بسم الله الرحمن الرحيم

Sudan University of Science and Technology

College of Graduate Studies

The Role of CT in Diagnosing Lymphadenopathy

Directed Complimentary Research Work Done for Partial Fulfillment for the Award of MSc Degree in Diagnostic Radiologic Technology

Prepared by:

Fathia A. Rhman Mohammed

Supervisor:

Dr. El Rayah Mustafa

MBBS, MD-CLINICAL RADIOLOGY

July 2006

Dedication

To:

- ***My Husband and my kids***
- ***My Family specially my sister***
- ***Dear Teachers***
- ***My Friends***
- ***My Colleagues***

Acknowledgement

I would like to thank every one who helped me to complete this research.

I would like to express my deep gratitude to my supervisor Dr. Elrayah Mohamed Mustafa and Dr. Khawad

Also great thank to Ustaz / Mustafa Gafar for his advises and comments.

Abstract

Any disease of lymph glands may be called lymphadenopathy .Infection and Carcinomatous metastates are common causes of lymphadenopathy . The main objective of this study is to evaluate the role of CT in diagnosing lympadenopathy . The study has been carried out during the period from July 2002 up to July 2006 in different CT departments . The data were collected from Radiologists reports and films finding . The general results:

1- CT scan is informative in diagnosing lymphadnopathy .
2- Spiral CT scan is the best modality for demonstring lymphadenopathy .
3- Axial scan with contrast medium is the suitable technique .

ملخص البحث

اى مـرض يصـيب الغـدد اللمفاويـة يـؤدى الـى تضـخمها . العـدوى والنقائـل السـرطانية مـن الأسـباب الشـائعة . الهـدف الرئيسـى لهـذه الدراسـة تقيـم دور الأشـعة المقطعيـة فـى تشـخيص تضـخم الغـدد اللمفاوية . أجريت هذه الدراسة فى الفترة من يوليو 2002 وحتى يوليـو 2006م فى أقسام مختلفة للأشعة المقطعيـة .جمعـت المعلومـات مـن تقارير أخصائى الأشعة والأفلام . النتائج العامة لهذه الدراسة :

1- الأشعة المقطعية ذات فعاليـة فـى تشـخيص تضـخم الغـدد اللمفاوية .
2- التصوير الطبقى الحلزونى أفضل أنـواع الأشـعة المقطعيـة فى فحص تضخم الغدد اللمفاوية .
3- التقنية المناسبة لهذا الفحص الوضع المحورى مع استعمال اوساط التباين.

List of figures

List of abbreviations

CT	**Computerize tomography**
ERCP	**Endoscopic Retrograde Cholangio Pancreatography**
IV	**Intravenous**
IVC	**Inferior-vena Cava**
Kvp	**Killo-voltage peak**
mA	**milli-ampere**
MHU	**million heat units**
WL	**window Level**

ww **window width**

Contents

Chapter one

Chapter (1)

1.1 Introduction

The CT scanner is revolutionary in that it does not record an image in conventional way. There is no ordinary image receptor, such as film or an image-intesifier tube, in a CT scanner. A collimated X-ray beam is directed on the patient, and the attenuated image forming radiation is measured by a detector whose response is transmitted to computer. The computer analyzes the signal from the detector, reconstructs an image and displays the image on a monitor, the image can then be photographed for later evaluation and filing.

Any disease of lymph glands may be called a lymphadenopathy. Infection and carcinomatous metastases are common causes of lymphadenopathy CT has the ability to detect lymphadenopathy and has general advantages chief among those advantages is ability to display vascular anatomy without the need for intra vascular contrast agent. The cross-sectional imaging capability of this technique allows the direct demonstration of normal and abnormal lymph nodes. Lymph node enlargement in the imaging hallmark of metastatic involvement, and a series of size criteria for normal and abnormal lymph nodes have evolved in the different areas of the body. Enlargement of lymph nodes above these criteria are suggestive but not diagnostic of malignant involvement.

The problem of the study:

The problem of study states that CT is informative in diagnosing lymphadenopathy.

1.3 Objectives:

1. To show the best CT scan technique for demonstrating lymphadenopathy
2. To demonstrate the optimum range of W-W and W-L for the detection of lymph nodes on CT examination.

1.4 Hypothesis:

The technique of CT used is vital in picking up lymphadenopathy.

1.5 Methodology

The sample who are suspected to have neck – axillary –Thoracic- Abdomen and pelvis lymphadenopathy . The patients under went CT studies their films evaluated by senior Radiologist the results , tablulate and discus .

Chapter Two

Chapter Two
2.1 Anatomy
2.1.1 Lymphatic System

Plexuses of minute vessels the lymph capillaries which start with closed ends in the tissues. Contain fluid called lymph. Lymph vessels which are formed by union of the lymph capillaries, and which drain the lymph into the venous system. Lymph nodes which consist of solid masses of lymphoid tissue and through which lymph must usually pass before reaching the venous system. Collection of lymphoid tissue in the walls of the alimentary canal and the respiratory tract as well as in spleen and the thymus. The circulating lymphocytes. The lymphatic system serves to drain interstitial fluid and return it to the venous system. The lymphatic system has no heart to pump lymph fluid to its destination. Rather, fluid is transported by diffusion, peristalsis, respiratory movements, cardiac activities, massage and muscular activity. The transportation of lymphatic fluid is in one direction only away from the tissues – the sequence of fluid movement is from lymphatic capillaries to the various lymph vessels where the fluid enters the lymph nodes and is returned to the venous system by element lymphatic vessels[4].

2.1.2 Lymph:

The thin walls of the lymph capillaries are permeable to larger molecules than are the blood capillaries and are therefore able to absorb proteins, debris of damaged cells and micro-organisms. They are important for returning tissue fluid and larger molecules to the blood stream. If the lymph vessels become obstructed, the tissues drained by those vessels become swollen, or oedematous, with a tissue fluid which has high protein content. Large molecules, cell debris and micro-organisms reach the lumen of the lymph capillaries either through the gaps between the cells which make up the single layer of the wall, or by micropinocytosis[4].

2.1.3 The lymph nodes:

At intervals along the course of lymphatics groups of lymph nodes are found. These structures are also called lymph glands and consist of a fibrous tissue capsule and framework, reticulo-endothelial tissue, and collections of cells similar to the lymphocytes of the blood. They are bean shaped and act as filters and extract such things as bacteria and malignant cells from the lymph the vessels which bring lymph to the node enter the convex surface and are called the afferent lymphatics and these are which leaves the concave surface or hilum is the efferent lymphatic. In addition to its action in many parts of the body the lymph vessels and nodes are arranged into superficial and deep sets. The superficial are found in the superficial fascia (the fatty layer beneath the skin) and the deep are found in the neighborhood of the deep blood vessels. There are also collections of lymphoid tissue in certain situations[4].

