Sudan University of Science and Technology

College of Graduate Studies

Assesment of Bone Density by Using CT in Paitent With Thyroid Disorder in Algazira state

تقييم كثافة العظام باستخدام الاشعة المقطعية لمرضي الغدة الدرقية

A thesis Submitted for Partial Fulfillment for Requirement of M.Sc Degree in Radiological Sciences and Medical Imaging

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بسم الله الرحمن الرحيم

قال تعالى:

(وَضَرَبَ لَنَا مَثَلًا وَنَسِيَ خَلْقَهُ قَالَ مَنْ يُحْيِي الْعِظَامَ وَهِيَ رَمِيمٌ * قُلْ يُحْيِيهَا الَّذِي أَنشَأَهَا أَوَّلَ مَرَّةٍ وَهُوَ بِكُلِّ خَلْقٍ عَلِيمٌ.)

صدق الله العظيم

سوره يس

الاية (79 – 78)

Dedication

to

MY PARENTS

ALLAH rest their souls in heaven and

Be Merciful to them

My Husband

My Son

My Daughters

Acknowledgment

First of all I would like to thank Allah who ever gave me health and power to carry on this work, and who is merciful on me all the time.

I would like to thank my supervisor . Dr Asma Ibrahim & my co supervisor Dr Mona Ahamed Mohamed whom dedicated most of them precious time giving me invaluable assistance and guidance throughout the whole work and for sharing their knowledge thus improving my skills.

Special gratitude extended to my husband Dr Mohmed Fadl Elseaed, My son Ahmed & my daughter Dan & Aan.

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List of abbreviations

DEXA	Dual energy x-ray absorptiometry.
BMD	Bone mineral density.
C,T,L	Cervical, thoracic and lumber vertebrae.
CT	Computer tomography
LVA	Lateral vertebral assessment.
T-score	Indicates the difference between the patient's measured BMD and the ideal peak bone mass achieved by a young adult.
Z-score	Indicates the difference between the patient's measured BMD and the ideal peak bone mass achieved by aged-matched peers.
Ca	Multiplanar reformats
T3	Triiodothyronine
HU	Hounsfield Unit
BMI	Bone mass index.
MRI	Magnetic resonance imaging
DP	Density peak.
WHO	World health organization.
ALP	Alkaline phosphates.
T4	Levothyroxine
THS	Thyroid hormone stimulation
CI	Clinical investigation.
RA	Rheumatoid arthritis.
HT	Hyperparathyroidism.
SPSS	Statistical package for social science.
ALP	serum alkaline phosphatase
ADT	Androgen Deprivation Therapy
DXA	Dual energy X-ray absorptiometry (DXA)
SMA	spinal muscular atrophy (SMA
EMI	Emergency Management Institute
GFR	glomerular filtration rate
MPR	Multiplanar reformats

Abstract

This study is retrospective, analytic and experimental descriptive study by using of statistical package for social science (SPSS) because it gives more specific and accurate data analysis.

General objective to identify the role of CT scan in the diagnosis of bone density. Specific objectives to monitor the ability of CT scan to assess osteoporosis in patients with thyroid disorder, to monitor the ability of CT scan in assessing osteopenia and in an identify the role of CT scan in assessing bone density.

The study was done in ALgazira Scan hospital, Wad Madani for advance, treatment and diagnostic centre, Shakrin diagnostic centre & Algazir Centre for X-ray diagnostic. In the period between 2016– 2018 used CT scan to assess the bone density for 100 patients with thyroid disorder, whom their ages were range between (25 – 100 yr).

The result demonstrates that CT scan is most accurate and sensitive in diagnosing and evaluating bone density. CT scan is the most accurate and sensitive in diagnoses osteoporosis (100%) and osteopenia (100%).

Osteoporosis results by decreasing calcium serum in bone, increase when thyroid disorder (100%), increase when age increase (35.85%), increase in females more than males (71.72%) because post menopause females had decreased in estrogen level, increases when the patients obese (79.48%), BMD decrease when height decrease (35.89%).

Osteopenia results by decrease calcium serum in bone, increases when thyroid disorder (100%), increase when age increase (36.36%), increase in males more than females (90.91%) because BMD decrease when testestrogen level decrease and increases with the age in the males,

increase in the thin patients (81.82%), and increases in height decrease (45.45%).

Recommended every patients with thyroid disorder must be underwent CT scan examination to assess significant change in bone mineral density, every patient, such as patients on high dose of steroid medication, may need follow-up periodically by intervals of six months, CT scan modality should be introduced in the syllabus of the faculties of radiology and the post menopause female should takes estrogen to avoid decrease bone density.

ملخص الدراسة

هـذه الدراسـة دراسـة وصـفية, تحليليـة وتجريبيـة أجريـت لدراسـة حـالات سـابقة باستخدام برنامج وذلك لدقته وإعطاء نتائج أفضل. **(SPSS)** التحليل الاحصائي.

الأهـداف العامـة لهـذه الدراسـة معرفـة دور جهـاز تقيـيم هشاشـة العظـام فـي تشـخيص كثافـة العظام.الأهـداف الخاصـة تتمثـل فـي مقـدرة جهـازه الأشـعة المقطعيـة فـي تشخيص هشاشة العظام في تشخيص مرض هشاشة العظام الحادة والمتوسطة.

أجريـت هـذه الدراسـة فـي مركـز شـاكرين التشخيصـي مركـز الجزيـزة التشخيصـي بالاشـعه الجزيـره اسـكان و مركـز ود مـدني العلاجـي التشخيصـي المتطـور بولايـة الجزيـرة فـي الفتـرة مـن2015 الـى 2017 باسـتخدام جهازالاشـعة المقطعيـه فـي تقيـيم هشاشـة العظـام (**CT**) لتقيـيم كثافـة العظـام مائـه مـريض خضـعوا للفحـص فـي مـدى عمري يتراوح بين (25 – 100 سنه).

أظهـرت نتـائج هـذه الدراسـة مـدى دقـة وفاعليـة اسـتخدام جهـاز تقيـيم كثافـة العظـام فـي تشـخيص حـالات هشاشـة العظـام الحـادة بنسـبة (100%) .أمـراض هشاشـة العظـام المتوسـطة والحـادة لمرضـي مصـابين بـإمراض الغـدة الدرقيـة نقصـان عنصـر الكالسـيوم فـي العظـام واوضـحت هـذه الدراسـة متطابقـة مـع دراسـات سـابقة بـأن هشاشـة العظـام الحـادة تزيـد بزيـادة العمـر بنسـبة (**35.85%**) لكـلا الجنسـين كمـا اثبتـت ايضـا ان هشاشـة العظـام الحـادة تزيـد فـي الانـاث اكثـر مـن الـذكور بنسـبة (71.72%) وذلـك بسـبب نقصـان هرمـون الاسـتروجين بعدسـن اليـأس كمـا اثبتـت الدراسـة ان هشاشـة العظـام الحـادة تزيـد بزيـادة الـوزن بنسـبة (**79.48%**) وكما انها تزيد ايضا بنسبة (**35.89%**) في الاشخاص الاقل طولا.

كمـا أظهـرت نتـائج هـذه الدراسـة مـدى دقـة وفاعليـة اسـتخدام جهـاز الأشـعة المقطعيـة تقيـيم كثافـة العظـام فـي تشـخيص حـالات هشاشـة العظـام المتوسـطة بنسبة (100%) .

أمـراض هشاشـة العظـام المتوسـطة لمرضـي مصـابين بـامراض الغـدة الدرقيـة مـع نقصـان عنصـر الكالسـيوم فـي العظـام واوضـحت هـذه الدراسـة متطابقـة مـع دراسـات سـابقة بـأن هشاشـة العظـام المتوسـطة تزيـد

بزيادة العمر بنسبة (36.36%) لكلا الجنسين كما اثبتت ايضا ان هشاشة العظام المتوسطة تزيد في الاناث اكثر من الزكور بنسبة (90.91%) وذلك بسبب نقصان هرمون التستروجين وزياده العمر في الذكور كما اثبتت الدراسة ان هشاشة العظام المتوسطة تزيد مع نقصان الوزن بنسبة (**81.82%**) وكما انها تزيد ايضا بنسبة (45.45%) في الأشخاص الاقل طولا.

اوصت هذه الدراسة بالفحص لمرضي الغدة الدرقية لتقييم كثافة العظام واخذ العلاج قبل حدوث هشاشة العظام كما أوصت أيضا المرضى اللذين يتناولون العقاقير الطبية مثل الكورتيزون والاندروجين بالفحص الدوري كل ستة وتوصي الدراسة بإدخال أجهزة المقطعية في كليات الأشعة أشهر كما أوصت الدراسة الإناث بعد سن اليأس بتناول هرمون الاستروجين لتفادي هشاشة العظام الحادة والمتوسطة.

1.1 Introduction

Disorders of the thyroid gland result primarily from autoimmune processes that stimulate the overproduction of thyroid hormones (thyrotoxicosis) or cause glandular destruction and underproduction of thyroid hormones (hypothyroidism). Neoplastic processes in the thyroid gland can lead to benign nodules or thyroid cancer. Thyroidal production of the hormones thyroxine (T4) and triiodothyronine (T3) is controlled via a classical endocrine feedback loop. Some T3 is secreted by the thyroid, but the most is produced by deiodination of T4 in peripheral tissues. Both T4 and T3 are bound to carrier proteins called [thyroid-binding globulin (Mohamed Inam Dinis2009).

The skeleton is divided into two descriptive regions axial skeleton, which is consists of bones of the skull, vertebral column, ribs, and sternum , and Appendicular skeleton which is consists of the bones of the limbs, including pectoral and pelvic girdles.(Richard S. Snell2008)

Osteoporosis is defined as ‘a disease characterized by low bone mass and micro-architectural deterioration of bone tissue, leading to enhanced bone fragility and an increase in fracture risk’. Using bone densitometry at the hip or spine measured by dual X-ray absorptiometry (DXA), the World Health Organization (WHO) also defines osteoporosis as a bone density of 2.5 standard deviations (SDs) below the young healthy adult mean value (T-score ≤ -2.5) or lower. Values between -1 and -2.5 SDs below the young adult mean are termed ‘osteopenia’. The rationale for this definition is the inverse relationship between bone mineral density (BMD) and fracture risk in postmenopausal women and older men. However, this definition should not be applied to younger populations. Fractures due to osteoporosis are a major cause of morbidity and mortality in elderly populations, with osteoporotic fractures of the spine

causing acute pain or deformity and postural back pain. One in two women and one in five men aged 50 years will have an osteoporotic fracture during their remaining lifetime. Caucasian and Asian races are particularly at risk. As the risk of fracture increases exponentially with age, changing population demographics will increase the burden of disease. (Kumar, Klark 2017)

Osteopenia is a bone condition characterized by a decreased density of bone, which leads to bone weakening and an increased risk of bone fracture. Osteopenia and osteoporosis are related conditions. In osteopenia, however, the bone loss is not as severe as in osteoporosis. This means someone with osteopenia is more likely to get a bone than someone with a normal bone density but is less likely to fracture a bone than someone with osteoporosis. (Kumar, Klark 2017)

Computed tomography can be defined as radiographic examination displayed as thin tomography images representing computer-assisted mathematic reconstruction of body tissues and contents.(Bontrager K 2005)

1.2Problem of study

Patients with thyroid disorder suffer from bones fracture due to osteoporosis result from hyper and hypothyroidism. CT scan can help a lot in assessment of bone density and so help to solve or prevent this bone fracture

1.3 Objectives

1.3.1 General objective

To identify the role of computer tomography scan to asses bone density.

1.3.2 Specific objectives

- To monitor the ability of computer tomography scan in diagnosis of bone diseases in patients hyperthyroidism
- To monitor the ability of computer tomography scan in diagnosis of bone diseases in patients hypothyroidism

1.4 The study overview

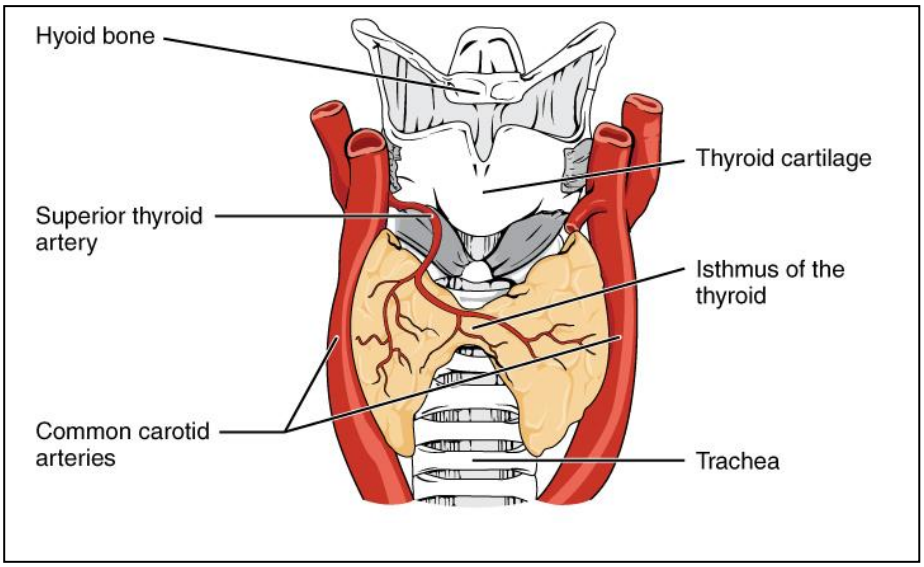
The study content five chapter, chapter one consist of introduction, problem of study and objectives of study. Chapter two includes the literature review & previous studies. Chapter three describe the material and methods. Chapter four includes result and lastly chapter five include the discussion, conclusion, recommendation, reference and appendix

2.1 Thyroid

2.1.1 Anatomy of thyroid

The thyroid gland is a highly vascular endocrine gland situated in the lower part of the front of the neck in close relation to larynx and trachea. The follicular cells of the thyroid gland secrete tri-iodo-thyronine (T3) and tetraiodo-thyronine (T4) hormones, which raise the rate of metabolism. The hormones are stored in the follicles of the gland as thyroglobulin. The parafollicular cells secrete calcitonin, which is a hypocalcemic hormone (Neeta V Kulkarni 2012).

