a physical substance known from the radioisotope's decay scheme.

2 is the assimilated division for the specific radiation produced in the source organ, s, and consumed by the objective organ, t, and 3. m is the mass of the objective organ.

Chapter Three

Materials and Methods

The information of this investigation were gathered from Inmas Center. Information of the specialized thyroid scan was taken amid June 2017- July 2017

3.1 Patient data :

A sum of 35 patients with various of thyroid sweep symptomatic were alluded to Inmas (Institute of Nuclear Medicine & Allied Sciences), in the time of study. Information were gathered to consider included, age, sex, demonstrative of examination, tallness, weight, and the material utilized as a part of exam and the action half-existence of these material.

3.2Machine used:

Orbiter 37 Gamma camera

3.3 Patient Preparation:

In the days preceding your examination, blood tests might be performed to gauge the level of thyroid hormones,the patient may trained to quick for a few hours before your exam since eating can influence the exactness of the take-up estimation.

3.4 Patient Positioning:

Quiet lying in prostrate position when it is the ideal opportunity for the imaging to start, with expanded neck. A progression of pictures will be procured utilizing gamma camera. Catching pictures of the thyroid organ from three unique edges is typically performed.The patient should stay still for brief time frames while the camera is taking pictures.

3.5 The convention utilized as a part of thyroid output:

The thyroid was imaged 20 minutes after the intravenous organization of 4.5 mCi (166.5 MBq) of " 99mTc Pertechnetate utilizing a scintillation gamma camera (Nucline SPIRIT DH-V, Variable Angle Dual-Head Digital Gamma Camera) for SPECT, outfitted with a parallel hole collimator.

Foremost picture were at that point acquired with the patient recumbent and neck expanded.

3.6 Method: MIRDOSE SOFTWARE AND RADAR SYSTEM

MIR Dose programming used to evaluate the thyroid and other radiosensitive organs an expansion to the powerful dosage per strategies. This program has been produced by Institute of Nuclear Medicine & Allied Sciences.

The program contains tables of the S factors for the normal radionuclides; the client must give the biokinetic information as home circumstances for the source organs. The program at that point creates tables of organ measurements per unit managed movement in the customary and SI units (rad/mCi and mGy/Mbq).

The product is accessible at site for open get to premise. This site, called the Radiation Dose Assessment Resource (RADAR), gives decay information to more than 800 radionuclides, retained parts for all accessible stylized phantoms and a few voxel apparitions, dynamic information, dosage factors (for all phantoms and nuclides), chance data also, other information by means of electronic exchange to clients around the world.

The assets have a few highlights that make it simpler to comprehend and use than existing assets in these ranges.

3.7 Nuclear medicine dose measurements:

As per an extraordinary report distributed in Radiology, in 2008 , Nuclear Medicine viable dosage can be figured by utilizing a directed action plan in view of body surface area in relation to adult reference values of 1.73 m surface area and 370 MBq administered activity, as 0.013 mSv per MBq .

The equation :

Dose = Activity in MBq * 0.013

Chapter Four

Results and Discussion

4.1: Results:

The part will feature the all consequences of the investigation that arrangement with Clinical sign, quiet statistic information, the outcomes were organized in the Tables (mean ± standard deviation (sd)) and the scope of the readings in enclosure. The measurement esteems in atomic prescription demonstrative are little, subsequently the measurement were displayed in milli-sievert. The weight by kg, height by m and body mass index (BMI) by kg/m2.

The mean and the standard deviation were ascertained utilizing the exceed expectations programming and SPSS program.

Table 4.1 shows least, most extreme, mean and standard deviation to understanding age weight, tallness and BMI as indicated by sexual orientation .

Table 4.2 show age of the patient and percent.

Table 4.3 shows weight of the patient and percent.

Table 4.4 show tallness of the patient and percent.

Table 4.6 show the activity (mCi), activity (MBq) , effective dose (mSv) this is according to the age.

Table 4.7 show the time of scan and the percent.

Table 4.8 show the activity (mCi), activity (MBq) , effective dose (mSv) this is according to the time and

Table 4.9show the activity (mCi), activity (MBq), effective dose (mSv) this is according to the weight.

Table 4.1 shows least, most extreme, mean and standard deviation to understanding age weight, tallness and BMI as indicated by sexual orientation .