2.1.4 The lymph nodes of the head and neck:

These are divided into superficial and deep groups the superficial are divided into the submental, submandibular pre auricular and occipital. They drain into the deep cervical lymph nodes. The deep nodes are divided into upper and lower sets on each side.The upper group receives lymph from the tonsils, tongue, mouth and superficial tissues and drains into the lower group.The interior group drains on the right side into the right lymph duct and on the left side into the thoracic duct.The superficial structures of the head and neck, i.e. skin, scalp, external, ear, lips, etc. drain into the neighboring superficial nodes from which lymph drains into the deep cervical nodes, lymph drains directly into the deep cervical nodes. Lymph drains directly into the deep cervical nodes from most of the deep structures of the head and neck and from these nodes lymph drains on the right side into the right lymph duct and on the left side into the thoracic duct by which it is discharged into subclavian veins[9].

2.1.5 The axillary lymph nodes

These drain the upper limb and the upper and outer part of the breast. Efferent vessels go from these nodes into the right lymph duct on the right side into the thoracic duct on the left side. The vessels drainage lymph from the superficial structures passes with the superficial veins in the subcutaneous tissue. The deep structures drain into lymphatics which accompany the deep veins. Both these sets of lymphatics converged on the auxiliary nodes which not only drain the upper limbs but also the upper and outer part of the breast [9].

2.1.6 The thoracic lymph nodes:

Lymph node are found in the neighborhood of the posterior parts of the inter costal vessels on the upper surface of the diaphragm and in the anterior mediastinum. These drain lymph from the chest wall and from the thoracic contents. The middle mediastinal nodes are situated along the trachea and main bronchi and receive lymph from the lungs. Those along the trachea are the paratracheal and those at the bifurcation of the trachea are called the tracheobronchial nodes. The bornchopulmonary nodes are found at the roots of the lungs.The posterior mediastinal nodes are situated along the descending aorta and oesophagus and receive lymph from the oesophagus. They communicate with the middle mediastinal group[9].

2.1.7 The abdominal lymph nodes

Lymph nodes are found along the branches of the vessels supplying the stomach, intestines-pancreas and gall bladder. Pre-aortic nodes – these are concentrated into groups at the origins of the coeliac superior and inferior mesenteric arteries. Para aortic nodes – these receive lymphatics from the nodes along the common, internal and external iliac veins. Their efferents form the right and left lumbar trunk by which lymph is conveyed to the cisterna chili and so to the thoracic duct the lymph entering the cisterna chili is transmitted by the thoracic duct to the left sub clavian veins[9].

2.1.8 The Pelvic lymph nodes:

These are situated in the groin below the inguinal ligaments at each side. They are divided into a superficial and deep set. The superficial inguinal nodes are found along the line of the inguinal fold. They receive lymph from the skin at the lower part at the abdomen, the buttock, the external genitalia and skin around the arms.The deep inguinal nodes are situated along the upper end at the femoral vein and receive lymph from the deep lymphatics of the lower limb and from the superficial inguinal nodes and external genitalia. The lymphatic drainage at the lower limb. Lymph from the superficial structures enters vessels which pass proximally with the subcutaneous veins. The deeper structures drain into lymphatics which accompany the anterior and posterior tibial. The popliteal and the femoral veins. All these lymphatics drain into the superficial or deep inguinal nodes[9].

2.2 Physiology

2.2.1 The lymphatic system:

The lymphatic system represents an accessory route by which fluids can flow from the interstitial spaces into the blood. And, most important of all the lymphatics can carry proteins and large particulate matter away from the tissue spaces, neither of which can be removed by absorption directly into the blood capillary.The lymphatic capillaries and their permeability:

Most of the fluid filtering from the arterial capillaries flows among the cells and is finally reabsorbed back into the venous ends of the blood capillaries but about one tenth of the fluid enters the lymphatic capillaries instead and returns to the blood through the lymphatic system rather than through the venous capillaries. The minute quantity of fluid that returns to the circulation by way of the lymphatics is extremely important because substances of high molecular weight such as proteins cannot be reabsorbed into the venous capillaries, but they can enter the lymphatic capillaries almost completely unimpeded. The reason for this is a special structure of the lymphatic capillaries which is the endothelial cells of the capillary attached by anchoring filaments to the connective tissue between the surrounding tissue cells. At the junctions of the adjacent endothelial cells there are usually very loss connections between the cells instead, the edge of one endothelial cell usually overlaps the edge of the adjacent one in such a way that the overlapping edge is free to flap inward, thus forming a minute valve edge is free to flap inward, thus forming a minute valve the opens to the interior of the capillary once it has entered because any back flow will close the flap valve [6].

2.2.2 Formation of lymph:

Lymph is derived from interstitial fluid that flows into the lymphatics, therefore, lymph as it first flow from each tissue has almost the same composition as the interstitial fluid in the part of the body from which the lymph flows. The protein concentration in the interstitial fluid averages about 2 grams per cent, and the protein concentration of lymph flowing from most peripheral tissues is near this value on the other hand lymph formed in the liver has a protein concentration as high as 6 grams per cent, and lymph formed in the intestines has a protein concentration as high as 3 to 4 grams per cent, since about two thirds of all lymph is derived from the liver and intestines, the thoracic lymph, which is a mixture of lymph from all areas of the body usually has a protein concentration of 3 to 5 grams per cent. The lymphatic system is also one of the major routes or absorption of nutrients from the gastrointestinal tract, being responsible principally for the absorption of fats, after a fatty meal, thoracic duct sometimes contains as much as 1 to 2 per cent fat. Large particles, such as bacteria can push their lymphatic capillaries and in this way enter the lymph. As the lymph passes through the lymph nodes, these particles are removed and destroyed [6].

2.2.3 Functions of the lymphatic system:

Fights diseases by producing lymphocytes and microphages. Returns proteins and other substances to the blood. Filters the lymph in the lymph nodes. Transfers fats from the intestine to the thoracic duct and hence to the blood [4].

2.2.4 Functions of the lymph nodes:

The filtration of lymph. The trapping of foreign material (antigens) by phagocytes. The production, of lymphocytes. The production of humeral antibodies. The provision of a pathway by which lymphocytes in the blood stream can re-enter lymphatic system[4].

2.3 Pathology

2.3.1 Lymphadenopathy:

Any disease of the lymph glands may be called a lymphadenopathy. Infection and carcinomatous metastases are common causes of lymphadenopathy. All other diseases affecting lymphatic and reticulo-endothelial tissue are uncommon. The increased size of a node may be caused by the Multiplication of the cells within the node, including lymphocytes, plasma cells, monocytes, or histiocytes. The Infiltration of cells from outside the node, such as malignant cells or neutrophils. The Draining of a source of infection by lymph nodes [7].