Thyroid anatomy



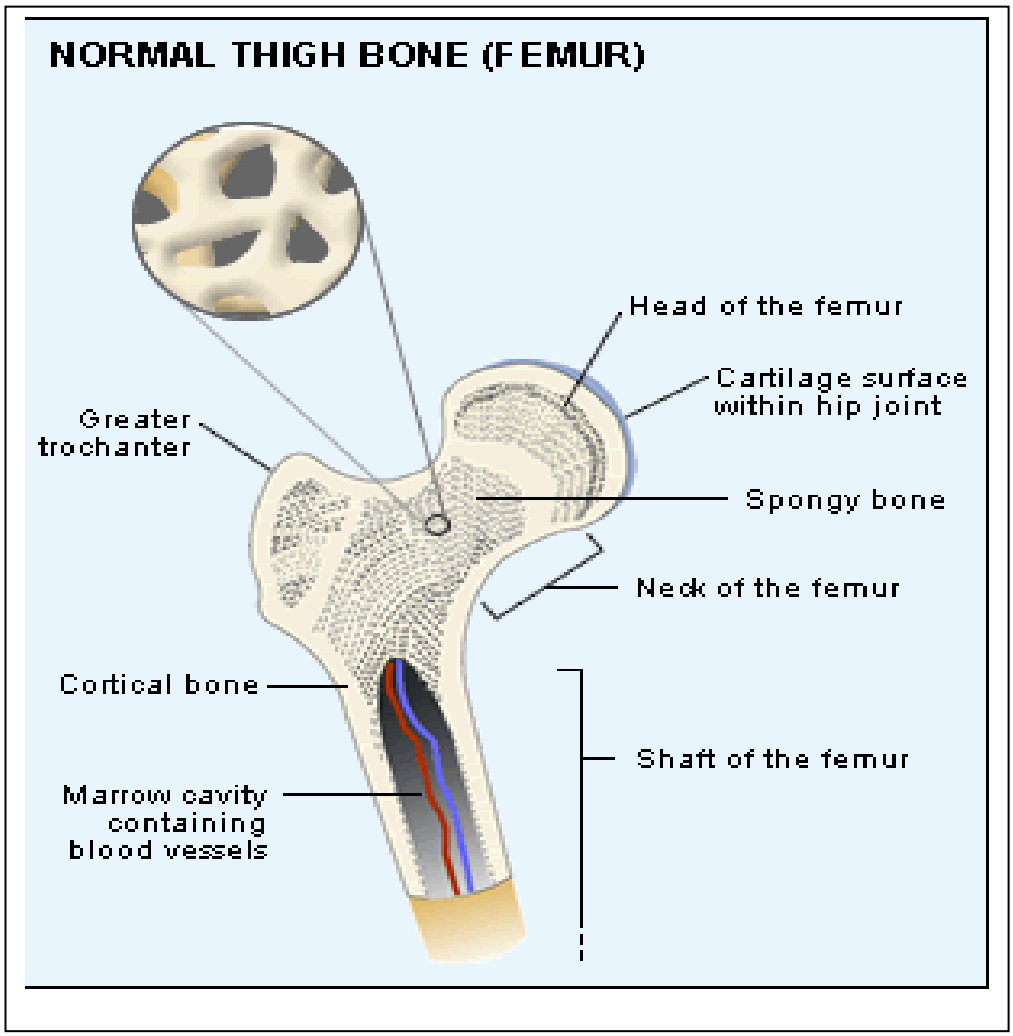
2.1.2 Anatomy of bone

2.1.2.1 bone compact

Compact bone, or dense bone, is contains many cylinder shaped units called osteons. The osteocytes (bone cells) are tiny chambers called lacunae that found between concentric layers of matrix called lamellae. The matrix contains collagenous protein fibers and mineral deposits, primarily of calcium and phosphorus salts. In each osteon, the lamellae and lacunae surround a single central canal. Blood vessels and nerves from the periosteum enter the central canal. The osteocytes have extensions that extend into passageways called canaliculi, and thereby the osteocytes are connected to each other and to the central canal. Spongy bone, or cancellous bone, is contains numerous bony bars and plates, called trabeculae. Although lighter than compact bone, spongy bone is still designed for strength. Like braces used for support in buildings, the trabeculae of spongy bone follow lines of stress. In infants, red bone marrow, a specialized tissue that produces blood cells, is found in the cavities of most bones. In adults, red blood cell formation, called hematopoiesis, occurs in the spongy bone of the skull, ribs, sternum (breastbone), and vertebrae, and in the ends of the long bones.(Mader2004)

The skeleton is divided into two descriptive regions, Axial skeleton is consist bones of the skull, vertebral column, ribs, and sternum. Appendicular skeleton is consist bones of the limbs, including pectoral and pelvic girdles.(Richard S. Snell2008)

Normal bone construction



2.1.2.2 Lumbar vertebrae

There are five lumbar vertebrae, the third L3 being the largest. Projecting posterior are bilateral pedicles composed of thick cortical bone connecting to lamina forming the spinal canal. .(Richard S. Snell2008)

L5 is somewhat atypical with awedge-shaped body, articulating inferiorly with the sacrum. Not infrequently, it may be fused, wholly or partly, with the body of the sacrum sacralization of L5. Extending from the pedicles is a bony plate called the pars articularis from which extend the superior and inferior articular facets.(Richard S. Snell2008)

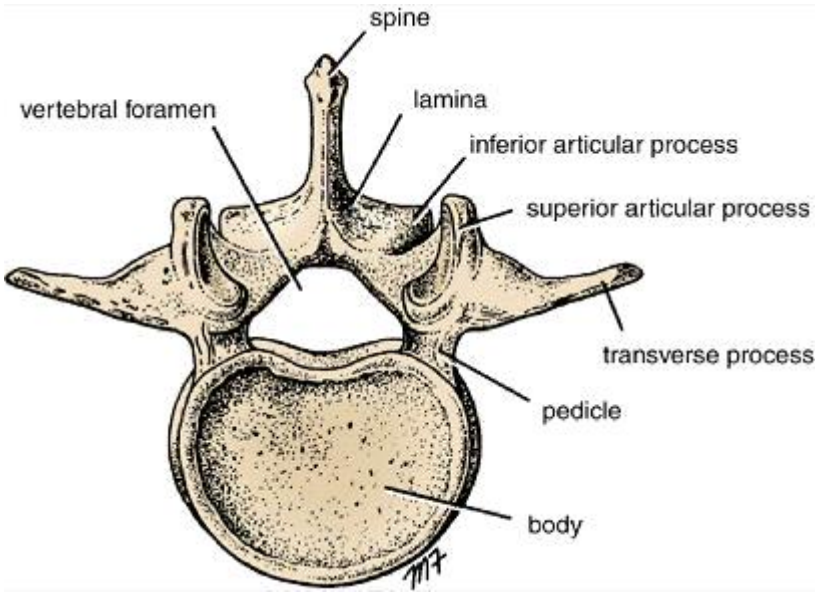
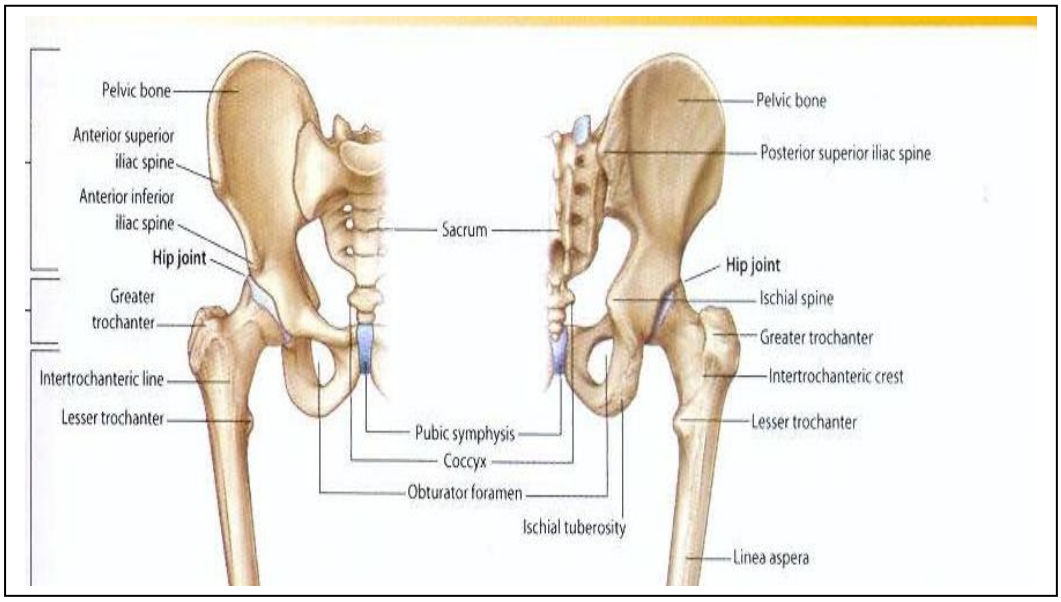


Fig (2-1) Shows fifth lumbar vertebra. (Richard S. Snell2008)

2.1.2.3 Hip bone

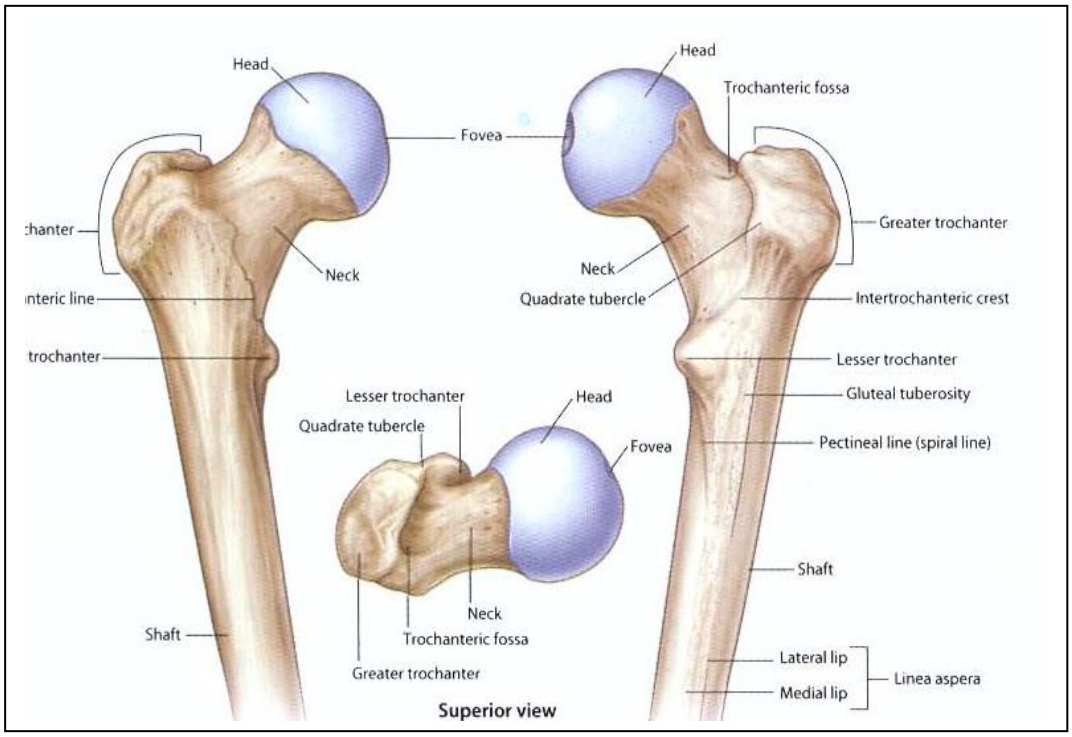
The mature hip bone is the large, flat pelvic bone formed by the fusion of three primary bones ilium, ischium and pubis at the end of the teenage zyears. The ilium forms the largest part of the hip bone and contributes the superior part of the acetabulum. The ilium has thick medial portions columns for weight bearing and thin, wing-like, posterolateral portions, the alae that provide broad surfaces for the fleshy attachment of muscles. The ischium forms the posteroinferior part of the hip bone. The superior part of the body of the ischium fuses with the pubis and ilium, forming the posteroinferior aspect of the acetabulum. The pubis forms the anteromedial part of the hip bone, contributing the anterior part of the acetabulum, and provides proximal attachment for muscles of the medial thigh. The pubis is divided into a flattened medially placed body and superior and inferior rami that project laterally from the body. (Keith, Moore, Arthur, Dalley, Anne Agur2010)



Fig(2.2). showed anatomy of Rt & Lt hips joints (Gray's atlas of anatomy)

2.1.2.4 Femur

The femur is the longest and heaviest bone in the body. It transmits body weight from the hip bone to the tibia when a person is standing. Its length is approximately a quarter of the person's height. The femur consists of a shaft body and two ends, superior or proximal and inferior or distal. (Keith, Moore, Arthur, Dalley, Anne Agur2010)



Fig(2.3). showed anatomy of Rt & Lt upper femur (Gray's atlas of anatomy)

2.2 Physiology

2.2.1 Thyroid physiology

The gland produces thyroxine (levothyroxine) (T4), triiodothyronine (T3) and calcitonin. Calcitonin is concerned with calcium metabolism and will be considered with the parathyroid hormone and control of plasma calcium, thyroid hormone have a calorigenic action. They stimulate oxygen consumption and energy expenditure by all active tissues of the body, with some exception, such as brain, pituitary and tests. Thyroid hormone are important for normal growth and development. This is clearly seen in congenital deficiency of thyroid hormone, resulting in the thyroid dwarf (the cretin). Thyroid hormone are essential for the normal development and function of central nervous system. Mental retardation is an important feature of cretinism. Thyroid hormones in metabolism, It indirectly cause protein breakdown to provide fuel for increase energy expenditure. Catabolism of muscle protein leads to muscle-westing and removal of bone protein results in hypercalcaemia, hypercalciuria and osetoporosis. Thyroid hormone promote conversion of B-carotene to vitamin A. they also facilitate absorption of vitamin B. thyroid hormones have a diuretic effect(J.JBray, P.A.Cragg, A.D.C.Macknight & R.G.Mill, 2th ed).

They are also an increase in the glomerular filtration rate (GFR) and an increase in renal excretion of sodium and calcium. Thyroid hormones increase the chronotropic and inotropic effect of catecholamines on the heart. They are increase the motility of gastrointestinal tract and improve the appetites. Thyroid hormones increase the excitability of nervous tissue. Thyroid hormone are also essential for the normal development and function of gonads. Thyroid hormones are important for maintenance of milk production and increase milk production. Thyroid hormone are important for bone marrow metabolism and for normal erythropoiesis (J.JBray, P.A.Cragg, A.D.C.Macknight & R.G.Mill, 2th ed).

2.2.2 Physiology of the skeletal system

Bone is a specialized connective tissue serving three major functions. Mechanical – supplying structure and muscle attachment for movement. Metabolic – providing the body's primary store of calcium and phosphate. Protective – enclosing the marrow and other vital organs. Bone structure is comprised of cells and a matrix of organic protein and inorganic mineral. Long bones (femur, tibia, humerus) and flat bones (skull, scapula) have different embryological templates, with varying proportions of cortical and trabecular bone. Cortical (compact or lamellar) bone forms the shaft of long bones and the outer shell of flat bones. Formed of concentric rings of bone, it is particularly adapted to withstand bending strain. Trabecular (cancellous) bone is found at the ends of long bones and inside flat bones. Comprised of a network of interconnecting rods and plates of bone, it offers resistance to compressive loads. It is also the main site of bone turnover for mineral homeostasis. Woven bone lacks an organized structure. It appears in the first few years of life, at sites of fracture repair and in high-turnover bone

disorders such as Paget's disease. Matrix components are type I collagen is the main protein, forming parallel lamellae of differing density (which impairs spreading of cracks). In cortical bone, concentric lamellae form around a central blood supply (Haversian system), which communicates via transverse (Volkmann's) canals. non-collagen proteins include osteopontin, osteocalcin and fibronectin and Bone mineral largely consists of calcium and phosphate in the form of hydroxyapatite.(Kumar, Clark, 2017)

2.3 Pathology

2.3.1 Pathology of thyroid

2.3.1.1 Hypothyroidism

Decrease secretion of thyroid hormone is called hypothyroidism (Mohamed Inam Dinis2009).

Clinical types & etiology

Hypothyriodism is divided into two types, primary hypothyroidism, decrease thyroid hormone production due to disease process in the thyroid gland. This is the most common type. other causes of primary hypothyroidism, remove of the thyroid gland by surgery, radiation therapy, hashimoto,s thyroiditis & primary idiopathic hypothyroidism. Secondary hypothyroidism and decrease thyroid hormone production due to failure of pituitary TSH secretion in condition such as hypopituitarism. This type of hypothyroidism is rare(Mohamed Inam Dinis2009)

Clinical feature

The clinical feature of hypothyroidism include cretinism (infant & children) and myxedema (in older children and adults)(Mohamed Inam Dinis2009)

Investigations

Serum free T4 level is decreased, serum TSH, elevated in primary hypothyroidism and no elevated in secondary hypothyroidism(Mohamed Inam Dinis2009).