Gender	No.	Percent	Age(years)	Weight(kg)	Height(m)	BMI
Male	8	22.86	51.25 ±15.03 (34-75)	66.00 ±11.55 (50-88)	1.63 ±0.07 (1.52-1.75)	24.95 ±2.02 (22.86-28.73)
Female	27	77.14	38.89 ±13.59 (17-71)	63.96 ±12.08 (41-85)	1.62 ±0.08 (1.48-1.75)	24.27 ±2.59 (18.22-28.73)
Total	35	100	41.83 ±14.83 (17-75)	64.83 ±12.01 (34-75)	1.62 ±0.08 (1.48-1.75)	24.40 ±2.48 (18.22-28.73)

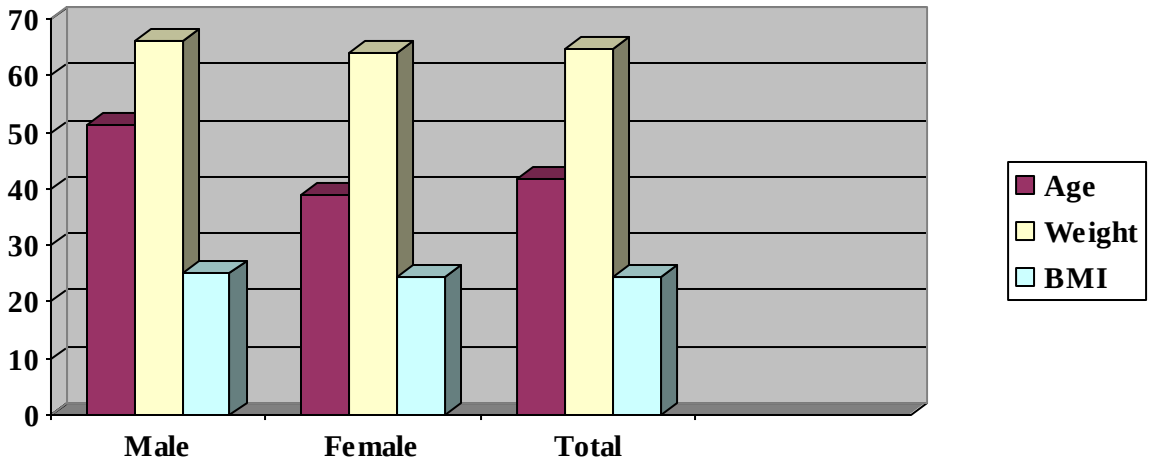


Fig 4.1Correlation between age ,weight ,BMI of patient and gender

Table 4.2: Age of patient and percent

Age	Frequency	percent
<20	1	2.9%
20-40	18	51.4%
41-60	11	31.4%
61-80	5	14.3%
Total	35	100%

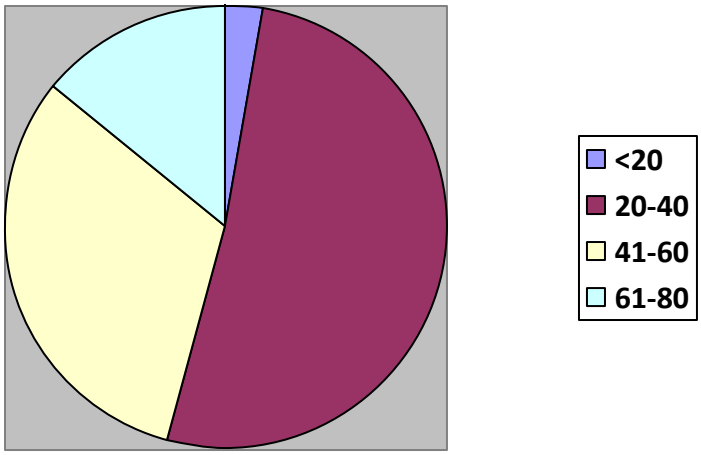


Table 4.3 : Weight of patient and percent

Weight	Frequency	Percent
<50	3	8.6%
50-60	11	31.4%
61-70	12	34.3%
71-80	5	14.3%
>80	4	11.4
Total	35	100%