Tularemia maybe accompanied by regional adenopathy most common cervical. Yersinia enterocolitica infection may cause cervical adenopathy. Salmonella infections may accompany generalized lymphadenopathy . Rubella infection is characterized by enlarged and tender posterior auricular, posterior cervical, and occipital lymph nodes. Mediastinal or infectious hilar adenopathy may occur in patients with tuberculosis chronic sinusitis, histoplasmosis, tulanemia infections .Lymph nodes that are noted to increase rapidly in size may indicate potential malignancy.

Confluent lymph nodes may be indicators of malignancy[7].

2.3.2 Causes of lymphadenopathy:

2.3.2.1 Infections

Tulanemia may be accompanied by regional adenopathy, most commonly cervical, with local tenderness, pain, and fever. Generalized lymphadenopathy also may develop. In a child with tuberculosis, generalized lymphadenopathy may indicate hematogenous spread of tubercle bacilli. Localized involvement is most common in the mediastinal, mesenteric, or anterior cervical nodes. Initially, the nodes are discrete, firm, mobile, and tender. If the patient remains untreated, the nodes soften, become fluctuant and matted, and adhere to overlying skin which may become erythematous. Bilateral involvement is characteristic of this condition. Pulmonary disease is common. Salmonella infection can correspond to generalized adenopathy. In patients with catscratch disease, the site of the scratch determines if axillary epitrochlear, suproclavicular, femoral, inguinal, or submaxillary lymph nodes are involved. The nodes are non tender, discrete, mobile, and moderately or greatly enlarged, occasionally tenderness, redness, warmth, and suppuration may occur. Bartonella henselae is the organism causing catscratch disease. Patients with infectious mononucleosis typically present with discrete, firm, nontender lymph nodes usually. Anterior cervical nodes are involved. Generalized lymphadenopathy may occur, and hepatosplenomegaly is common. Cytomegalovirus may cause mononucleosis like syndrome with generalized adenopathy fever atypical lymphocytes, and hepatosplenomegaly. Gianotti-Crosti syndrome accompanies generalized lymphadenopathy, hepatomegaly, splenomegaly, nonicteric hepatitis, and crops of popular lesions that persist for 2-8 weeks [7].

2.3.2.2 Immunologic or connective tissue disorders

Juvenile rheumatoid arthritis should be considered in unexplained fever and persistent lymphadenopathy in a child. Serum sickness can correspond with generalized tender lymphadenopathy. Chronic graft versus host disease may occur [7].

2.3.2.3 Primary diseases of lymphoid or reticuloendothelial tissue are these :

Acute leukemia.Lymphosarcoma.Reticulum cell sarcoma.Hodgkin disease.Non-hodgkin lymphoma.Malignant histocytosis or histocytic lymphoma.Non endemic Burkitt tumor. Nasopharyngeal rhabdomyosarcoma.Neuroblastoma.Thyroid carcinoma, chronic lymphocytic thyroiditis. Benign sinus histiocytosis. Angioimmunoblastic or immunoblastic lymphadenopathy
Chronic pseudolymphomatous lymphadenopathy (chronic benign lymphadenopathy) [7].

2.3.2.4 Immunodeficiency syndromes and phagocytic dysfunction:

Chronic granulomatous disease of childhood. Acquired immunodeficiency syndrome. Hyperimmunoglobulin E {Job} syndrome[7].

2.3.2.5 Metabolic and storage diseases

Gaucher disease. Niemann – Pick disease. Cystinosis [7]

2.3.2.6 Hematopoietic disease:

Sickle cell anemia. Thalassemia.Congenital hemolytic anemia
Autoimmune hemolytic anemia [7]

2.4 Equipment

2.4.1 Computed Tomography

In the last 40 years no other advancement in X-ray apparatus has been as significant as the development of the computed tomography scanner. In the 1970s, Godfrey Hounsfield first demonstrated the process. Hounsfield was an engineer with EMI, Ltd. A British company. Both he and his company have received high acclaim. Alan Cormack, a physicist from Tufts University, shared the Nobel Prize in physics with Hansfield in 1982. Cormack developed the mathematics used to reconstruct CT images [(5)].

2.4.2 Principles of operation:

The way of CT scanner produces across-sectional image is complicated. The principles can be demonstrated looking at the simplest of CT systems. The simple CT consists of a finely collimated X-ray bam and a single detector. The X-ray source and detector are connected so that they move synchronously when the source-detect assembly makes one sweep, or translation across the patient, the Internal structure of the body attenuate the X-ray beam according to their mass densities and anatomical numbers. The intensity of radiation detected varies according to this attenuation pattern and forms an intensity profile or (projection). At the end of this translation the Source-detector assembly returns to its starting position, and the entire assembly rotates and begins a second translation. During the second translation, the detector signal against is proportional to the X-ray beam attenuation of anatomic structures, and a second projection is scanned. If this process is repeated many times, a large number of projections will be generated. These projections are not displayed visually but are stored in digital form in the computer. The computer processing of these, projections involves the effective superposition of each projection to reconstruct in image of the anatomical structures in that slice. The superposition of the projections doesn't occur as one might imagine. The detector signal during each translation is registered in increments with values as high as 1000. The value for each increment is related to the x-ray attenuation coefficient of the total path through the tissue. Through the use of simultaneous equations, a matrix of valves is obtained that represents the cross section of the anatomy scanned[3].

2.4.3 Operational Modes:

2.4.3.1 First generation scanners:

Translate-rotate configuration. Pencil-shaped beam. Single detector. 5 min scan time[3]

2.4.3.2 Second-generation scanners:

Translate-rotate configuration . Fan-shaped beam. Detector array. 30-s scan time[3]

2.4.3.3 Third-generation scanners:

Rotate – rotate configuration . Fan-shaped beam.Detector array.1-s scan time . Disadvantage = ring artifacts[3]

2.4.3.4 Fourth-generation scanners

Rotate – stationary configuration .Fan-shaped beam.Detector array
1-s scan time [3]

2.4.3.5 Fifth Scanners:

Continuing developments in et scanner design – improvements image quality at less patient dose, faster scan time, making cine CT, use slip ring technology into spiral CT scanners. This allows continuous rotation of the x-ray tube and detectors [3].

2.4.4 System Components:

The three major components of a (CT) scanner: The Gantry, the computer and the operating console. Each component has several subsystems[5].

2.4.4.1 Gantry:

The Gantry includes the x-ray tube the detector array, the high-voltage generator, the patient-support couch, and mechanical support for each. These subsystems receive electronic commands from the operating console and transmit data to the computer for image production and analysis [5] .