Treatment

Thyroxine replacement(Mohamed Inam Dinis2009)

2.3.1.2 Hyperthyroidism

Excessive secretion of thyroid hormone is called hyperthyroidism(Mohamed Inam Dinis2009)

Etiology

Primary hyperthyroidism occurs when there is excessive secretion of thyroid hormones and due to primary abnormality in thyroid gland, it is the most common type. Causes craves disease (in>95%) which is an autoimmune thyroid disease in which autoantibodies stimulate the thyroid cell to produce excessive hormone, hyperfunctional follicular adenoma, hyperfunctional multinodular goiter, ingestion of excessive exogenous thyroid hormone and thyroiditis in early stage. Secondary hyperthyroidism when the excessive secretion of hormone is due to primary abnormality outside the thyroid gland. As seen in TSH secretion pituitary adenoma and ectopic thyroid secretion by ovarian teratoma(Mohamed Inam Dinis2009)

Clinical features

Nervousness, anxiety, insomnia, tremors, weight loss, heart intolerance, increase sweat, palpitation, tachycardia, cardiac arrhythmias atrial fibrillation and cardiac failure, amenorrhea, infertility, muscle weakness and osteoporosis(Mohamed Inam Dinis2009)

Investigations

Serum free T4 is elevated, serum TSH is decrease in primary hyperthyroid and elevated in secondary hyperthyroidism(Mohamed Inam Dinis2009)

Treatment

Antithyroid drugs, subtotal thyroidectomy & radioiodine(Mohamed Inam Dinis2009)

2.3.2 Pathology of bones

2.3.2.1 Osteopenia

Osteopenia is a bone condition characterized by a decreased density of bone, which leads to bone weakening and an increased risk of breaking a bone fracture. Osteopenia and osteoporosis are related conditions. In osteopenia, however, the bone loss is not as severe as in osteoporosis. That means someone with osteopenia is more likely to fracture a bone than someone with a normal bone density but is less likely to fracture a bone than someone with osteoporosis. Osteomalacia, osteomyelitis, and osteoarthritis are different conditions that are frequently confused with osteopenia because they sound similar. Osteomalacia is a disorder of the mineralization of newly formed bone, which causes the bone to be weak and more prone to fracture. There are many causes of osteomalacia, including vitamin D deficiency and low blood phosphate levels. Osteomyelitis is bone infection. Osteoarthritis is joint inflammation featuring cartilage loss and is the most common type of arthritis. Osteoarthritis does not cause osteopenia, osteoporosis, or a decreased

bone mineral density. Causes of Osteopenia genetics familial predisposition to osteopenia or osteoporosis, as well as other genetic disorders, hormonal causes, including decreased estrogen such as in women after menopause or testosterone, smoking, excess alcohol, thin frame, Immobility, certain medications such as corticosteroids, including prednisone and antiseizure medications, malabsorption due to conditions such as celiac spur and chronic inflammation due to medical conditions such as rheumatoid arthritis.(Kumar, Clark, 2017))

Symptoms and signs of osteopenia does not cause pain unless a bone is broken fractured. Interestingly, fractures in patients with osteopenia do not always cause pain.(Kumar, Clark, 2017))

Osteopenia or osteoporosis can be present for many years prior to diagnosis for these reasons. Many bone fractures due to osteopenia or osteoporosis, such as a hip fracture or vertebral fracture of a bone in the spine, are very painful. However, some fractures, especially vertebral fractures of the bony building blocks of the spine, can be painless and therefore osteopenia or osteoporosis may go undiagnosed for years. Complications menorrhagia is the most common cause of anemia reduction in red blood cells in premenopausal women. A blood loss of more than 80mL around three tablespoons per menstrual cycle can eventually lead to anemia. Most cases of anemia are mild. (KUMAR, KLARK 2017)

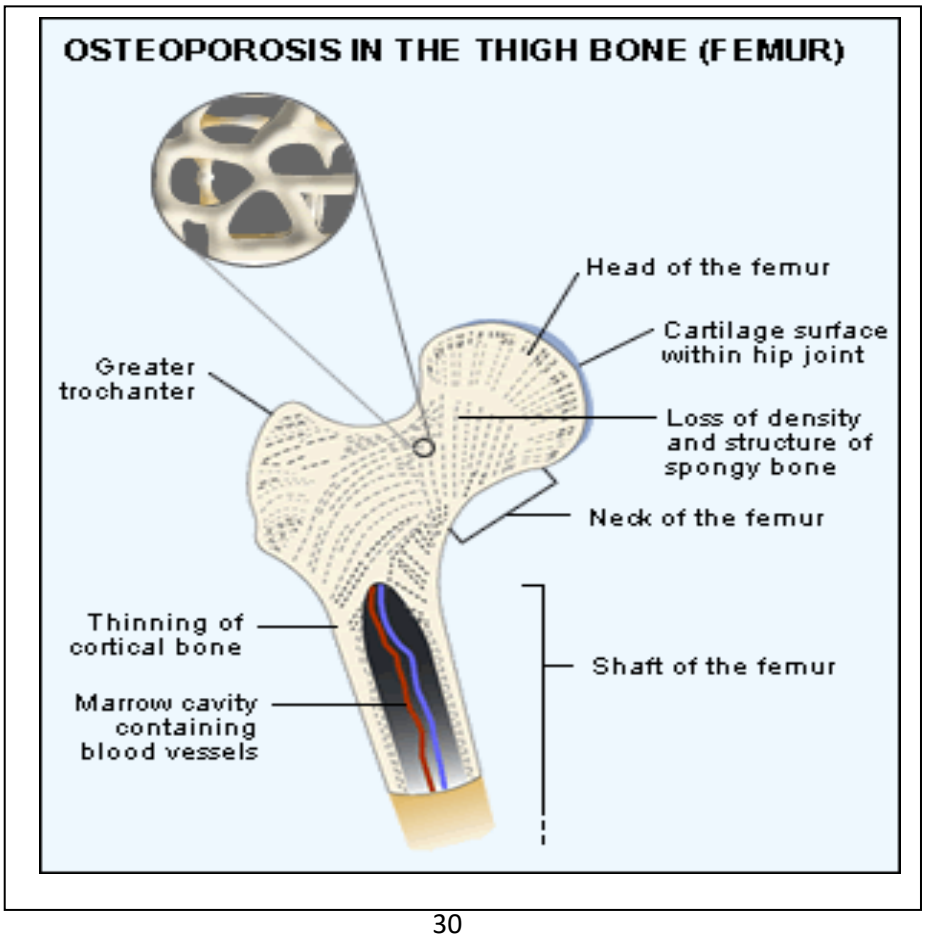
2.3.2.2Osteoporosis

Osteoporosis is a disease characterized by increased porosity of the skeleton resulting from reduced bone mass. It is associated with an increase in bone fragility and susceptibility to fractures. The disorder may be localized to a certain bone or region, as in disuse osteoporosis of a limb, or may involve the entire skeleton, as a manifestation of a metabolic bone disease. Generalized osteoporosis may be primary, or secondary to a large variety of conditions. Symptoms of osteoporosis in the early stages of bone loss, you usually have no pain Loss of height over time, a stooped posture, fracture of the vertebra, wrist, hip or other bone and back pain, which can be severe, as a result of a fractured or collapsed vertebra. Causes of osteoporosis post-menopausal woman and not taking estrogen, have a personal or maternal history of hip fracture or smoking. man with clinical conditions associated with bone loss, use medications that are known to cause bone loss, high bone turnover, which shows up in the

form of excessive collagen in urine samples, thyroid condition, such as hyperthyroidism, parathyroid condition, such as hyperparathyroidism and experienced a fracture after only mild trauma.(Robbins2007)

Fracture is the only cause of symptoms in osteoporosis. Vertebral crush fracture is suggested by the sudden onset of severe pain in the spine, often radiating around to the front. However, only about 1 in 3 vertebral fractures is symptomatic. Pain from mechanical derangement, increasing kyphosis, height loss and abdominal protuberance follow crushed vertebrae. Colles's fractures typically follow a fall on an outstretched arm. Fractures of the proximal femur usually occur in older individuals falling on their side or back. Other causes of low-trauma fractures must not be overlooked, including metastatic disease and myeloma. (Kumar, Clark, 2017)

Image of osteoporosis



2.4 Computed tomography equipment

2.4.1Computed tomography

Computed tomography (CT) was invented in the 1970s, earning its chief inventor, Sir Godfrey Hounsfield, the Nobel Prize for medicine in 1979. CT was the first fully digital imaging technique that provided cross-sectional images of any anatomical structure (Paul Butler, Adam.W.M.Mitchell & Harold Ellis).

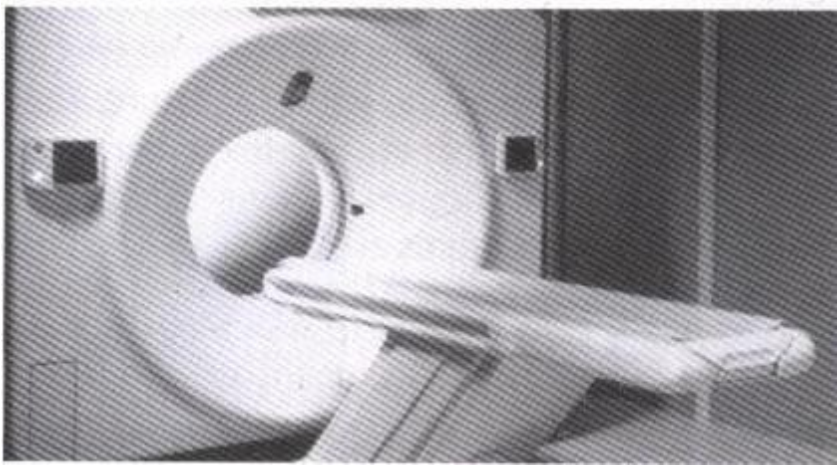
2.4.2Basic principles

Current generation CT scanners use the same basic technology as the first clinical EMI machine in 1972 In conventional CT, the X-ray tube and detector rotate around the patient with the table stationary. The X-ray beam is attenuated by absorption and scatter as it passes through the patient with the detector measuring transmission. Multiple measurements

are taken from different directions as the tube and detector rotate. A computer reconstructs the image for this single “slice.” The patient and table are then moved to the next slice position and the next image is obtained in spiral (helical) CT the X-ray tube rotates continuously while the patient and table move through the scanner. Instead of obtaining data as individual slices, a block of data in the form of a helix is obtained (Paul Butler, Adam.W.M.Mitchell & Harold Ellis).

Scans can be performed during a single breath hold, which reduces miss registration artifacts, such as occur when a patient has a different depth of inspiration between conventional scans.

Equipment of computer tomography



(bontrager)

2.4.3Image reconstruction

To convert the vast amount of raw data obtained during scanning to the image requires mathematical transformation. Depending on the parameters used (known as “kernels”), it is possible to get either a high spatial resolution (at the expense of higher noise levels) used for lung and bone imaging, or a high signal to noise ratio (at the expense of lower resolution) used for soft tissues. The CT image consists of a matrix of image elements (pixels) usually 256 _ 256 or 512 _ 512 pixels. (Paul Butler, Adam.W.M.Mitchell & Harold Ellis)

Each of these displays a gray scale intensity value representing the X-ray attenuation of the corresponding block of tissue, known as a voxel (athree-dimensional “volume element”). CT scanners operate at relatively high diagnostic X-ray energies, in the order of 100 kV. At these energies,

the majority of X-ray-tissue interactions are by Compton scatter, so the attenuation of the X-ray beam is directly proportional to the density of the tissues. The intensity value is scored in Hounsfield units (HU). By definition, water is 0 HU and air _1000 HU and the values are assigned proportionately. These values can be used to differentiate between tissue types. Air (_1000 HU) and fat (_100 HU) have negative values, most soft tissues have values just higher than water (0 HU), e.g., muscle (30 HU), liver (60 HU), while bone and calcified structures have values of 200–900 HU. The contrast resolution of CT depends on the differences between these values, the larger the better. Although better than plain X-ray in differentiating soft tissue types, CT is not a good as magnetic resonance imaging (MRI). For applications in the lungs and bone (where the differences in attenuation values are large), CT is generally better than MRI. The use of intravenous contrast agents can increase the contrast resolution in soft tissues as different tissues show differences in enhancement patterns. Oral contrast can outline the lumen of bowel and allow differentiation of bowel contents and soft tissues within the abdomen. Usually iodinated contrast agents are used for CT, although a dilute barium solution can be used as bowel contrast.(Paul Butler, Adam.W.M.Mitchell & Harold Ellis)

2.4.4Window and level

The human eye cannot appreciate anywhere near the 4000 or so gray scale values obtained in a single CT slice. If the full range of reconstructed values were all displayed so as to cover all perceived brightness values uniformly, a great deal of information would be lost as the viewer would not be able to distinguish the tiny differences between differing HU values. By restricting the range of gray scale information displayed, more subtle variations in intensity can be shown. This is done

by varying the range (“window width”) and centre (“window level”) (Fig. 1.16)(Paul Butler, Adam.W.M.Mitchell & Harold Ellis).

2.4.5Spiral CT and pitch

In conventional, incremental CT the parameters describing the procedure are slice width and table increment (the movement of the table between slices). With spiral CT, the patient, lying on the couch, moves into the scanner as the tube and detectors rotate in a continuous movement, rather than the couch remaining still while each “slice” is acquired. The information during spiral CT is obtained as a continuous stream and is reconstructed into slices. The parameters for spiral CT are slice collimation (the width of the X-ray beam and therefore the amount of the patient covered per rotation), table feed per rotation, and the reconstruction increment. A spiral CT covers the whole volume even if

the table feed is greater than the collimation – it is possible to scan with a table feed up to twice the collimation without major loss of image quality. Often, scans are described by their pitch where pitch _ table feed/collimation.Typical values for collimation (slice thickness) are 1–10 mm with rotation times of 0.5–3 seconds. (Paul Butler, Adam.W.M.Mitchell & Harold Ellis).

To reconstruct from the helical volume, it is necessary to interpolate the projections of one scanner rotation. It is not necessary to reconstruct as consecutive slices – slices with any amount of overlap can be created(Paul Butler, Adam.W.M.Mitchell & Harold Ellis).

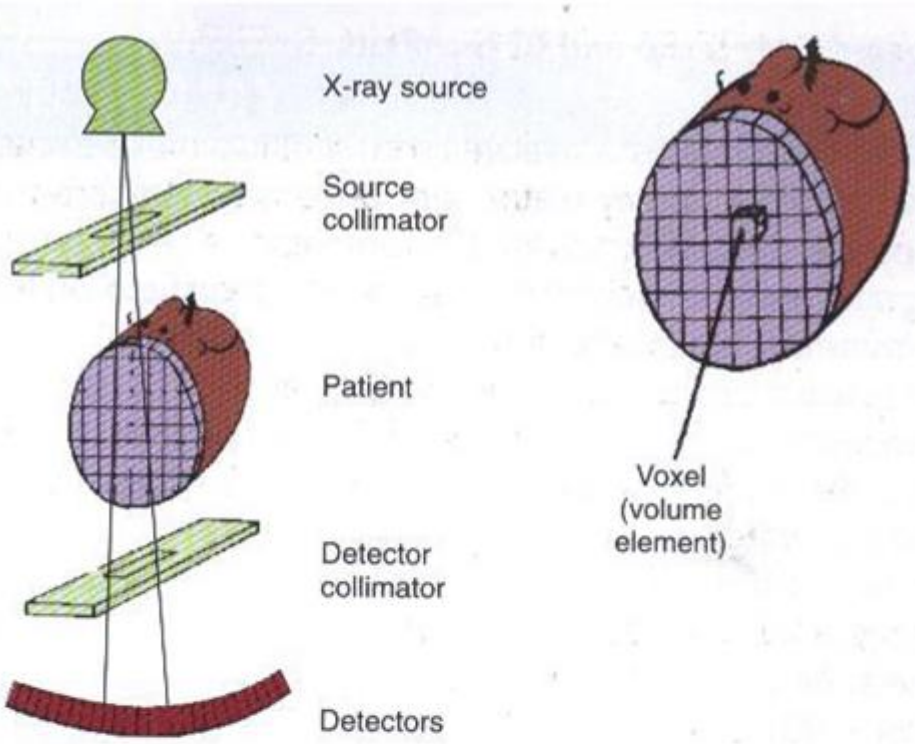
2.4.6Multi-detector CT

CT scanners are now available with multiple rows of detectors (at the time of writing, commonly 64) allowing acquisition of multiple slices in one spiral acquisition. In conjunction with fast rotation speeds, the volume coverage and speed performance are improved allowing, for instance, an abdomen and pelvis to be scanned with an acquisition slice thickness of 1.25 mm in about quarter the time (approximately 10 seconds) that a 10 mm collimation CT scanner could cover the same volume, with the same or lesser radiation dose. The main problem with this type of scanning is the number of images acquired; 300–400 in the

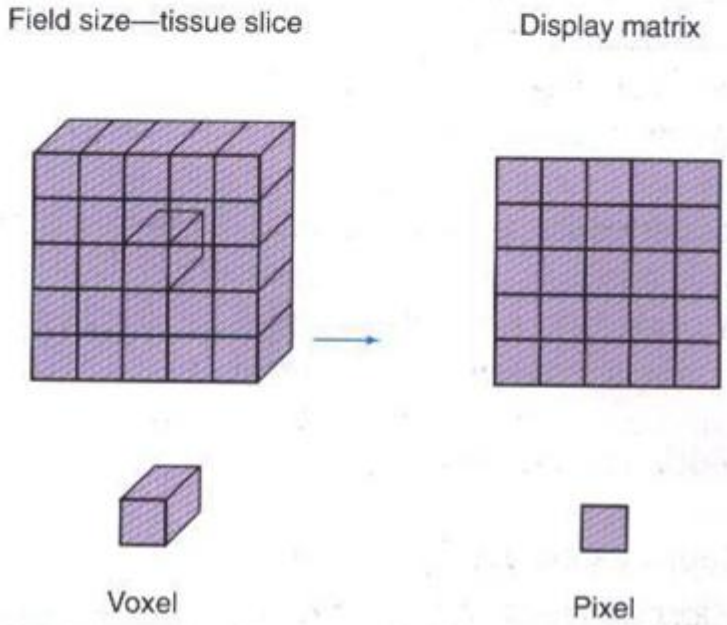
example above instead of about 40 with single slice techniques(Paul Butler, Adam.W.M.Mitchell & Harold Ellis).