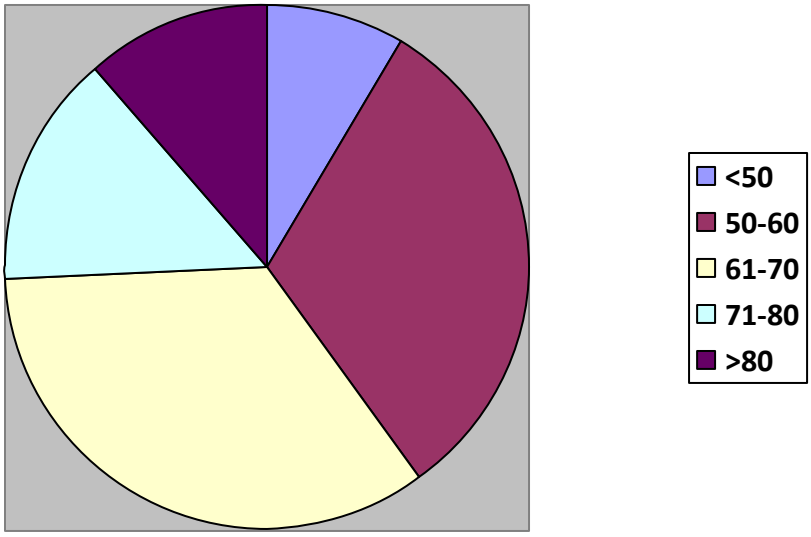


Table 4.5: Activity (mCi), activity (MBq), effective dose (mSv) according to the gender

Gender	Activity(mCi)	Activity(MBq)	Effective dose
Male	5.53±0.52 (5-6.4)	204.4±19.35 (185-236.8)	2.66±0.25 (2.41-3.08)
Female	5.50±0.51 (5-6.2)	203.6±18.74 (185-229.4)	2.65±0.24 (2.41-2.98)
Total	5.51±0.50 (5-6.4)	203.8±18.59 (185-236.8)	2.65±0.24 (2.41-3.08)

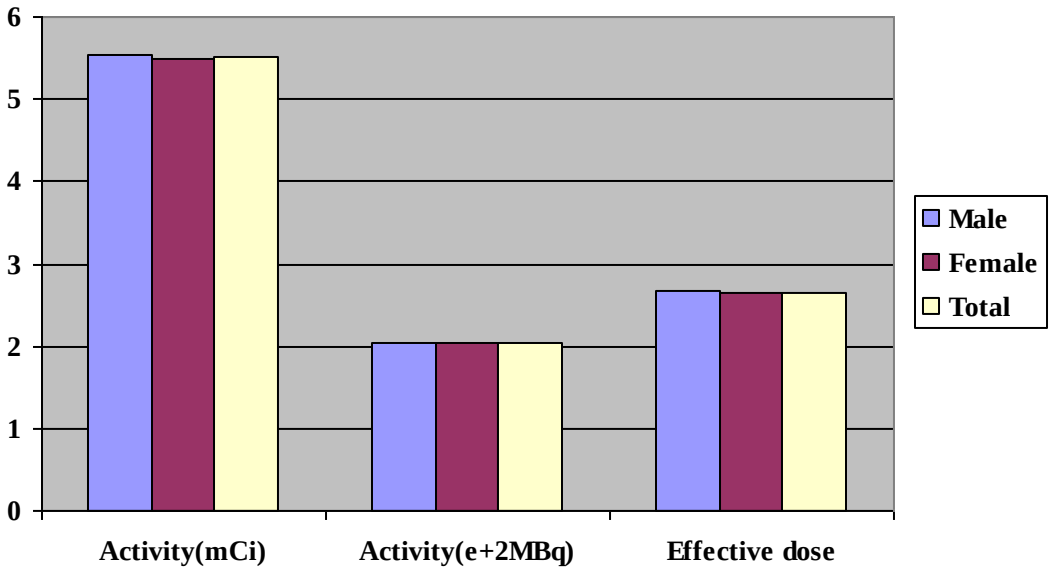


Table 4.6: Activity (mCi), activity (M B q), effective dose (mSv) according to the age