2.4.4.1.1 X-Ray tube:

The x-ray tube use in CT scan has special requirements. The anode heating capacity must be high (several million heat units (8MHU Capacity)).High-speed motors are used .Focal spot size – small focal spot used for high spatial resolution.X-ray tube energy differently depending on the design of the CT scanner. Third-generation operates with either a continuous or a pulsed x-ray beam.(Continuous up to 400MA) (Pulse 1000Ma). Fourth and fifth-generation CT scanners use a continuous x-ray beam[(5).]

2.4.4.1.2 Detector assembly:

Early CT scan had one detector, modern CT scanners have multiple detectors in an array numbering up to 8000 in two general classifications: scintillation detectors and gas-filled detectors[(3)].

2.4.4.1.3 Collimators:

Proper collimation reduces patient close by restricting the volume at tissue irradiated. There are usually two collimators. The first, the prepatient collimators, mounted on the x-ray, housing, limits the area of the patient that intercepts the useful beam and there by determines the slice thickness and patient dose. The predetector collimator restricts the x-ray beam viewed by the detector array. This collimator reduces the scatter radiation incident on the detector array and therefore improved image contrast [(3)].

2.4.4.1.4 High – voltage generator.

All CT scanners operate on three-phase or high-frequency power. High voltage generator building into the gantry or mounting it on the rotating wheel of the gantry[(3)].

2.4.4.1.4 Patient positioning and support couch.

The patient couch must be constructed of a material with a low atomic, it should be smoothly and accurately motor driven and should be smoothly and accurately motor driven and should be capable of automatic indexing[(3)].

2.4.4.2 Computer:

The computer is a unique sub system of the CT scanner. Depending on the image format, as many as 250,000 equations must be solved simultaneously, thus a large-capacity computer is required.At the heart of the computer used in CT are the microprocessor and primary memory. These determine the time between the end of scanning and the appearance of an image: the reconstruction time.The efficiency of an examination is greatly influenced by reconstruction time especially when a large number of slices are involved.Many CT scanners use an array processor instead of a microprocessor for image reconstruction. The array processor does many calculations simultaneously. It is significantly faster than the microprocessor, and an image can be reconstructed in less than I s(5).

2.4.4.3 Operating Console

Many CT scanners are equipped with two or three consoles: one for the CT radiological technologist to operate the scanner, one for another technologist to post process image for filming, and one for the physician to view the image and manipulate its contrasts, size and general visual appearance. A typical operating console contains controls and monitors for the various technique factors.

Operation is generally in excess at 120 Kvp the usual x-ray tube current is 100mA if the x-ray beam is continuous and several hundred mA if it is a pulsed beam, the length of time required per scan is often selectable and varies from 1 to 5s.The operating console usually has two television monitors. One is provided so that patient data the second monitor is provided so that the operator can view the resulting scan before transferring it to either hard copy or the physician’s viewing console(3).

2.4.5 Image storage:

There are a number of useful image storage formats. Current CT scanners stone image on either magnetic tapes or discs. If the disc format is used, data from a single patient are transferred to a single disc that can be stored in a jacket with other patient reports and film. If magnetic tape storage is used, data from many patients can be transferred to a single tape. Each tape generally accommodates 150 scan which is equivalent to 5 to 10 patients.

Removable hand discs are also used. For later viewing and filing, CT scan is usually recorded on film in a laser camera[3].

2.4.6 Spiral CT

In 1989, spiral computed tomography was introduced with great promise. In some imaging departments, CT use had declined in favor of magnetic resonance imaging (MRI) which has better contrast resolution. As a result spiral CT has emerged as a new and improved diagnostic tool. Spiral CT improves the imaging of anatomy that would other wise be compromised by voluntary and involuntary patient motion. In addition spiral CT can perform conventional transverse imaging for regions of the body where motion is not a problem, such as the head, spine and extremities.Spiral CT can also image more tissue in a single examination[3].

2.4.6.1 Imaging principles:

In 1989, Spiral CT was introduced with great promise for advanced patient examination. The term spiral some call it helical-was coined because it is the apparent motion of the x-ray tube during scan. When the examination begins, the x-ray tube rotates continuously without reversing. While the x-ray tube is rotating the couch moves the patient through the plane of the rotating x-ray beam. The x-ray tube is energized continuously, and data are continuously collected. This data can be reconstructed at any desired z-axis position along the patient[3].

2.4.6.2 Scanner Design:

Spiral CT is made possible by slip-ring technology. Continuing development of advanced imaging protocols is also due to improvements in the x-ray tube, the high voltage generator, and the detector array [3].

2.4.6.2.1 Slip-Ring-Technology:

Slip rings are electromechanical devices that conduct electricity and electric signals through rings and broches from a rotating surface onto affixed. Surface-one surface is a smooth ring, and the other a ring with brushes that sweep the ring. Spiral CT is made possible by the use of slip-ring technology, which allows the gantry to rotate continuously without interruption. In a slip-ring gantry system, power and electric signals are transmitted through stationary rings within the gantry, eliminating the need for the electrical cables that make continuous impossible. There are two slip-ring designs in spiral CT scanners: The disc and the cylinder. The disc design incorporates concentric conductive rings in the plane of rotation. In the cylindric design, the conductive rings lie parallel to the axis of rotation, forming a cylinder. There are usually three slip rings on a gantry, one provides high-voltage power to the x-ray tube or low voltage power to the gantry-mounted tube or low voltage power to control a second provides low-voltage power to control system on the rotating gantry. The third transfers digital data from the rotating detector array in a third generation scanner[3].

2.4.6.2.2 X-Ray Tube:

Spiral CT places a considerable a thermal demand on the x-ray tube. The x-ray tube is energized up to 60s continuously. Because of the continuous rotation and energization of the x-ray tube for longer exposure times, higher power levels must be sustained. Most systems use an x-ray tube with two focal spots. The small focal spot is used for high-resolution examination, and the large spot is used for high-technique studies of large patients spiral CT x-ray tubes are very large, they have an node heat capacity of approximately BMHU they have anode-cooling rates of approximately 1 MHU per minute because the anode disc has a larger diameter, and it is thicker, resulting in much greater mass[3] .

2.4.6.2.3 **X-Ray Detectors:**

The efficiency of the x-ray detector array reduces patient dose, allows faster scanning time, and improves image quality by increasing the signal-to-noise ratio [3].

2.4.6.2.4 High-voltage Generator:

The design constraints place on the high-voltage generator is the same as those for the x-ray tube. In a properly designed spiral CT scanner, those two pieces of equipment should be matched to maximum capacity [5].