2.4.7Advanced image reconstructions

From the spiral dataset, further reconstructions can be performed. Multiplanar reformats (MPR) can be performed in any selected plane, although usually in the coronal and sagittal planes (Fig. 1.17). Three dimensional reconstructions can also be obtained using technique(Paul Butler, Adam.W.M.Mitchell & Harold Ellis) (



Collimation and volume element (voxel).



Computed tomographic image—voxels and pixels.

2.4.8 Technique

2.4.8.1 Indication

Osteoporosis , osteopenia, osteomalacia and assess an individual's risk for developing fractures. (Algazira state. Shakrin Centre2017)

2.4.8.2 Contraindication

Barium examination, vertebroplasty, scoliosis, pregnant, lumber 5 and Lumber 1 with ribs. (Algazira state. Shakrin Centre2017)

2.4.8.3 Patient preparation

The patient is positioned supine and head-first for complete spine. During CT examination of lumbar spine only, positioning the patient supine and feet-first may improve comfort by limiting how much of the patient's body enter the gantry(Daniel N, DeMaio)

Previous studies

2.5.1 Study done by Recklinghausen, 1891. They studied Bone Mineral Metabolism Homeostasis in Hyperthyroidism. And the result are the bone disease was published in 1891 when von Recklinghausen described the "worm eaten" appearance of long bones of a young woman who died due to hyperthyroidism.[10] Plummer gave similar description in 1920 and reported – "A 53 year old woman gave a history of hyperthyroidism. The patient died three hours after operation. The ribs showed multiple fractures, were very friable and could easily be crushed between the fingers. The calvarium was found to be extremely thin, and was almost translucent when held up to the light". In early part of the century, emphasis of studies in thyrotoxicosis was on calcium–phosphorus metabolism. With the introduction of antithyroid drugs and radioiodine therapy in 1940s, clinically apparent hyperthyroid bone disease became less common. In 1970s, with the availability of serum 25(OH)D assay, there was resurgence of interest in vitamin D metabolism in hyperthyroidism. Recently introduced methods of bone density measurement like dual-energy X-ray absorptiometry (DEXA), as well as biochemical markers of bone resorption and formation, have led to further interest in hyperthyroidism related bone disease.[11] These newer techniques have documented skeletal loss in patients with hyperthyroidism, as well as in those on excessive thyroid hormone replacement. Histomorphometric studies demonstrate that thyroid hormones increase the activation of new remodeling cycles and stimulate osteoclastic and osteoblastic activity in trabecular and cortical bone. In an in vitro organ culture of fetal rat bone, Mundy et al. demonstrated a direct stimulation of bone resorption by thyroid hormones.[12] Addition of

thyroid hormone increased 45Ca release by 10–60% during a 6-day long culture of bones of fetal rats previously treated with radioisotope. Histologically, an increase in number and activity of osteoclasts was detected.These cells appeared similar to those seen in cultured bone treated with PTH.[12] The stimulation of bone resorption was inhibited by cortisol, calcitonin and phosphate as well as by propranolol.The mechanisms of thyroid hormone induced bone resorption include cAMP-mediated, increased sensitivity of beta adrenergic receptors to catecholamines, increased sensitivity of bone cells to PTH, osteoclast activator factor and interleukin-1 (IL-1) mediated increased bone resorption.[13] Thyroid stimulating hormone (TSH) deficiency, rather than thyroid hormone excess, has been suggested as the underlying cause. To investigate the molecular mechanism of osteoporosis in thyroid disease, Basstt et al. characterized the skeleton in mice lacking either thyroid hormone receptor α or β (TRα0/0, TRß-/-). Remarkably, in the presence of normal circulating thyroid hormone and TSH concentrations, adult TRα0/0 mice had osteosclerosis accompanied by reduced osteoclastic bone resorption, whereas juveniles had delayed endochondral ossification with reduced bone mineral deposition. By contrast, adult TRß-/- mice with elevated TSH and thyroid hormone levels were osteoporotic with evidence of increased bone resorption, whereas juveniles had advanced ossification with increased bone mineral deposition. Analysis of T3 target gene expression revealed skeletal hypothyroidism in TRα0/0 mice, but skeletal thyrotoxicosis in TRß-/- mice. These studies demonstrate that bone loss in thyrotoxicosis is independent of circulating TSH levels and mediated predominantly by TRα. This study suggests TRα as a novel drug target in the prevention and treatment of osteoporosis.

2.5.2 Study done by Marci R Turner, medical resident,1 Ximena Camacho, analyst,2 Hadas D Fischer, epidemiologist,2 Peter C Austin, senior scientist,2 Geoff M Anderson, professor,3 Paula A Rochon, senior scientist,4 Lorraine L Lipscombe, scientist4, 2011. They studied Levothyroxine dose and risk of fractures in older adults: nested case-control studyand the results are Of 213 511 prevalent levothyroxine users identified, 22 236 (10.4%) experienced a fracture over a mean 3.8 years of follow-up, 18 108 (88%) of whom were women. Compared with remote levothyroxine use, current use was associated with a significantly higher risk of fracture (adjusted odds ratio 1.88, 95% confidence interval 1.71 to 2.05), despite adjustment for numerous risk factors. Among current users, high and medium cumulative doses (>0.093 mg/day and 0.044-0.093 mg/day) were associated with a significantly increased risk of fracture compared with low cumulative doses (<0.044 mg/day): 3.45 (3.27 to 3.65) and 2.62 (2.50 to 2.76), respectively

2.5.3 Study done by Jiang E, Wang Z, Meng Q, Li S, Wang F, Shao G, Zhang L. 2008/2009 . They studied bone density at various skeletal sites for the diagnosis of primary osteoporosis and the results are the objective of this study was to evaluate the diagnostic value of bone density changes in lumbar vertebrae and femoral necks in patients with primary osteoporosis (OP) at various ages. Dual-energy X-ray absorptiometry (DXA) scans were performed on patients who had their primary visits between March 2008 and February 2009. The bone mineral density (BMD) of the lumbar vertebrae 1-4 (L1-L4) in anteroposterior projection and the proximal femoral neck in lateral projection were measured. If the BMD values (T score) of any site is -2.5 or less ($T \leq -2.5$), the patients were diagnosed as primary OP, and the T scores were statistically analyzed. The 81 patients who had lumbar vertebrae with a $T \leq -2.5$ led to a positive rate of 80.1 % in the diagnosis of primary OP; the 47 patients who had femoral neck with a $T \leq -2.5$ gave a positive rate of 47.0 %. The patients with type I or type II primary OP were divided into two age bbgroups of ≤70 and ≥71 years old. The comparison of lumbar spine T score values did not show significant statistical difference ($P > 0.05$) betweeng the age groups, while the result of the femoral necks revealed significant difference between the two groups ($P < 0.001$). In diagnosis of primary OP, anteroposterior lumbar spine offers a significantly higher detection rate than that of the femoral neck, but to the patients older than 70, the measurement of femoral neck may generate higher detection rate. It is more sensitive to measure lumbar trabecular bone, especially to the patients in early postmenopausal period. BMD in elderly patients may falsely increase with age; attention should be paid to the determination of the hip bone mass.

2.5.4 Study done by Swathi K 1 , Haseena S2 , Hussain Saheb Shaik3. They studied Effect of TSH Suppression Therapy on Bone Density in Hypothyroidism. 2014 and the results are the mean value of mean bone mineral area in lumbar spine, femur neck and radius & ulna were 47.53+3.80, 4.47+0.35 and 4.50+0.45 respectively. The mean value of Bone mineral area in lumbar spine is less compared to controls. The mean values of lumbar spine, femur neck, and radius & ulna were 39.47+5.07, 3.23+0.54 and 2.89+0.43 respectively.).

2.5.5 Study done by Douglas C. Bauer, MD; Bruce Ettinger, MD; Michael C. Nevitt, PhD; and Katie L. Stone, PhD, for the Study of Osteoporotic Fractures Research Group 2001. They studied Risk for Fracture in Women with Low Serum Levels of Thyroid-Stimulating Hormone. And the result are After adjustment for age, history of previous hyperthyroidism, self-rated health, and use of estrogen and thyroid hormone, women with a low TSH level (<0.1 mU/L) had a threefold increased risk for hip fracture (relative hazard, 3.6 [95% CI, 1.0 to 12.9]) and a fourfold increased risk for vertebral fracture (odds ratio, 4.5 [CI, 1.3 to 15.6]) compared with women who had normal TSH levels (0.5 to 5.5 mU/L). After adjustment for TSH level, a history of hyperthyroidism was associated with a twofold increase in hip fracture (relative hazard, 2.2 [CI, 1.0 to 4.4]), but use of thyroid hormone itself was not associated with increased risk for hip fracture (relative hazard, 0.5 [CI, 0.2 to 1.3]).

2.5.6 Study done by Khatri IA, Chaudhry US, Seikaly MG, Browne RH, Iannaccone ST. They studied Low bone mineral density in spinal muscular atrophy and the results are Eighty-four dual-energy x-ray absorptiometry scans were performed on 79 patients between the ages of 4 months and 18 years with the mean age of 8 years. Z scores were used to compare their BMDs. BMD was lowest in patients with spinal muscular atrophy (SMA) with Z score of -2.25 +/- 0.31 standard deviation scores. The Z score for patients with Duchenne muscular dystrophy was -1.72 +/- 0.1. The BMD in non ambulatory patients with SMA was significantly decreased compared with ambulatory patients with SMA ($P < 0.05$).

2.5.7 Study done by Jiang E, Wang Z, Meng Q, Li S, Wang F, Shao G, Zhang L. 2008, 2009 . They studied study on bone density at various skeletal sites for the diagnosis of primary osteoporosis and the results are the objective of this study was to evaluate the diagnostic value of bone density changes in lumbar vertebrae and femoral necks in patients with primary osteoporosis (OP) at various ages. Dual-energy X-ray absorptiometry (DXA) scans were performed on patients who had their primary visits between March 2008 and February 2009. The bone mineral density (BMD) of the lumbar vertebrae 1-4 (L1-L4) in anteroposterior projection and the proximal femoral neck in lateral projection were measured. If the BMD values (T score) of any site is -2.5 or less ($T \leq -2.5$), the patients were diagnosed as primary OP, and the T scores were statistically analyzed. The 81 patients who had lumbar vertebrae with a $T \leq -2.5$ led to a positive rate of 80.1 % in the diagnosis of primary OP; the 47 patients who had femoral neck with a $T \leq -2.5$ gave a positive rate of 47.0 %. The patients with type I or type II primary OP were divided into two age groups of ≤ 70 and ≥ 71 years old. The comparison of lumbar spine T score values did not show significant statistical difference ($P > 0.05$) between the age groups, while the result of the femoral necks revealed significant difference between the two groups ($P < 0.001$). In diagnosis of primary OP, anteroposterior lumbar spine offers a significantly higher detection rate than that of the femoral neck, but to the patients older than 70, the measurement of femoral neck may generate higher detection rate. It is more sensitive to measure lumbar trabecular bone, especially to the patients in early postmenopausal period. BMD in

elderly patients may falsely increase with age; attention should be paid to the determination of the hip bone mass.

2.5.8 Study done by Sieber PR, Rommel FM, Theodoran CG, Russinko PJ, Woodward CA, SchimkeL. They studied the role of distal third radius dual energy x-ray absorptiometry (DXA) and central DXA in evaluating for osteopenia and osteoporosis in men receiving androgen deprivation therapy for prostate cancer and the results arethe authors assessed the use of distal third radius dual energy X-ray absorptiometry (DXA) concomitantly with central (hip and lumbar spine) DXA to identify men with osteopenia or osteoporosis receiving androgen deprivation therapy (ADT) for prostate cancer. Initial classification with central DXA demonstrated 60 (17%) normal, 187 (55%) osteopenic, and 96 (28%) osteoporotic patients.

Sixteen of 60 (27%) normal patients were reclassified as osteopenic (14) or osteoporotic (2), and 20 of 187 (11%) osteopenic patients were reclassified as osteoporotic with the combination of central DXA plus distal third radius DXA. The difference in reclassification was statistically significant. The addition of distal third radius to central DXA scanning in men with bone loss associated with ADT identifies a statistically significant number of men being reclassified as having osteopenia or osteoporosis. Combined central and distal third radius DXA scanning should be considered routine in the evaluation of all men suspected of bone loss associated with ADT. This has specific significant clinical relevance because of the large number of men with none valuable central DXA studies. Fracture risk prediction and treatment recommendations based on this reclassification will need to be determined by follow-up studies.

2.5.9 study done by Marwaha RK, Tandon N, Kaur P, Sastry A, Bhadra K, Narang A, Arora S, Mani K. They studied establishment of age-specified bone mineral density reference range for Indian females using dual-energy x-ray absorptiometry and the results are we undertook this study to establish age-specified bone mineral density (BMD) reference range for Indian females using dual-energy X-ray absorptiometry. BMD at multiple skeletal sites was measured in 2034 healthy women aged 18-85yr. The effect of anthropometry and biochemical parameters on BMD was determined. Peak BMD was observed between 30 and 35yr at the hip, lumbar spine, and radius. Significant positive correlation of height and weight with BMD was observed at 33% radius, femur neck, and lumbar spine, whereas significant negative correlation was seen between serum alkaline phosphatase (ALP) and serum parathyroid hormone levels with BMD at aforementioned sites. On multivariate regression analysis, age, weight, and serum ALP were the most consistent contributors to variance in the BMD. Compared with age-matched United States females, BMD of lumbar spine was significantly lower for our subjects in all age groups. Prevalence of osteoporosis among women aged older than 50yr was significantly higher based on Caucasian T-scores as opposed to using peak BMD/standard deviation values from the population under review at lumbar spine but not at femoral neck.

2.5.10 Done by ButtrosDde A, Nahas-Neto J, Nahas EA, Cangussu LM, Barral AB, Kawakami MS. They studied risk factors for osteoporosis in postmenopausal women from southeast Brazilian and the results are according to WHO criteria, 106 (24.6%) women showed osteoporosis (T-score < -2.5 DP), 188 (43.6%) osteopenia (-1.0/-2.4 DP), and 137 (31.8%) were normal (> -1.0 DP). Osteoporosis was detected in 12% of women aged 40-49 years, in 21.8% of women aged 50-59 years and in 45.7% of women aged > 60 years ($p < 0.001$). Osteoporosis occurred in 11.8% of women with a menopause period < 5 years, in 29.4% with a menopause period from 6 to 10 years, and in 41% of women with a menopause period > 10 years ($p < 0.001$). Of the women with early menopause, 80% showed osteopenia/osteoporosis ($p = 0.03$), and of those with BMI < 20 kg/m², 50% were osteoporotic ($p < 0.001$). The risk for osteoporosis detection increased with age (OR = 1.1; CI 95% = 1.0-1.1), time of menopause (OR = 1.1; CI 95% = 1.0-1.1), smoking (OR = 1.9; CI 95% = 1.2-3.2), RA (OR = 3.6; CI 95% = 1.3-9.6) and maternal fracture history (OR = 2.1; CI 95% = 1.1-3.0) ($p < 0.05$). In contrast, HT use (OR = 0.3; 95% CI = 0.2-0.6) and high BMI (OR = 0.9; 95% CI = 0.8-0.9) reduced the risk.

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Material and methods

3.1 The type of study

Retrospective, analytical and experimental descriptive study for 100 patients was be investigated by CT scan in Algazira state in ALgazira Scan hospital,Wad madani Centre for treatment, diagnostic advance, Shakrin diagnostic centre & Algazir Centre for X-ray diagnostic

3.2 Population of patients

All the patients was investigated by CT scan with different age and gender in the duration from 2016 – 2018.

3.3 Sample and sample size

Simple sample random for 100 patients whom investigation by CT scan.

3.4 Data collection

The data was collected by data collection sheets which was be designed by different variables to register the outcome result of direct CT7examinations.