Age	Activity(mCi)	Activity(MBq)	Effective Dose
<20	5±0 (5-5)	185±0 (185-185)	2.41±0 (2.41-2.41)
20-40	5.26±0.35 (5-6.2)	194.5±12.89 (185-229.4)	2.53±0.17 (2.41-2.98)
41-60	5.82±0.55 (5-6.4)	215.3±20.25 (185-236.8)	2.80±0.26 (2.41-3.08)
61-80	5.84±0.36 (5.2-6.0)	216±13.24 (192.4-222)	2.81±0.17 (2.5-2.9)
Total	5.51±0.50 (5-6.4)	203.8±18.59 (185-236.8)	2.65±0.24 (2.41-3.08)

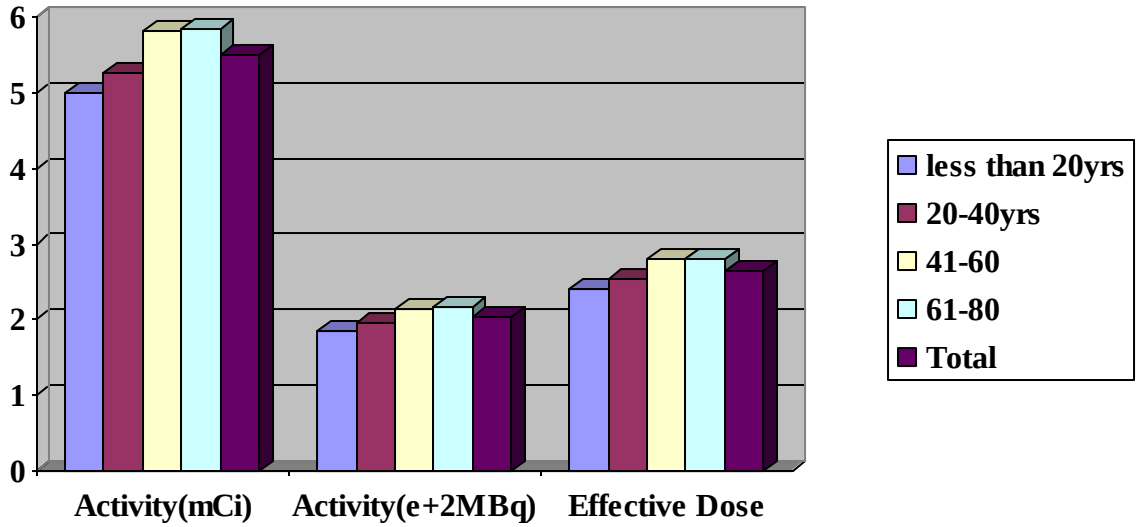


Table 4.7: Time of scan and the percent

Time	Frequency	percent
<200	4	11.4%
201-400	23	65.7%
401-600	6	17.1%
>600	2	5.7%
Total	35	100%