2.5 Technique

2.5.1 Chest C.T.

The primary purpose of thoracic computed tomography is to sense as a diagnostic adjunct to conventional chest radiography. Conventional chest radiography-because of its cost effectiveness, still remains the primary screening tool in patients suspected of having chest pathology. However, virtually any abnormality discovered with conventional imaging will be investigated using CT, the superior contrast resolution and cross-sectional imaging afforded by CT make it available modality for the investigation of new pathology and the management and evaluation of previously diagnosed conditions[2]

2.5.1.1 Procedure for CT of the chest:

Jewelry and metallic objects must be removed before the patient placed supine on the table with the arms elevated axial supine with the arms elevated Ascanogram is obtained to allow the technologist to determine the range of the scan for the procedure. Routine chest CT includes scanning from the apices to the lung bases 7 TO 10mm slices and 2 to 3mm obtained at specified point in the chest. Faster acquisition times have increased the application of chest CT as artifacts due to respiratory and cardiac motion have been minimized.Additionally, assuming the patient is able to hold his or her breath, volume scanning has virtually eliminated anatomic mis registration, which occurred when the patient took a separate inspiration for each slice in conventional CT.Patient under going chest CT are coached by the technologist to hyperventilate prior to the procedure they take two or three deep breaths and are then asked to hold their breath for the 20 to 30 seconds required for the scan. Chest CT images are view with two sets of window settings.

1. Lung windows.
2. Mediastin windows.

The use of intravenous contrast media is important for visualization of structures within the mediastinum department protocols determine the specific type volume and injection sites[1]
.

2.5.1.2 Pathologic indications:

Tumors: metastatic lesion, mediastinal and hilar neoplasia, carcinoma.
Circulatory pathology: aneurysms, aortic dissection, pulmonary embolus.
Inflammatory / infections conditions: abscess, empyema.Trauma: mediastinal or lung injury. Disease processes of the chest: asbestosis, sarcoidosis, emphysema [1].

2.5.2 Abdomen and Pelvis CT

With the advent of CT the ability to diagnose abdominal and pelvic morphology has been significantly enhanced, because of its speed and accuracy. CT has become an effective management and treatment tool for abdominal and pelvic disease and has been especially useful in malignancy cases. The use of the standard diagnostic tests such as intravenous urography and endoscopic retrograde cholangiopancreatography (ERCP) has been greatly reduced because of the superior contras resolution of the CT examination.[2]

2.5.2.1 Procedure for CT of the Abdomen and Pelvis:

Metallic objects from the abdomen / pelvis area must be removed before the patient is placed supine with the arms elevated. As canogram is obtained to allow the technologist to determine the range of the scan for procedure. A routine abdomen CT protocol typically includes scanning from the diaphragm to the iliac crests in 7 to 10mm slices, and a routine pelvis CT protocol often includes scanning from the iliac crests to symphesis pubis. In 7 to 10mm any suspicious areas visualized may then be scanned using thinner slices. Faster exposure times have improved the quality of CT images as artifacts due to peristalitic motion have been reduced; additionally the patient is able to hold their breath. Patients undergoing abdomen/pelvis CT are coached by the technologist to hyper ventilate prior to the procedure. The two or three deep breath and are then asked to hold their breath for the 20 to 30 seconds required for the scan.To distinguish the GI tract from adjacent structures oral and/or rectal contrast media are required in abdomen and pelvis CT. Unopacified portions of the small and large bowel maybe misdiagnosed as lymph nodes, abscesses, or masses. Oral contrast media must be ingested before the exam in a manner that allows the contrast media to be distributed throughout the GI tract. Typically the patient ingests oral contrast at three intervals:

1. The night before the exam that will be in the long bowel.
2. 1 hour before the exam, will be in the small bowel..
3. Immediately before exam, will be the stomach.

Contrast media may be instilled rectally if oral contrast has not reached the rectum.Non ionic, iodinated intravenous contrast media is frequently required for abdominal CT, particularly for evaluation of the liver and pancreas, vessel opacification throughout the abdomen is helpful in differentiating vessels from masses and in assessing vessel pathology and integrity[2].

2.5.2.2 Pathologic Indications:

2.5.2.2.1 Abdomen:

Tumours lymphoma, metastatic lesions. Inflammatory/infectious conditions.Renal stones .Trauma .Lymphadenopathy. Circulatory pathology[1]

2.5.2.2.2 Pelvis

Tumours Inflammatory infectious conditions .Trauma [1]-

Chapter Three

Chapter 3

Material and Methods

3.1 Patients

Random sample of 54 patients who were clinically had different clinical diagnoses undergone the CT examination to show the abnormality, their average age range between (1-80) years (33) patients were males and (16) females.

Reports on CT films was done by different radiologists.

3.2 Machine used

Manufacture	Kvp	MA	Number of detectors
1. Siemenens – somatom-sprit	120	150-180	Single slice
2. GE- High speed advance system	120	180	16 slices
3. Toshiba Asteion Dual	120	250	dual Slices

3.3 Technique

3.3.1 Neck

3.3.1.1 slice thickness

4mm,5mm,7mm

3.3.1.2 I.V Contrast media

Centre	Volume	Rate of injection
1	60 ml	1.5 ml /s
2	80 ml	2.5 ml /s
3	50 ml	1.5 ml /s

3.3.1.3 scan obtained

1- topogram 2- spiral axial scan without contrast media 3- spiral axial scan with contrast media .

3.3.2 Thoracic and axilla
3.3.2.1 Slice thickness

8mm,10 mm

3.3.2.2 I. V contrast media

Centre	Volume	Rate of injection
1	70 ml	2.0 ml /s
2	100 ml	2.0 ml /s
3	60 ml	1.5 ml /s

3.3.2.3 scan obtained

1- topogram 2- spiral axial scan without contrast media 3- spiral axial scan with contrast media .

3.3.3 Abdomen and pelvis
3.3.3.1 Slice thickness

5mm,8 mm,10mm

3.3.3.2 I. V contrast media

Centre	Volume	Rate of injection
1	120 ml	2.0 ml /s
2	150 ml	5.0 ml /s
3	100 ml	3.0 ml /s

3.3.3.3 Oral Contrast media

Centre	Volume	Rate of intake
1	1000 ml	400 ml Drink at night before exam . 200ml Drink one hour before exam . 200 ml Drink 30 min before exam . 200 ml Drink 15 min before exam
2	800 ml	400 ml Drink two hour before exam .

		200ml Drink one hour before exam. 100 ml Drink 30min before exam . 100 ml Drink 15 min before exam .
3	1000 ml	400ml Drink at night before exam . 400 Drink one hour before exam . 200ml Drink 30min before exam.

3.3.3.4 Scan Obtained .

1- topogram 2- spiral axial scan without contrast media 3- spiral axial scan with contrast media .