3.5 Machine used

-General electric spiral sixteen slice

KV 120 with mAs 60 in Wad madani Centre for treatment, diagnostic advance,

-Toshiba spiral 64 slice

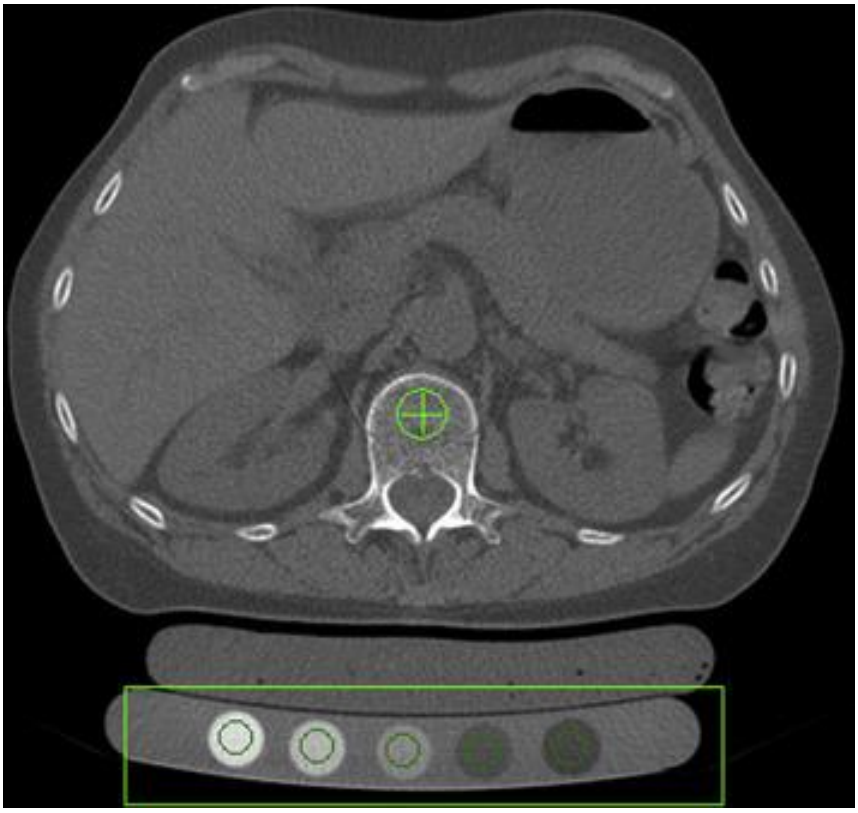
KV120, MA 200, with rotation time 0.75 in Shakrin diagnostic centre & Algazira Centre for X-ray diagnostic

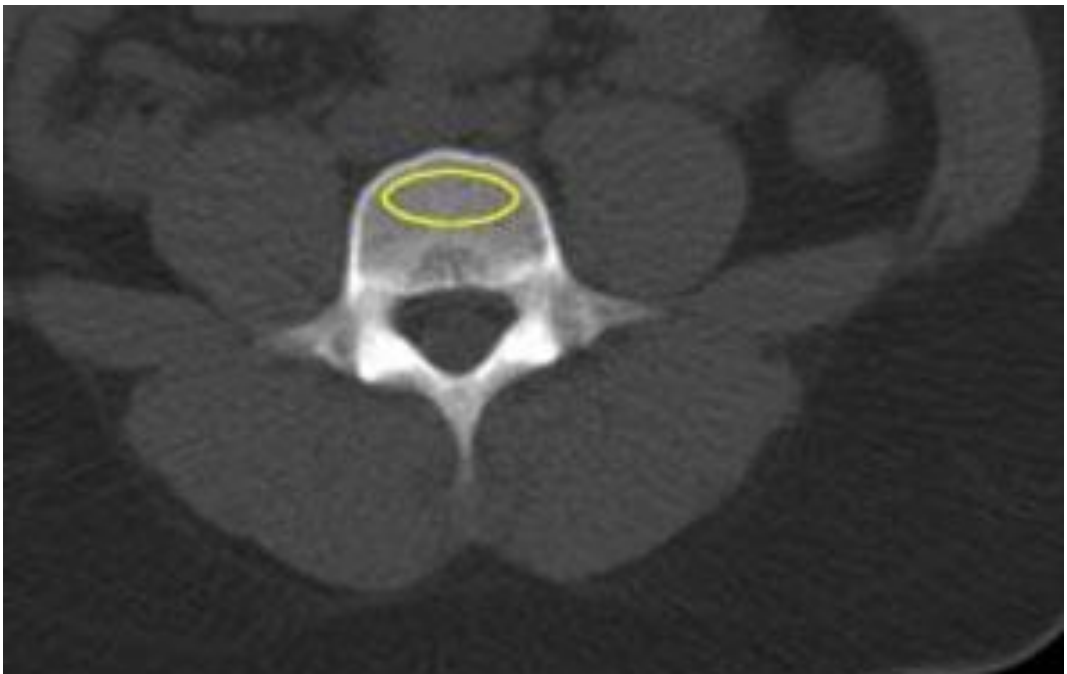
3.6 Mathod

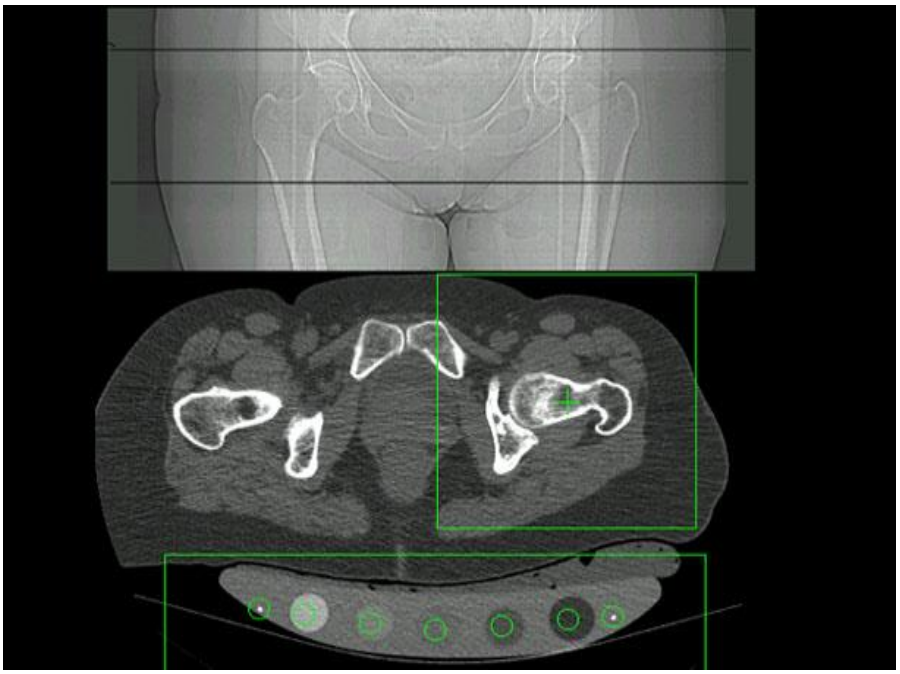
3.6.1 Image interpretation

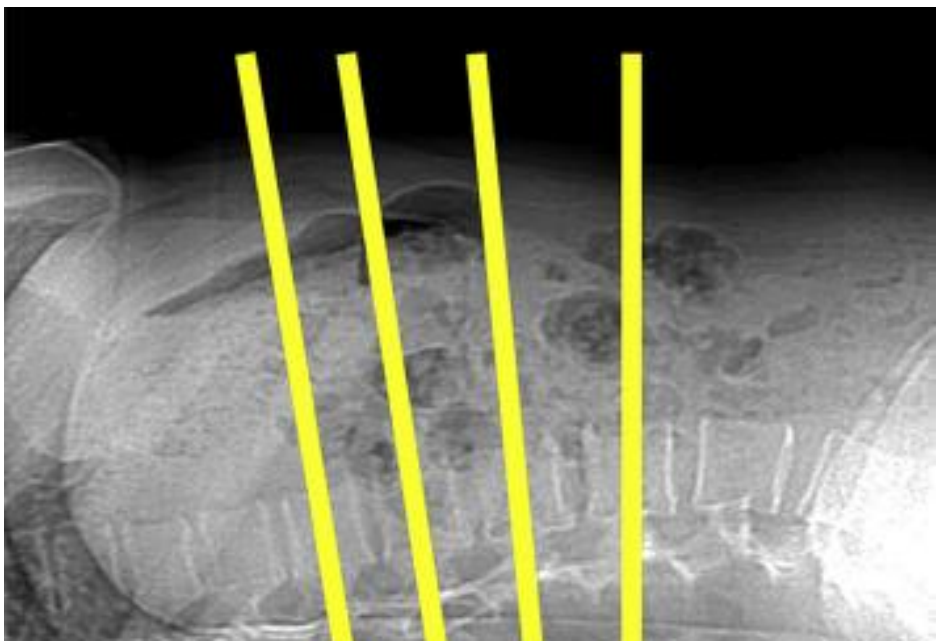
We take 30 slice for all image views in lumber computer tomography scan, coronal, sagittal & axial. The axial view who the basic Computer tomography, but we take 30 slice form axial & coronal view in hip joint just, but no take sagittal view because superimpose

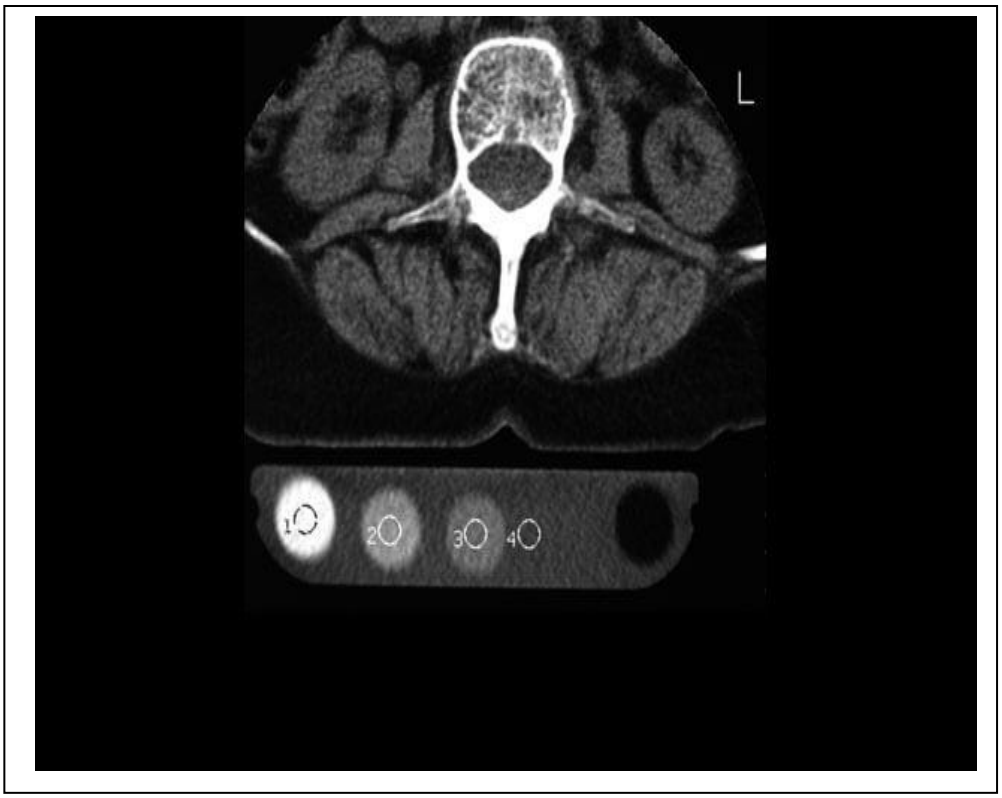
3.6.2 Osteoporosis images by computed tomomgraphy











3.7Data analysis

The data was analyzed by using statistical package for social science (SPSS) because it gives more specific and accurate data analysis.

3.8 Data storage

Patient data collecting sheets was kept out of the reach and stored in personal computer.

3.9Area of study

The study was carried out in CT department in Algazira state in ALgazira Scan hospital,Wad madani Centre for treatment, diagnostic advance, Shakrin diagnostic centre &Algazir Centre for X-ray diagnostic.

3.10 Duration of study

2016-2018

Age group	**No.**	
25 – 40 yr	8	**16%**

Chapter four: Results and Discussion

Fig ((4.1)) Shows frequency distribution according to age group.

40 – 55 yr	8	**16%**
55 – 70 yr	18	**36%**
70 – 85 yr	11	**22%**
85 – 100 yr	5	**10%**
	50	100

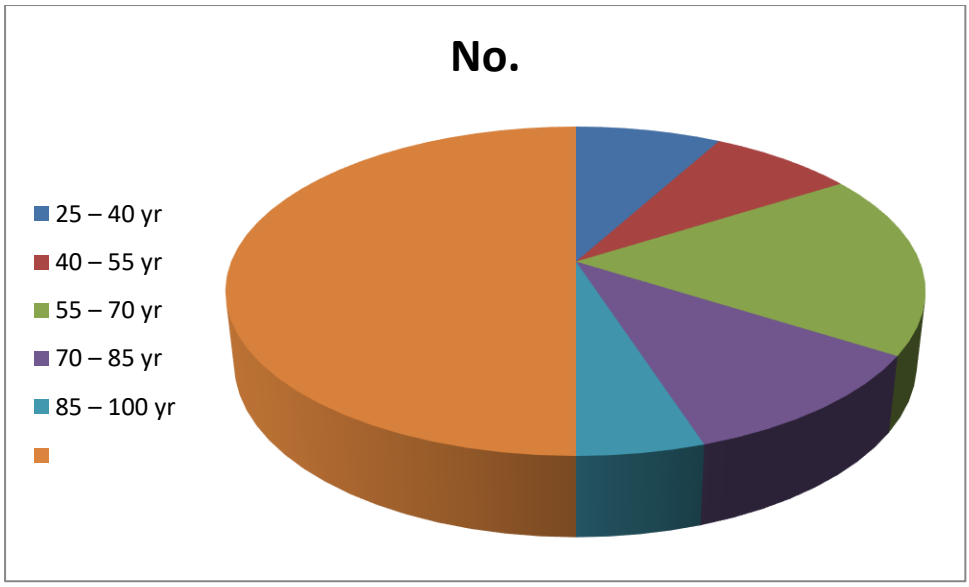


Table (4.1.2) Frequency distribution according to gender group.

Gender group	No.	%
Male	**21**	**41%**
Female	**29**	**58%**
Total	**50**	**100%**

Fig (4.2) Shows frequency distribution according to gender group

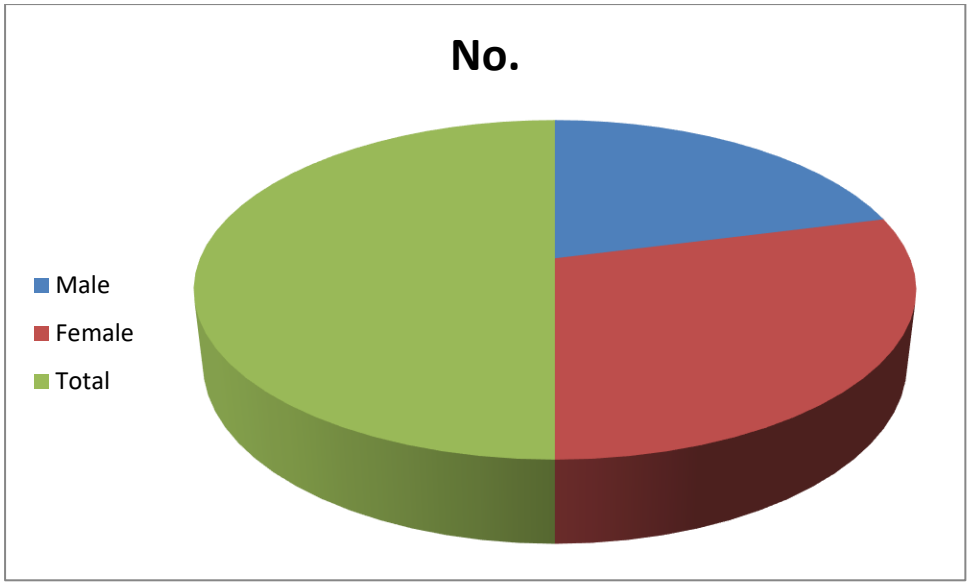


Table (4.1.3) Frequency distribution according to height.

Height	No.	%
140 – 150 cm	9	**18%**
150 – 160 cm	15	**30%**
160 – 170 cm	11	**22%**
170 – 180 cm	10	**20%**
180 – 190 cm	5	**10%**

Total	**50**	**100%**

Fig (4.3) Shows frequency distribution according to height.