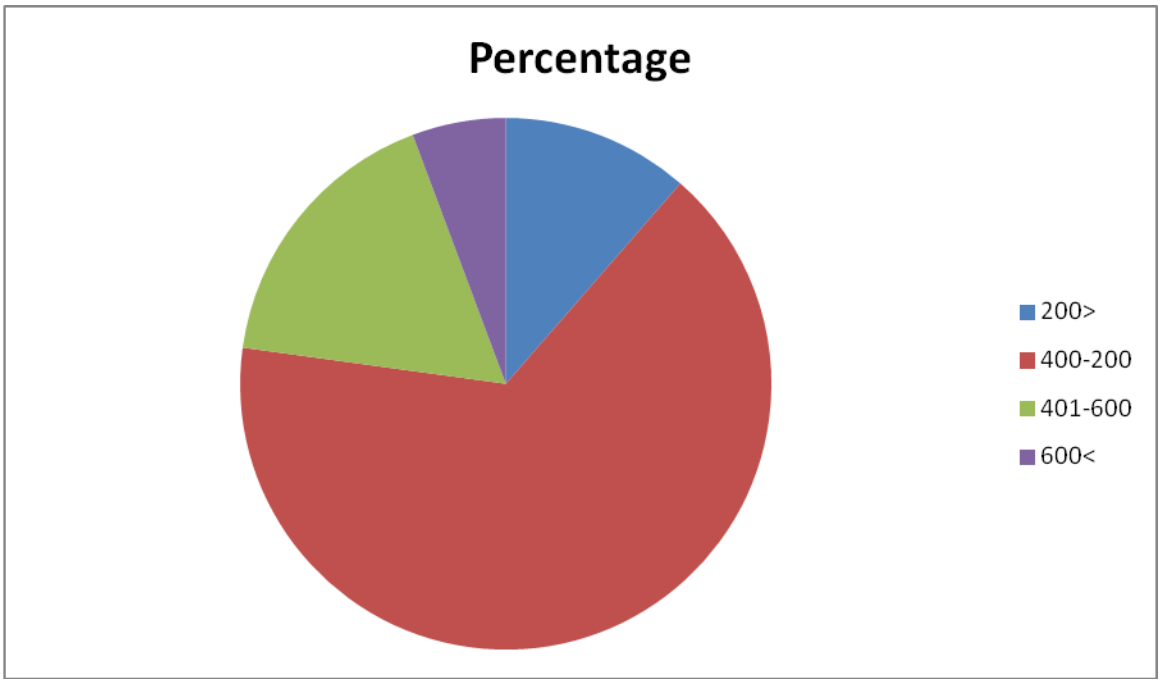
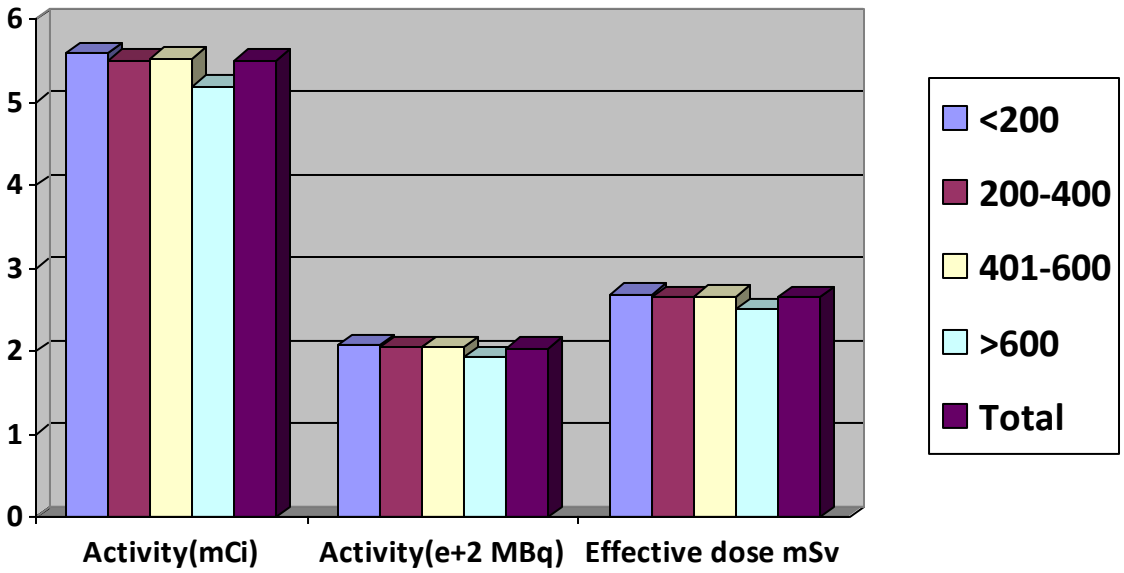


Table 4.8: Activity (mCi), activity (M B q), effective dose (mSv) according to the time

Time	Activity(mCi)	Activity(MBq)	Effective Dose
<200	5.6±0.59 (5-6.2)	207.2±21.79 (185-229.4)	2.69±0.28 i (2.41-2.98)
201-400	5.53±0.53 (5-6.2)	204±19.17 (185-236.8)	2.65±0.25 (2.41-3.08)
401-600	5.53±0.53 (5-6.2)	204.7±19.67 (185-229.4)	2.66±0.26 (2.41-2.98)
>600	5.2±0.0 (5.2-5.2)	192.4±0.0 (192.4-192.4)	2.5±0.0 (2.5-2.5)
Total	5.51±0.50 (5-6.4)	203.8±18.59 (185-236.8)	2.65±0.24 (2.41-3.08)



4.2: Discussion

Thyroid output (thyroid scintigraphy) is an atomic pharmaceutical examination used to assess thyroid tissue. The technique is utilized for wide clinical signs, for example, unctional status of a thyroid knob, thyrotoxicosis - differential finding, or thyroid disease.

The particular target of this examination is assessment the radiation dosage for patients introduction amid thyroid sweep, In this examination utilized Technetium-99m Pertechnetate it has physical half-life 6 hours, gamma discharge 140(keV).