3.4 Method of evaluation .

all films were evaluated by centers Radiologists .

Chapter four

Chapter (4)

Results and Data Analysis

Table (4-2) and Graph Show the Patients ages

Item	Frequency	Percentage
1-10	4	7%
11-20	1	2%
21-30	2	4%
31-40	12	22%
41-50	12	22%
51-60	9	17%
61-70	8	15%
71-80	6	11%
Total	**54**	**100%**

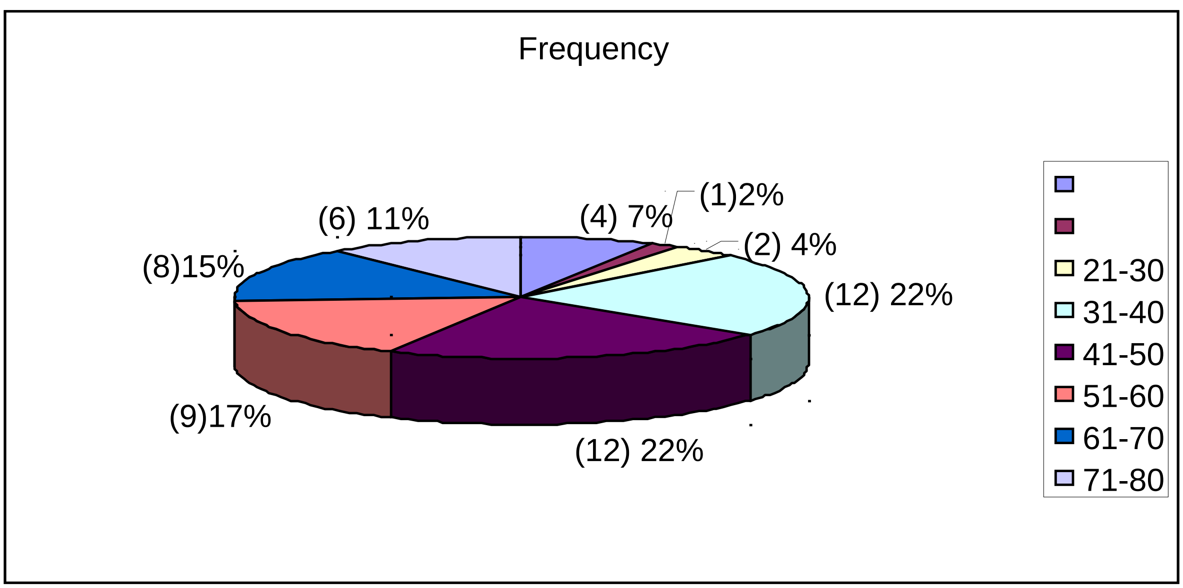


Table (4-3) and Graph Show the Sex of patients

Item	Frequency	Percentage
Male	38	70%
Female	16	30%
Total	**54**	**100%**

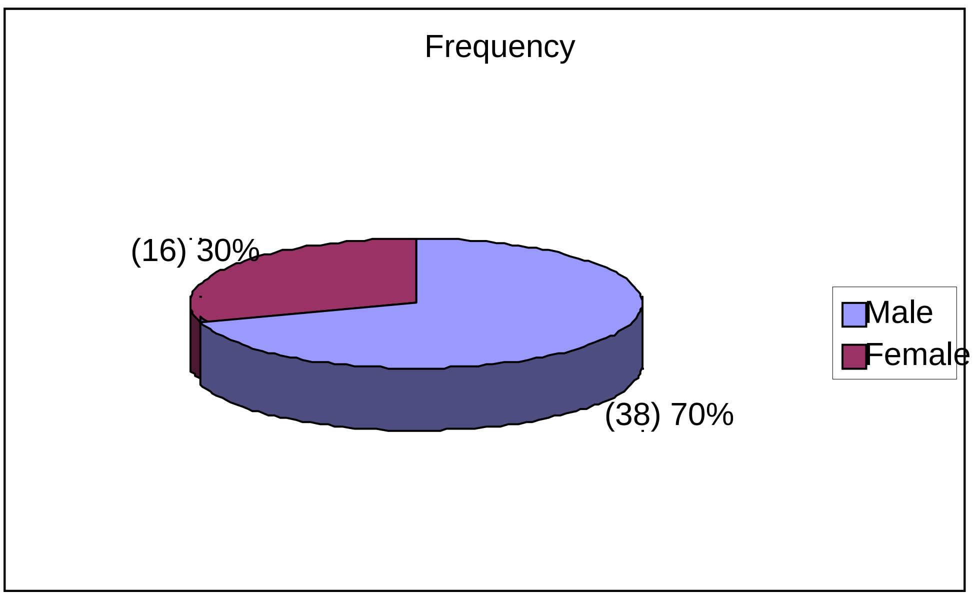


Table (4-4) and Graph
Show the Lymph Nodes Site

Item	Frequency	Percentage
Neck	7	13%
Axillary	4	8%
Thoracic	12	22%
Abdomen	25	46%
Pelvis	6	11%
Total	**54**	**100%**

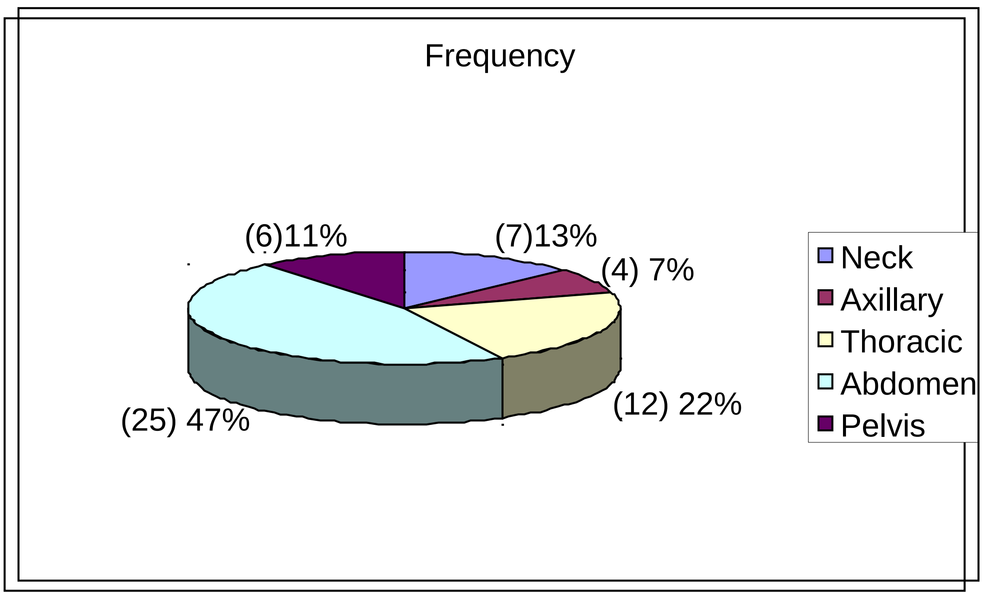


Table (4-5) and Graph show the Contrast Media used

Item	Frequency	Percentage
Intravenous contrast media	25	46%
Intravenous + oral contrast media	28	52%
Without contrast media	1	2%
By rectal	0	0%
Total	**54**	**100%**