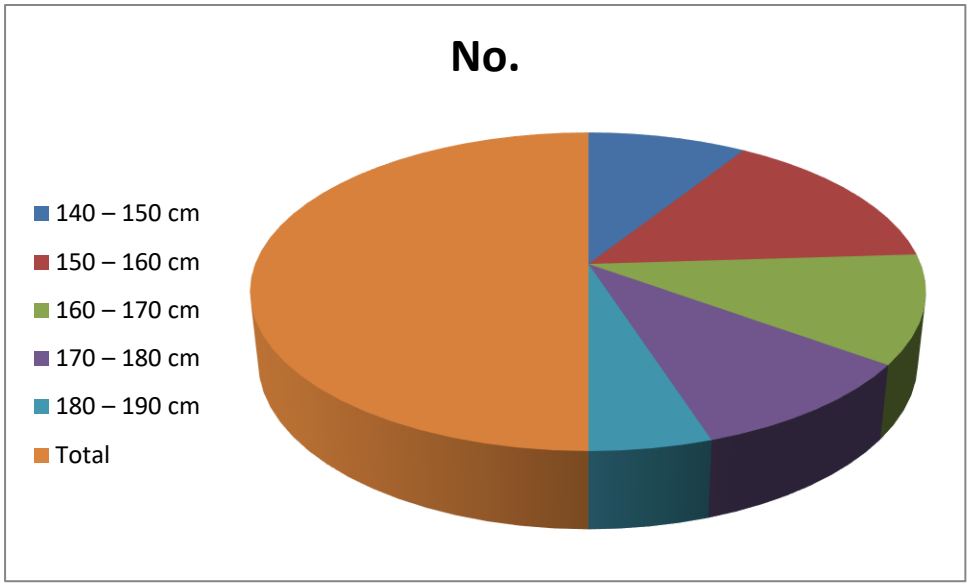


Table (4.1.4) Frequency distribution according to weight.

Weight	No.	%
Obese	**33**	**66%**
Thin	**17**	**34%**
Total	**50**	**100%**

Fig (4.1.4) Shows frequency distribution according to weight.

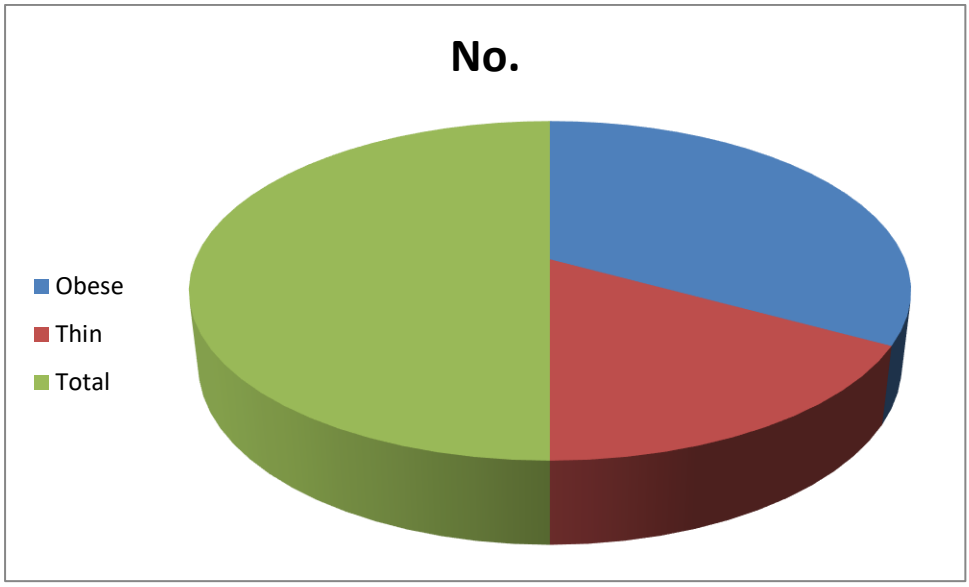


Table (4.1.5) Frequency distribution according to CT finding.

CT finding	No.	%
Normal	50	**50%**
Osteoporosis	39	**39%**
Osteopenia	11	**11%**
Total	**100**	**100%**

Fig (4.5) Shows frequency distribution according to DEXA finding.

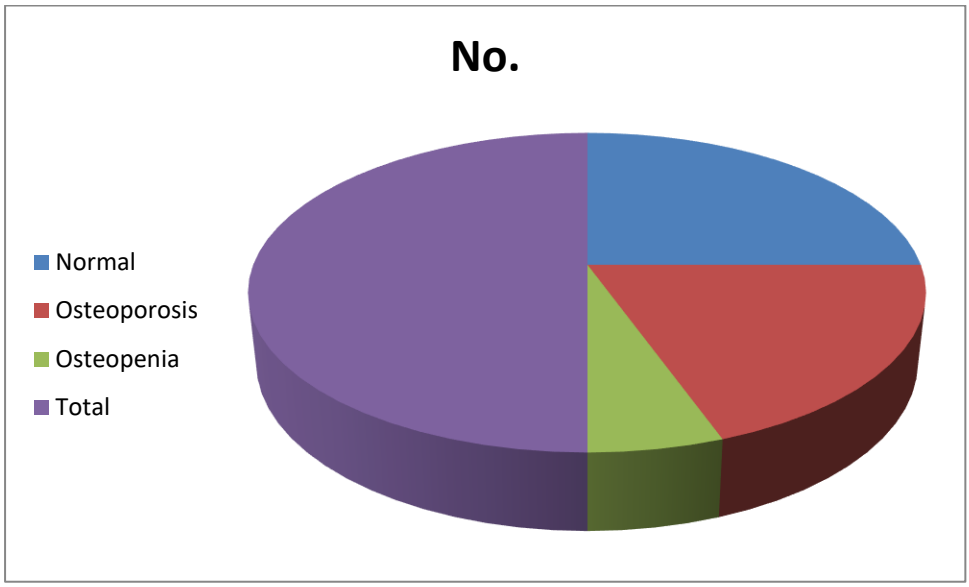


Table (4.1.6) Frequency distribution according to calcium serum investigation.

Calcium serum investigation	No.	%
Normal	50	50
Abnormal	50	50
Total	100	100%

Fig (4.6) Shows frequency distribution according to calcium serum investigation.

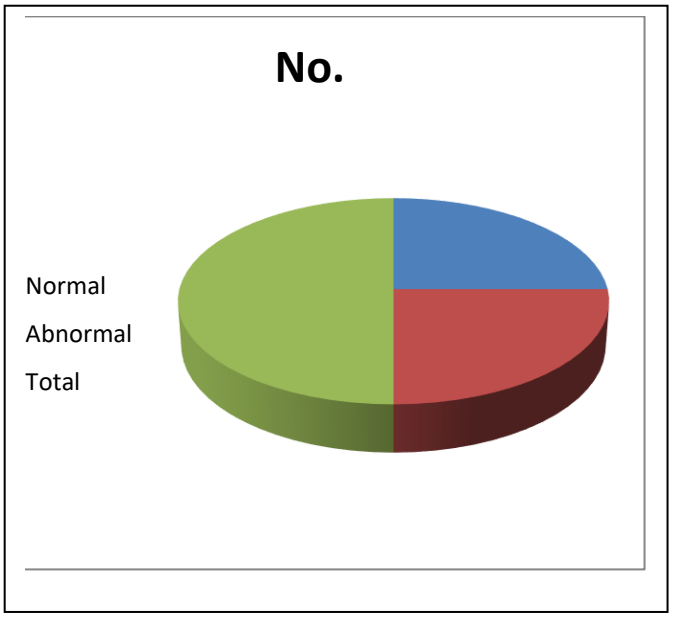


Table (4.1.7) Relationship between osteoporosis and age

Statistics

Group osteoporosis

N	Valid	39
	Missing	0

Age group	Frequency	Percent%	Valid Percent%	Cumulative Percent%

Valid	25-40 yr	7	17.94		
	40-55 yr	7	17.94		
	55-70 yr	14	35.85		
	70-85 yr	7	17.94		
	85 – 10 yr	4	10.25		
	Total	**39**	**100**		

Fig (4.7) Shows relationship between osteoporosis and age.

.

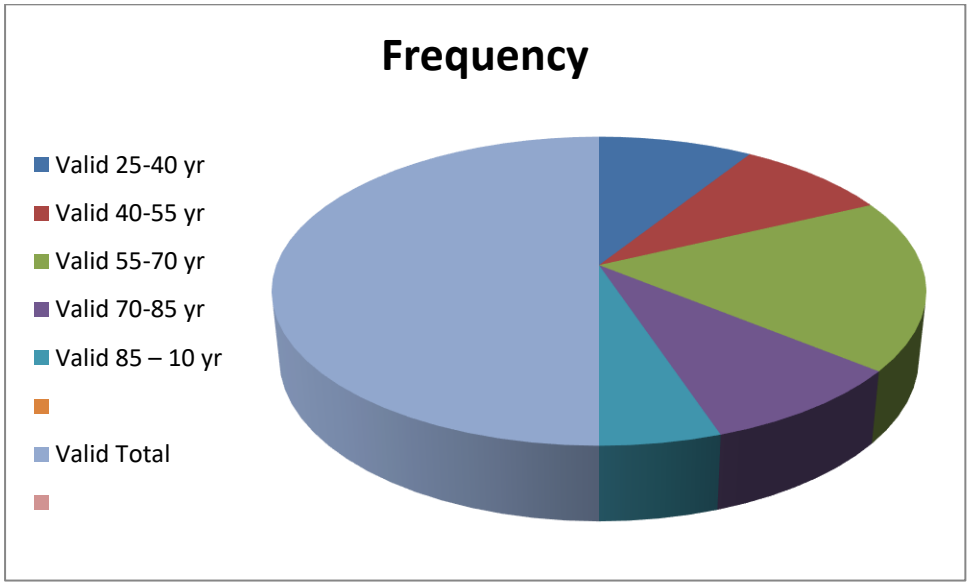


Table (4.1.8) Relationship between osteopenia and age.

Statistics

Group osteopenia

N	Valid	11
	Missing	0

Age group		Frequency	Percent%	Valid Percent%	Cumulative Percent%
Valid	25-40 yr	1	9.09		
	40-55 yr	1	9.09		
	55-70 yr	4	36.36		
	70-85 yr 85 – 100 yr	4 1	36.36 9.09		
	Total	**11**	100		

Fig (4.8) Shows relationship between osteopenia and age

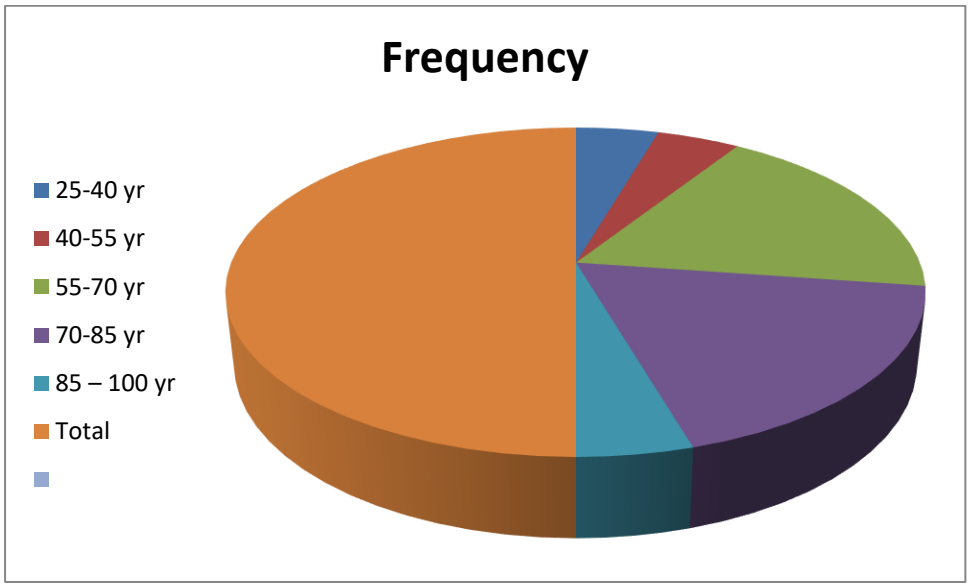


Table (4.1.9) Relationship between osteoporosis and gender.

Statistics

Group osteoporosis

N	Valid	39
	Missing	0

Gender group		Frequency	Percent%	Valid Percent%	Cumulative Percent%
Valid	Female	28	71.72		
	Male	11	28.28		
	Total	**39**	100		

Fig (4.9) Shows relationship between osteoporosis and gender.

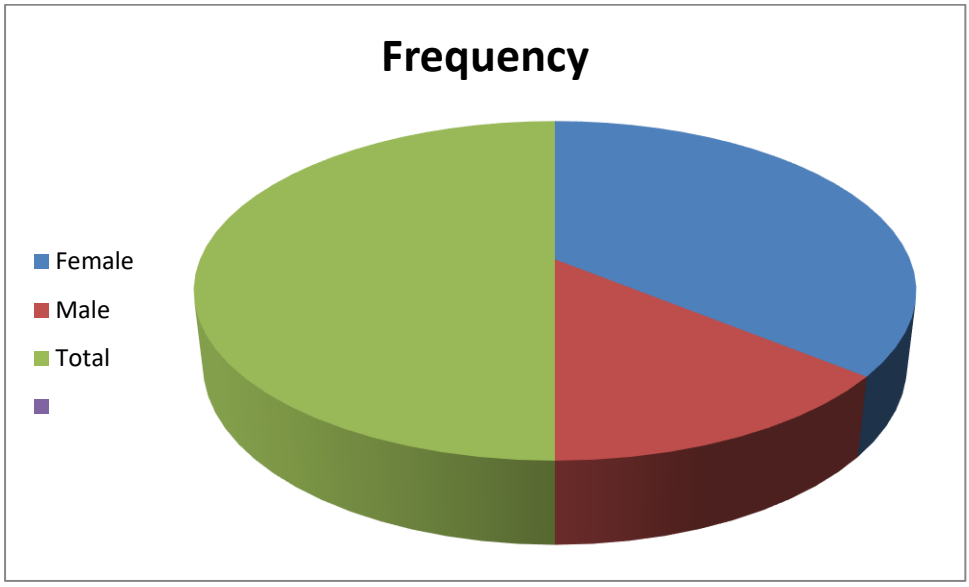


Table (4.1.10) Relationship between osteopenia and gender.

Statistics

Group osteopenia

N	Valid	11
	Missing	0

Gender group		Frequency	Percent%	Valid Percent%	Cumulative Percent%
Valid	Female	1	9.91		
	Male	10	90.09		
	Total	**11**	100		

Fig (4.10) Shows relationship between osteopenia and gender

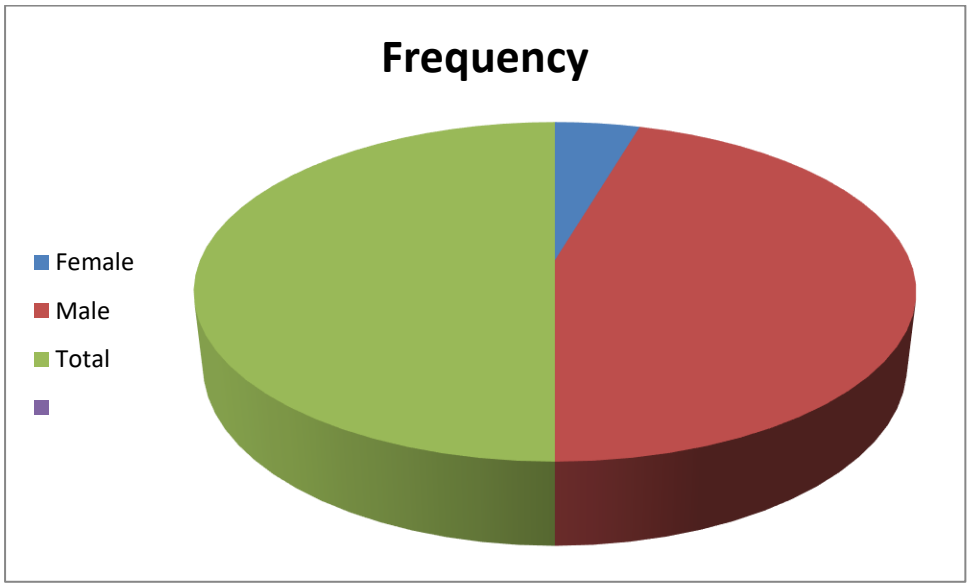


Table (4.1.11) Relationship between osteoporosis and height.

Statistics

Group osteoporosis

N	Valid	39
	Missing	0

Height		Frequency	Percent%	Valid Percent%	Cumulative Percent%
Valid	140-150 cm	9	23.07		
	150-160 cm	14	35.89		
	160-170 cm	6	15.38		
	170-180 cm	8	20.5		
	180 – 190 cm	2	5.12		
	Total	**39**	100		

Fig (4.11) Shows relationship between osteoporosis and height.

too).(3) **Table (4.10)**.