A total of 35 patients under thyroid scan, were measured in Institute of Nuclear Medicine & Allied Sciences. Table 4.1 demonstrates the patient information ,the principle of the age , weight,height and body mass index are 41.83, 64.83, 1.62, 24.40 separately as per the sexual orientation. we see that the percentange of female (77.14%) is more prominent than male (22.86%).

This is on account of there is swelling happens physiology of the thyroid organ high for fe guys, particularly when pubescence. Tables 4.2, 4.3, 4.4 demonstrate the age, weight , stature of patient and percent separately We see that the patient age run between (20-40) is most astounding percent it exhibited (51.4%) from aggregate of patient (figure 4.2). Figures (4.3), (4.4) indicate relationship amongst's weight and stature of patient and percent individually.

we found that the scope of weight between (61-70) is higher percent of persistent (34.3%), and the rate (46%) introduced the higher percent of patient whose tallness between (161-170).

Table 4.5 the patient controlled movement and successful measurements for patients experienced thyroid output demonstrates the estimations of regulated action normal 203.8 ± 18.59 Mbq gone between (185-236.8) and the estimations of powerful measurement normal 2.65 ±0.24 mSv. What's more, run between (2.41-3.08) as indicated by the sex, Figure(4.5) demonstrates connection activity (mCi), activity (MBq) , effective dose (mSv) and the sexual orientation. Table(4.6) demonstrates activity as (mCi), activity in (MBq) and effective dose measurements (mSv) as per the age.

we found that the age is impacts in the compelling dosage when the age increment the dosage is expanding. (Figure 4.6).

Table(4.7) demonstrates time of output and the percent, we see that in figure (4.7) the higher level of sweep is 65.7% in the scope of (200- 400) second ,the movement and the viable measurement is impacts in time of output appears in table(4.8), when the action increment the time is diminish (figure 4.8). table (4.9) appears as the activity and the effective dose is the influences in time of scan shows in table(4.8),when the activity increases the time is decreased (figure 4.8). table (4.9) shows the correlation between activity, in effective dose and the weight ,when the weight increase the activity and the effective dose also increase (Figure 4.9).

As thyroid scintigrahpy includes coordinate light of a portion of the interior and radiosensitive organs of the patient, surface dosages for particular organs were assessed as delineated (Table 4.8 and 4.9). This can be effortlessly disclosed because of the utilization of " 99mTc rather than 123-I which focus just thyroid organ then again to " 99mTc. Consequently all adjoining organs assimilated the radioactive material.

Iodine is not accessible on the grounds that it more costly instead of " 99mTc, which is more accessible and of multipurpose applications, The dosages in the present examination, of the request of 0.2 mSv/week, proposed that introduction was most certainly not liable to surpass as far as possible.

In this examination, the organ surface measurements for patients were likewise altogether higher. This may be ascribed because of the high activity managed to the patient contrasted with the global conventions.

Fligher action was utilized as a part of this division convention keeping in mind the end goal to diminish the season of imaging on the grounds that the nation has just two atomic pharmaceutical focuses.

Chapter Five

Conclusion and Recommendation

5.1: Conclusion

The thyroid output is more typical symptomatic technique utilized, and it is more normal in female than male. This examination measured patient introduction amid thyroid scans by utilizing technetium-99m pertechnetate.

The measure of movement utilized focus in thyroid organ furthermore, the little measure of it move to different tissues at that point discharge by urinary framework, the age, weight of patient and time of scan impacts in the movement and the compelling measurements .

Higher movement was utilized as a part of this division convention keeping in mind the end goal to diminish the season of imaging in light of the fact that the nation has just two atomic prescription focuses.

Radiation well being guidelines and great work rehearse is very required to enhance radiation assurance. Choice of the little measurement of the movement and great patient situating for the methodology could likewise decrease the radiation measurement.

5.2: Recommendation

The atomic pharmaceutical office staff ought to be prepared in any event every year to get more learning about atomic medication and to be refreshed with new advancement in this branch of solution.

Additionally the staff should take more security method when they manage patients since the patients after infusion by the radioactivity progress toward becoming sucrose of radiation. Utilize little measure of radionuclide enough to deliver great picture quality to diminish the powerful measurement .

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