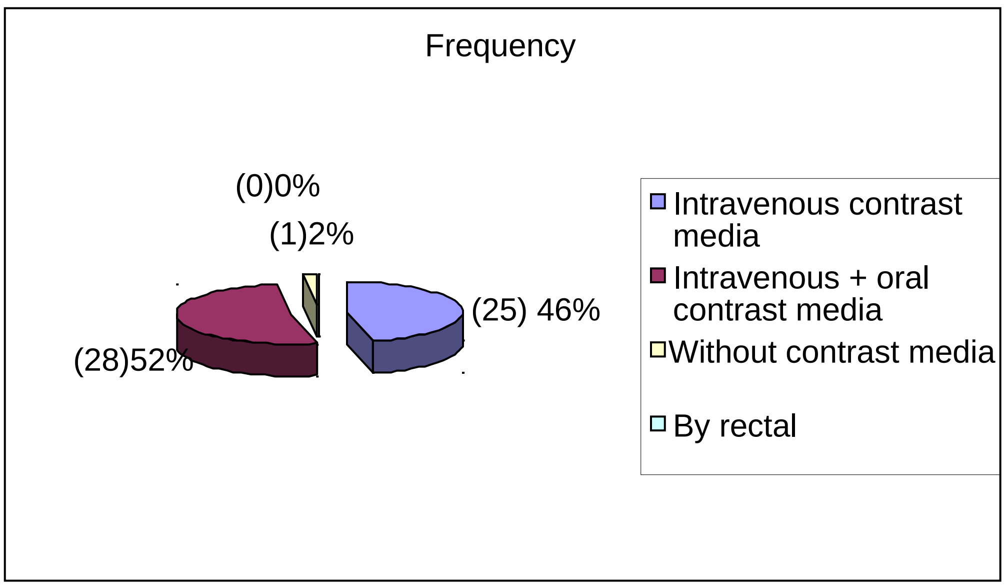


Table (4-6) and Graph Show the
Slice thickness used in the neck region

Item	Frequency	Percentage
4mm	3	43%
5mm	1	14%
7mm	3	43%
Total	**7**	**100%**

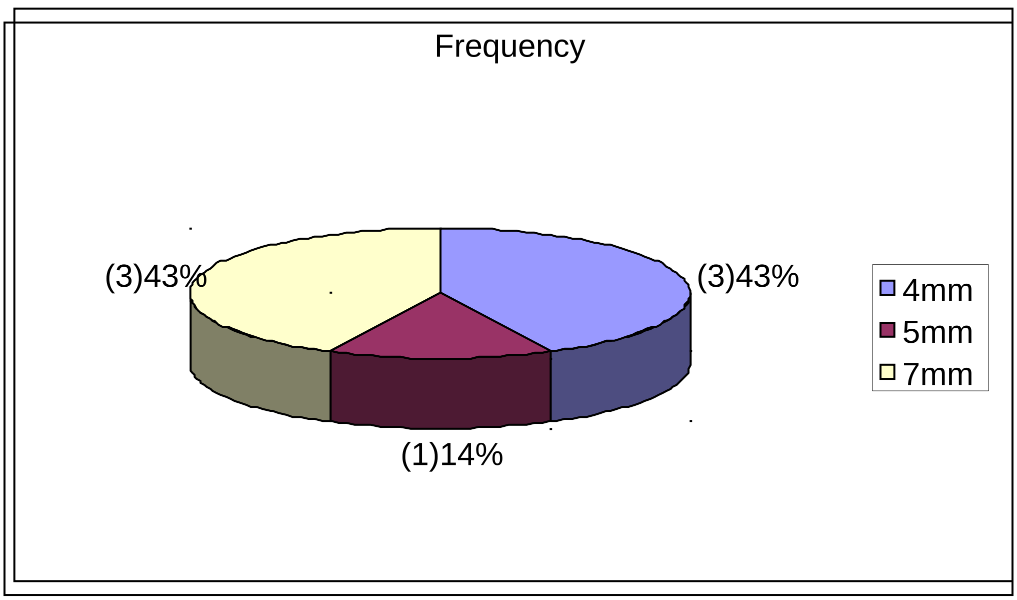


Table (4-7) and Graph Show the Slice thickness used in the axillary region

Item	Frequency	Percentage
8mm	1	25%
10mm	3	75%
Total	**4**	**100%**

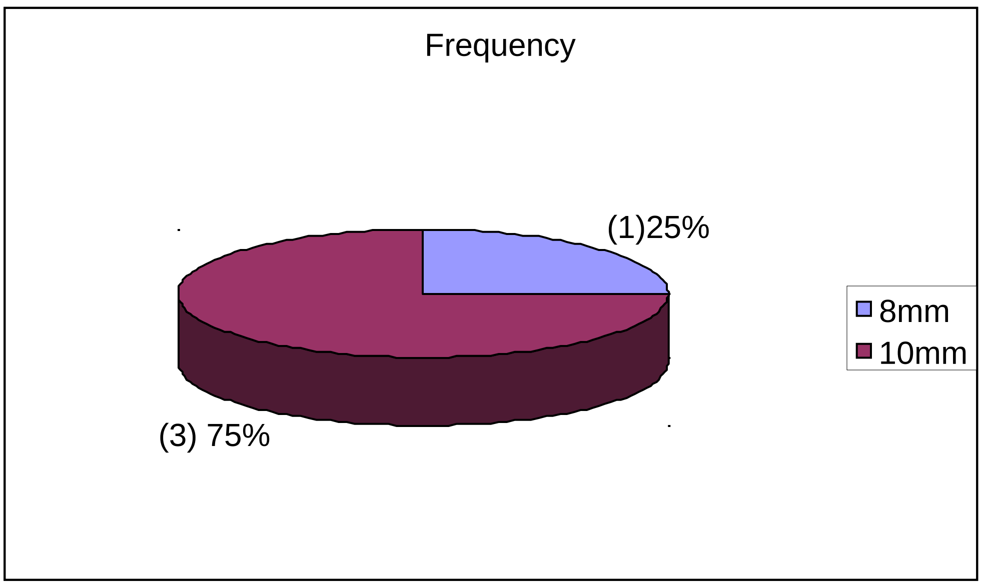


**Table (4-8) and Graph show the
Slice thickness used in the chest region**

Item	Frequency	Percentage
5mm	3	25%
8mm	4	33%
10mm	5	42%
Total	**12**	**100%**

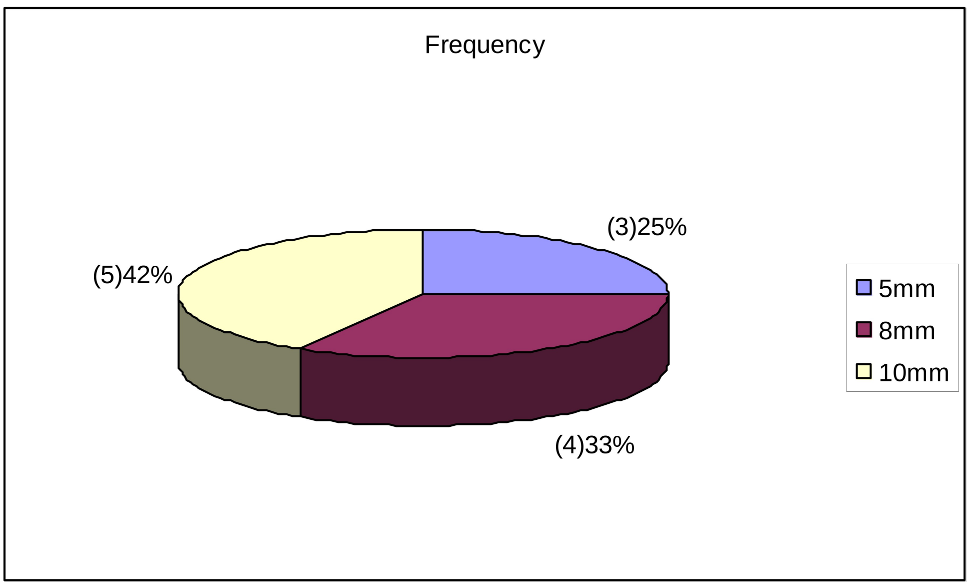
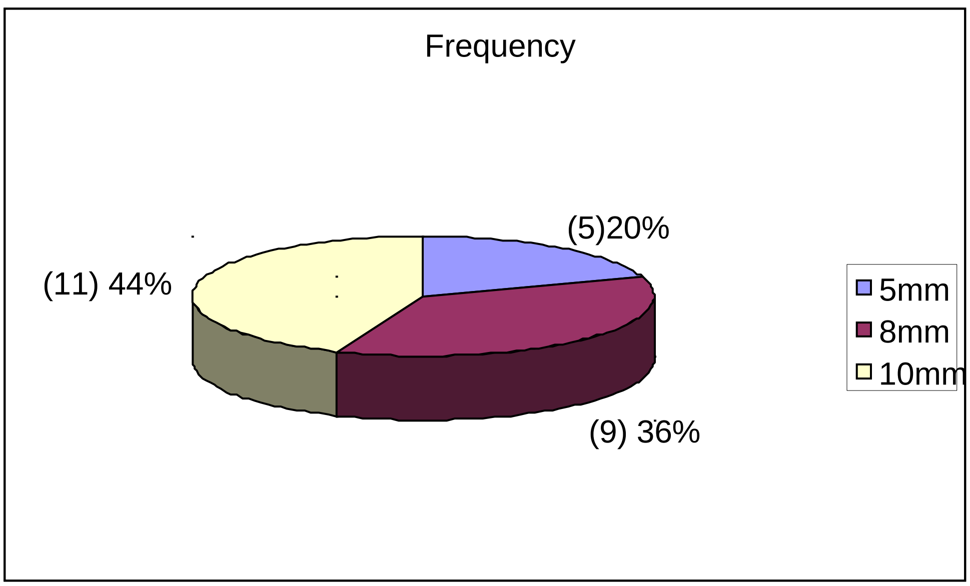


Table (4-9) and Graph Show