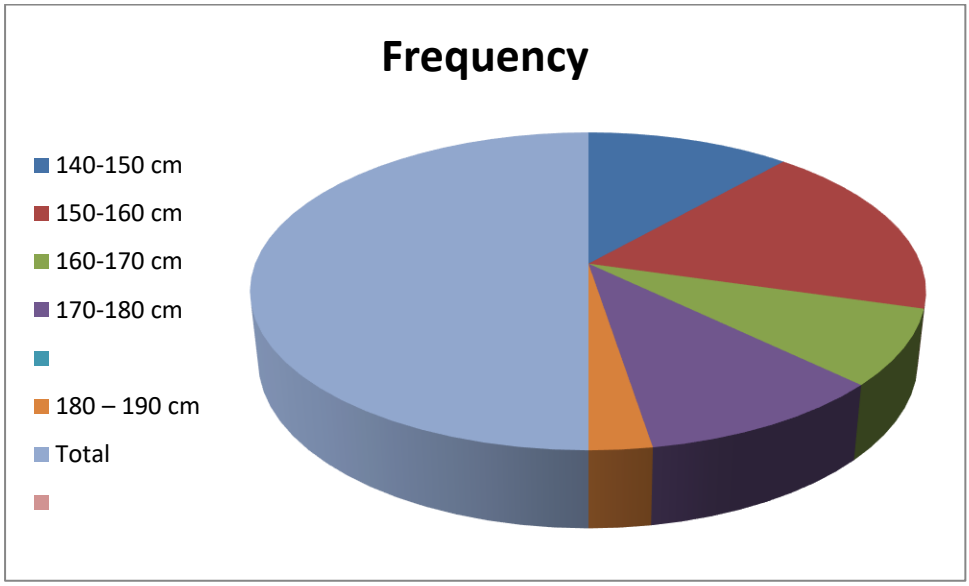


Table (4.1.12) Relationship between osteopenia and height.

Statistics

Group osteopenia

N	Valid	11

	Missing	0

Height		Frequency	Percent%	Valid Percent%	Cumulative Percent%
Valid	140-150 cm	0	0		
	150-160 cm	1	9.09%		
	160-170 cm	5	45.45%		
	170-180 cm	2	18.18%		
	180 – 190 cm	3	27.27%		
	Total	**11**	100%		

Fig (4.12) Shows relationship between osteopenia and height.

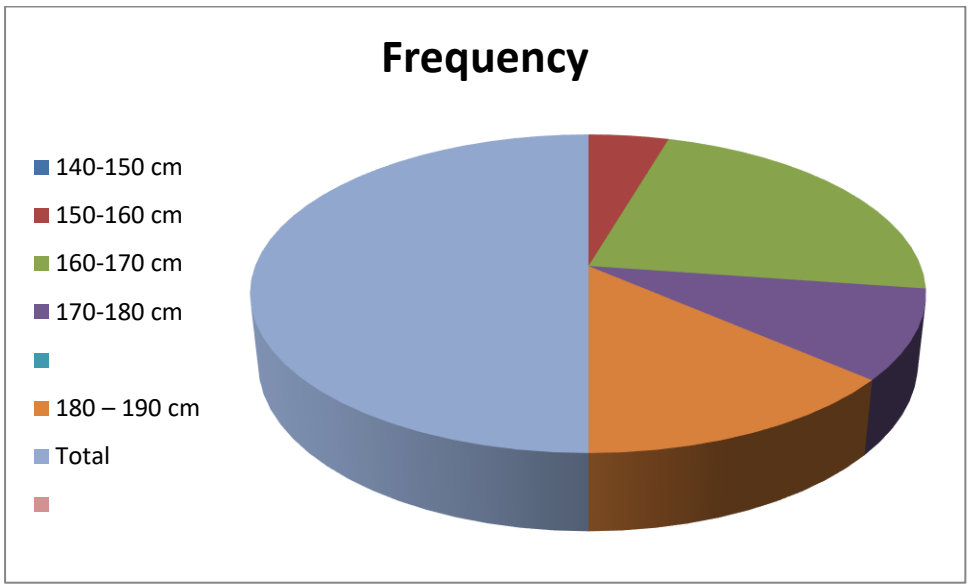


Table (4.1.13) Relationship between osteoporosis and weight.

Statistics

Group osteoporosis

N	Valid	39
	Missing	0

Weight		Frequency	Percent%	Valid Percent%	Cumulative Percent%
Valid	Thin	8	20.52		
	Obese	31	79.48		
	Total	**39**	100		

Fig (4.13) Shows relationship between osteoporosis and weight.

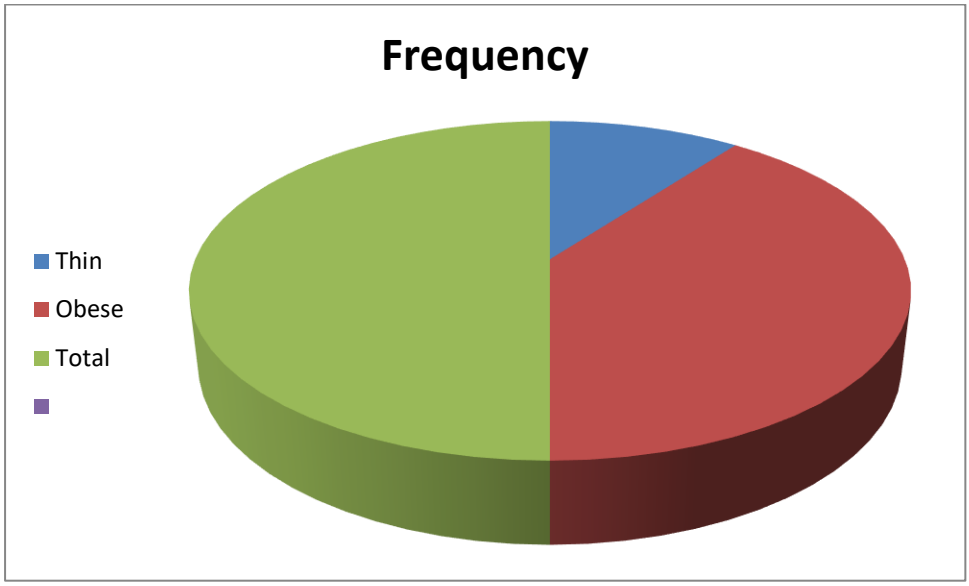


Table (4.1.14) Relationship between osteopenia and weight.

Statistics

Group osteopenia

N	Valid	11
	Missing	0

Weight		Frequency	Percent%	Valid Percent%	Cumulative Percent%
Valid	Thin	9	81.82		
	Obese	2	18.18		
	Total	**11**	100		

Fig (4.14) Shows relationship between osteopenia and weight.

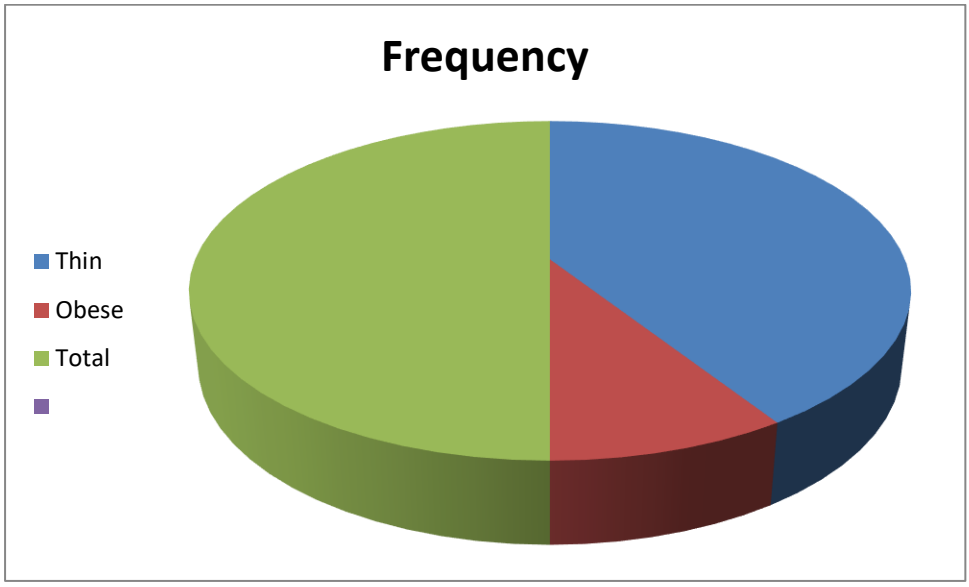


Table (4.1.15) Relationship between osteoporosis and calcium serum investigation.

Statistics

Group osteoporosis

N	Valid	39
	Missing	0

calcium serum investigation		Frequency	Percent%	Valid Percent%	Cumulative Percent%
Valid	Normal	0.0	0.0		
	Abnormal	39	100.0		

Fig (4.15) Shows relationship between osteoporosis and calcium serum investigation.

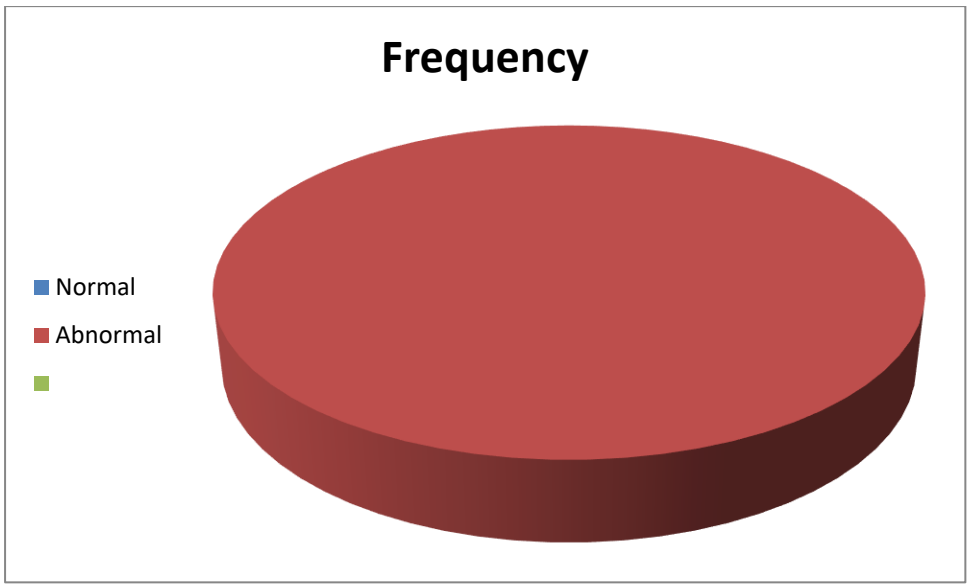


Table (4.1.16) Relationship between osteopenia and calcium serum investigation.

Statistics

Group osteopenia

N	Valid	11
	Missing	0

Calcium serum investigation		Frequency	Percent%	Valid Percent%	Cumulative Percent%
Valid	Abnormal	11	100.0		
	Normal	0	0.0		
	Total	**11**	**100.0**		

Fig (4.16) Shows relationship between osteopenia and calcium serum investigation.

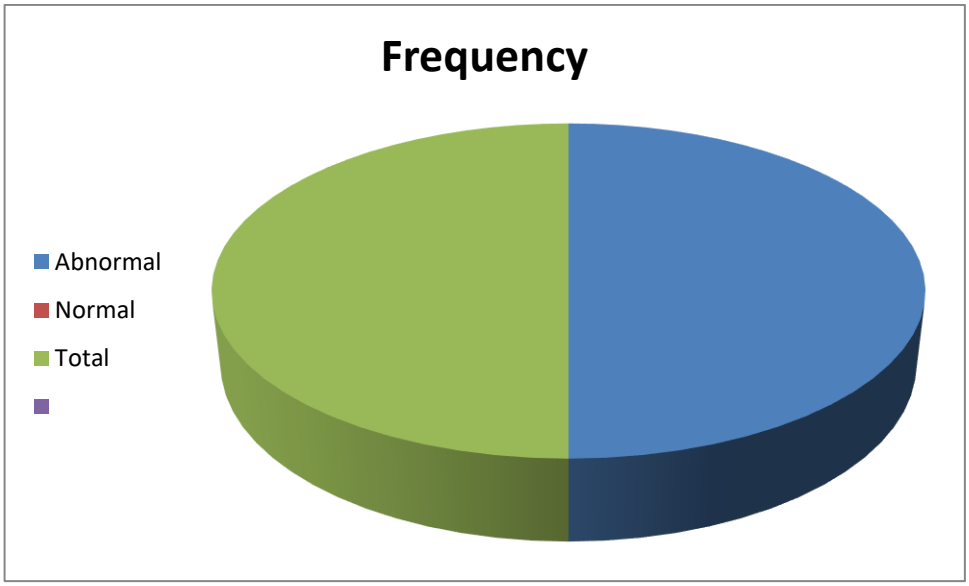


Table (4.1.17) Accuracy and sensitivity of CT to investigated osteoporosis.

Statistics

Accuracy

N	Valid	20
	Missing	0

Accuracy and sensitivity

Accuracy		Frequency	Percent%	Valid Percent%	Cumulative Percent%
Valid	Normal	8	40		
	Osteoporosis	12	60		
	Total	**20**	100		

Fig (4.17) Shows accuracy and sensitivity of CT scan to investigated osteoporosis.

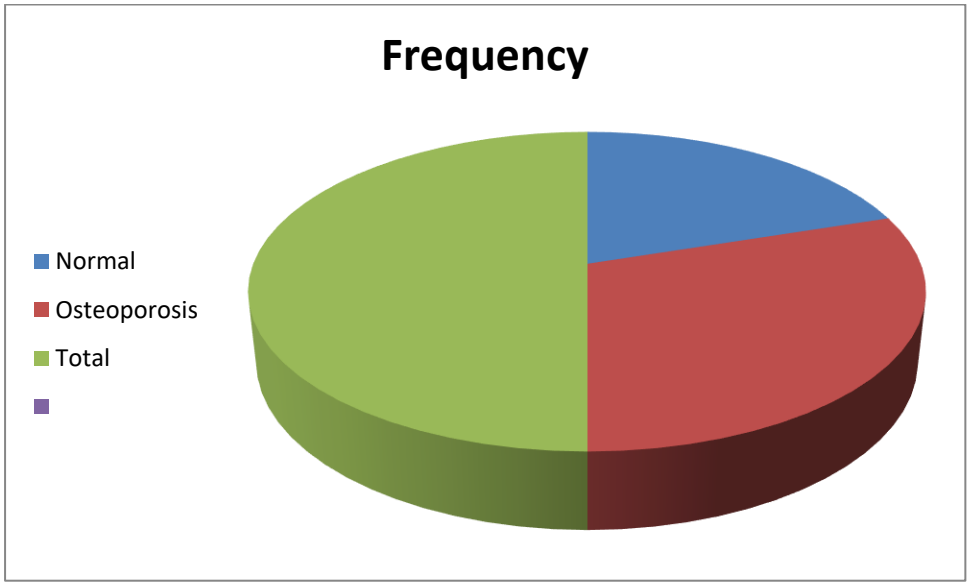


Table (4.1.18) Accuracy and sensitivity of CT to investigated osteopenia.

Statistics

Accuracy

N	Valid	18
	Missing	0

Accuracy and sensitivity

Accuracy		Frequency	Percent%	Valid Percent%	Cumulative Percent%
Valid	Normal	8	44.44		
	Osteopenia	10	55.56		
	Total	**18**	100		

Fig (4.18) Shows accuracy and sensitivity of CT scan to investigated osteopenia

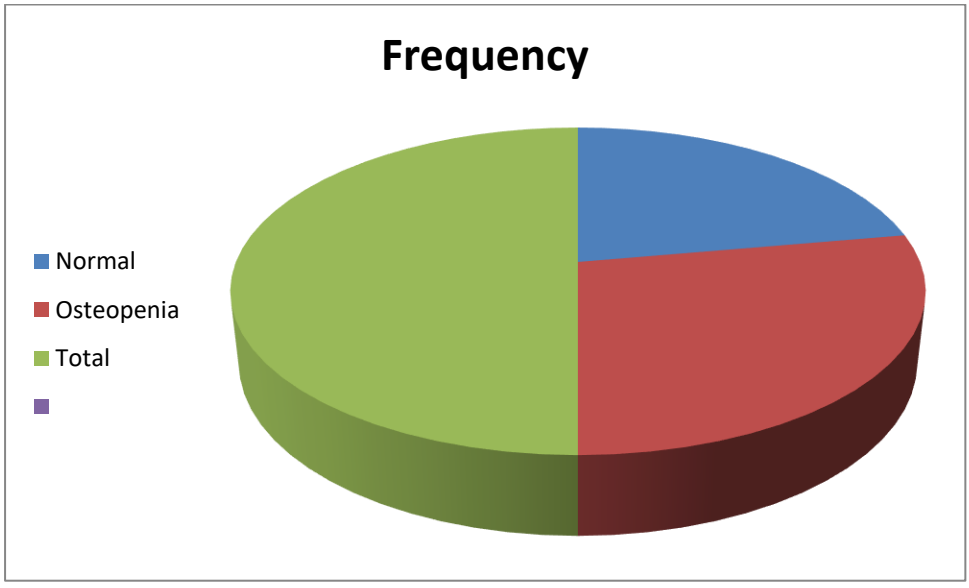


Table (4.1.19) Frequency distribution according to thyroid .

Calcium serum investigation	No.	%
Normal	50	50
Abnormal	50	50
Total	100	100%

Fig (4.19) Shows relationship between normal and thyroid disorder.

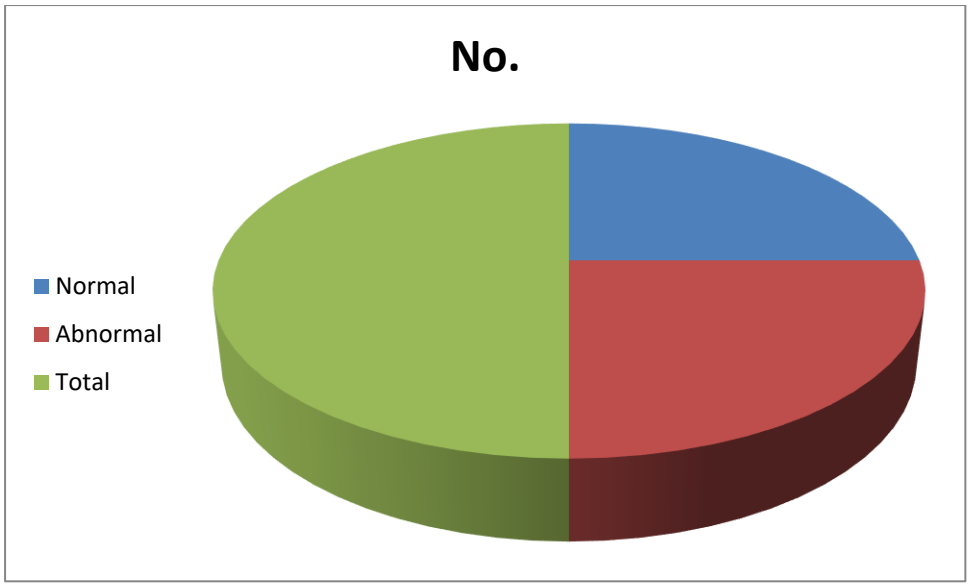


Table (4.2.20) Relationship between osteoporosis and thyroid.

Statistics

Group osteoporosis

N	Valid	39
	Missing	0

Weight		Frequency	Percent%	Valid Percent%	Cumulative Percent%
Valid	**Thyroid**	39	%78		
	Total	**39**	100		

Fig (4.20) Shows relationship between osteoporosis and thyroid.

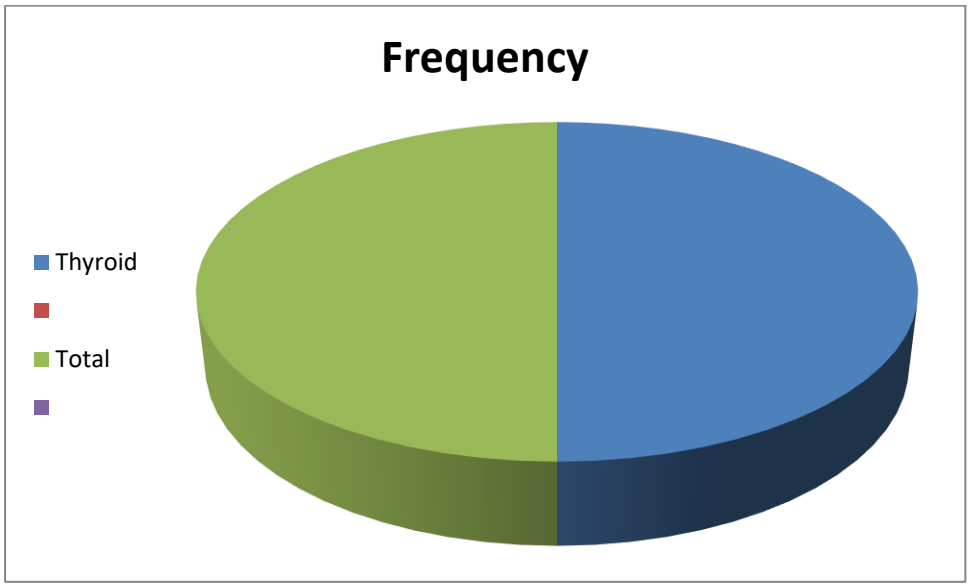


Table (4.1.21) Relationship between osteopenia and thyroid.

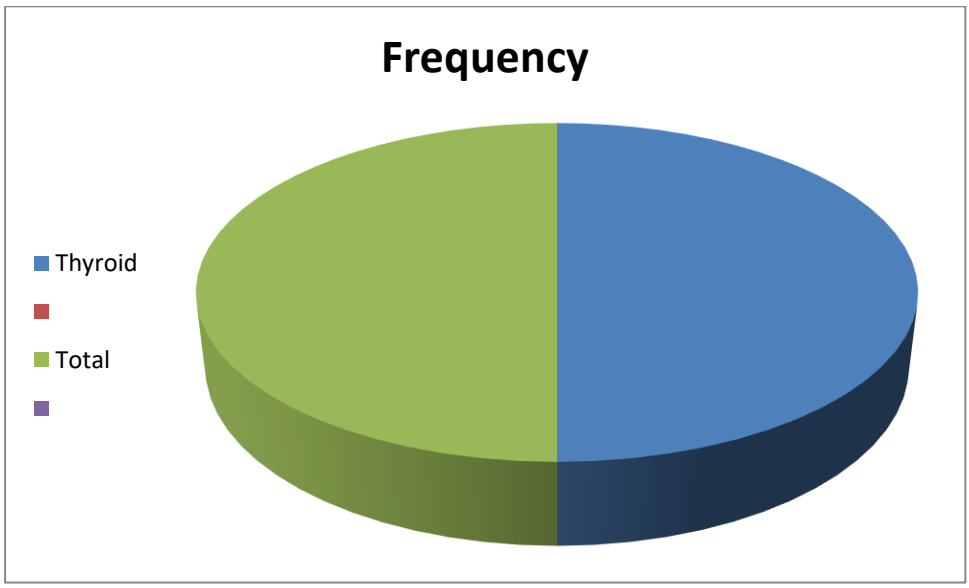
Statistics

Group osteopenia

N	Valid	11
	Missing	0

Weight		Frequency	Percent%	Valid Percent%	Cumulative Percent%
Valid	**Thyroid**	11	%22		
	Total	**11**	100		

Fig (4.21) Shows relationship between osteopenia and thyroid.



5.1Discussion

5.1.1 Distribution of age group

Showed the distribution of age group for 50 patients whom diagnosed by CT scan.(25 – 40 yrs) 8 (**16%**), (40 – 55 yrs) 8(**16%**), (55 – 70 yrs) 18 (**36%**), (70 – 85 yrs) 11(**22%**) and (85 – 100 yrs) 5 (**10%**). The magnitude number of patients in the age group of (55 – 70 yrs) 18 (**36%**) because BMD decrease when the age increase, due to decrease testron and estrogen hormones . **Table(4.1)**

Fig (4.2) Shows frequency distribution according to gender group.

5.1.2Distribution of gender group

Showed the distribution of gender group for 50 patients whom diagnosed by CT scan. Females 29(58%) and males 21(41%) The magnitude number of patients in the females 29(58%) because BMD decrease after the post menopause in the females. **Table (4.2)**.

Fig (4.3) Shows frequency distribution according to height.

5.1.3 Distribution according to height

Showed distribution of height for 50 patients with thyroid disorder whom diagnosed by CT scan.(140 – 150 cm) 9 (18%), (150 – 160 cm) 15(30%),(160 – 170 cm) 11 (22%), (170 – 180 cm) 10 (20%) and (180 – 190 cm) 5(10%) The magnitude number of patients in height (150-160cm) 15(30%) because BMD decrease when height decrease. **Table (4.3)**

5.1.4 Distribution according to weight

Showed distribution according to weight for 50 patients with thyroid disorder whom diagnosed by CT scan. Obese 33(66%) and thin17(34%).The magnitude number of patients in obese 33(66%). **Table (4.4)**.

5.1.5 Distribution according to CT finding

Showed distribution according to CT finding for 100 patients normal & abnormal whom diagnosed by CT scan. Normal 50(50%) and osteoporosis 39(39%) and osteopenia 11(11%)

.

5.1.6 Distribution according to investigation calcium serum

Showed distribution according to investigation calcium serum for 100patients whom diagnosed by CT scan. Normal (100%) and abnormal (100%) because the calcium is the main compounds of the bones (bones weaken when the low levels of calcium and other minerals in your bones). **Table (4.2)**.

5.1.7 Relationship between osteoporosis and age

Showed relationship between osteoporosis and age for 39 patients had osteoporosis from 50 patients whom diagnosed by CT scan. (25 – 40 yrs) 7 (17.94%), (40 – 55 yrs) 7(17.94%), (55 – 70 yrs) 14 (35.85%) and (70 – 85 yrs) 4 (10.25%). The magnitude number of patients in (55 – 70 yrs) 14 (35.85%) because BMD decrease when age increase, due to decrease testron and estrogen hormones.

5.1.8 Relationship between osteopenia and age

Showed relationship between osteopenia and age for 11 patients had osteopenia from 50 patients whom diagnosed by CT scan. (25 – 40yrs) 1 (9.09%), (40 – 55 yrs) 1(9.09%) , (55 – 70 yrs) 4 (36.36 %) (70-85yrs)4 (36.36%), (85– 100 yrs)1 (9.09%).The magnitude number of patients in (55-70yrs) and (70-85yrs) 4 and 4(36.36%) and (36.36%) because BMD decrease when age increase, due to decrease testron and estrogen hormones. **Table (4.8)**.

5.1.9 Relationship between osteoporosis and gender

Showed relationship between osteoporosis and gender for 39 patients had osteoporosis from 50 patients whom diagnosed by CT scan. Male 11(28.28%) and females 28 (71.72%). The magnitude number of patients in females 28 (71.72%) because BMD decrease after the post menopause in the females. **Table (4.9)**.

5.1.10 Relationship between osteopenia and gender

Showed relationship between osteopenia and gender for 11 patients had osteopenia from 50 patients whom diagnosed by CT scan. Males 10(90.91%) and females 1 (9.09%). The magnitude number of patients in males 10(90.91%) because BMD decrease testron and elders in the males, (although it's often thought of as a women's disease, osteopenia affects men too)

5.1.11 Relationship between osteoporosis and height

Showed relationship between osteoporosis and height for 39 patients had osteoporosis from 50 patients whom diagnosed by CT scan. (140 – 150 cm) 9 (23.07%), (150 – 160 cm) 14(35.89%), (160 – 170 cm)6 (15.38%), (170 – 180 cm) 8 (20.51%) and (180 – 190 cm) (5.12%).The magnitude number of patients in (150 – 160 cm) 14 (35.89%)because BMD decrease when height decrease . **Table (4.11)**.

5.1.12 Relationship between osteopenia and height

Showed relationship between osteopenia and height for 11patients had osteopenia from 50 patients whom diagnosed by CT scan. (140 – 150 cm) 0 (0%), (150 – 160 cm)1 (9.09%), (160 – 170 cm) 5 (45.45%), (170 – 180 cm) 2 (18.18%) and (180 – 190 cm) 3(27.27).The magnitude number of patients in (160 – 170 cm) 5 (45.45%) because BMD decrease when height decrease. **Table (4.12)**.

5.1.13Relationship between osteoporosis and weight

Showed relationship between osteoporosis and weight for 39 patients had osteoporosis from 50 patients with thyroid disorder whom diagnosed by CT scan. Obese 31(79.48%) and thin 8(20.52%).The magnitude number of patients in Obese 31 (79.48%) . **Table (4.13)**.

5.1.14Relationship between osteopenia and weight

Showed relationship between osteopenia and weight for 11 patients had osteopenia from 50 patients with thyroid disorder whom diagnosed by CT scan. Obese 2(18.18%) and thin 9(81.82%). The magnitude number of patients in thin 9(81.82%) because BMD decrease, due to low water and elements when weight decrease. **Table (4.14)**.

5.1.15Calcium investigation

Showed relationship between osteoporosis and calcium serum investigation for 39 patients had osteoporosis from 50 patients with thyroid disorder whom diagnosed by CT scan. Abnormal 39(100%) because BMD decrease when calcium serum decrease, calcium is the main compounds of the bones as (bones weaken when low levels of calcium and other minerals in the bones). (3) **Table (4.15).**

5.1.16Relationship between osteopenia and calcium serum investigation

Showed relationship between osteopenia and calcium serum investigation for 11 patients had osteopenia from 50 patients with thyroid disorder whom diagnosed by CT scan. Abnormal 11(100%) because BMD decrease when calcium serum decrease, calcium is the main compounds of the bones as (bones weaken when low levels of calcium and other minerals in the bones).Table (4.16**)**

5.1.17Accuracy and sensitivity of CT scan in diagnosed osteoporosis

Showed the accuracy and sensitivity of CT scan in diagnosed osteoporosis for 20 patients from 50patients whom diagnosed by CT scan. Normal 8(40%) and osteoporosis 12(60%) because CT scan is the most accuracy and sensitivity in diagnosed osteoporosis by (100%). **Table (4.17)**.

.5.1.18Accuracy and sensitivity of CT scan in diagnosed osteopenia

Showed the accuracy and sensitivity of CT scan in diagnosed osteopenia for 18 patients from 50 patients whom diagnosed by CT scan. Normal 8(44.44%) and osteopenia 10(55.56%) because CT scan is the most accuracy and sensitivity in diagnosed osteopenia by (100%). **Table (4.18)**.

5.1.19 Relationship between thyroid disorders and normal

Showed relationship between normal and thyroid disorders for 100 patients had 50 patients with osteoporosis and osteopenia from 100 patients,50 thyroid disorder and 50 normal.

5.1.20 Relationship between osteoporosis and thyroid

Showed relationship between osteoporosis and thyroid for39 patients had osteoporosis from 50 patients with thyroid disorder whom diagnosed by CT scan.

5.1.21 Relationship between osteopenia and thyroid

Showed relationship between osteoporosis and **thyroid** for 11 patients had osteopenia from 50 patients with thyroid disorder whom diagnosed by CT scan

5.2Conclusions

- The CT scan is the most accurate and sensitive to evaluated in diagnoses bone density.
- CT scan is the most accurate and sensitive in diagnoses osteoporosis (100%).
- CT scan is the most accurate and sensitive in diagnoses osteopenia (100%).
- Osteoporosis is result by decrease calcium serum in bones and patient with thyroid disorders
- Osteopenia are result by decrease calcium serum in bones and patients with thyroid disorder

5.2 Recommendations

- CT scan to see a significant change in bone mineral density.
- Every patient, such as patients on high dose of steroid medication, may need follow-up periodically by intervals of six months.
- CT scan modality should be introduced in the syllabus of the faculties of radiology to decrease ambulance cost.
- The post menopause female should takes estrogen to avoid decrease bone density.
- Thyroid patients must be takes anti-thyroid to decrease risk bones fracture.

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Appendices

Data Collection Sheet (Questionnaire)

NO ( )

Patient Data

Age

25 – 40 yrs ( ) 40 – 55 yrs ( )

55 – 70 yrs ( ) 70 – 85 yrs ( )

85 – 100 yrs ( )

Gender

Male ( ) Female ( )

Weight

Obese ( ) Thin ( )

Height

140 – 150 cm ( ) 150 – 160 cm ( )

160 – 170 cm ( ) 170 – 180 cm ( )

180 – 190 cm ( )

Lab investigation

Thyroid function

Normal ( ) **Abnormal ( )**

Calcium serum

Normal ( ) Abnormal ( )

CT finding

Osteoporosis ( ) Osteopenia ( )

,Normal ( )