Slice thickness used in the abdomen region

Item	Frequency	Percentage
5mm	5	20%
8mm	9	36%
10mm	11	44%
Total	**25**	**100%**



.

Table (4-10) and Graph show the Slice thickness used in the pelvis

Item	Frequency	Percentage
8mm	2	33%
10mm	4	67%
Total	**6**	**100%**

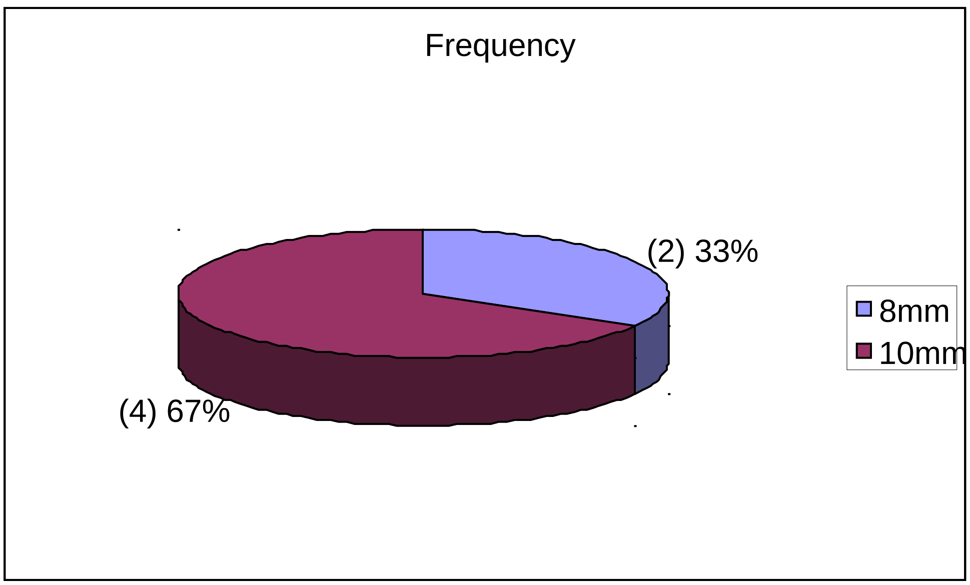


Table (4-11) Display Window

Table (4-11) Which shows the range of W-W and W L which used with neck, axillary chest-abdomen and pelvis

Site	Range of W-W	Range of W-L
Neck	360-222	100-40
Axillary	544-300	100-40
Chest	360-114	100-25
Abdomen	370-140	85-11
Pelvis	300-160	60-2

Table (4-12) and Graph show the
Size of the neck lymph nodes

Item	Frequency	Percentage
Small	2	29%
Moderate	2	29%
Large	3	42%
TOTAL	**7**	**100%**

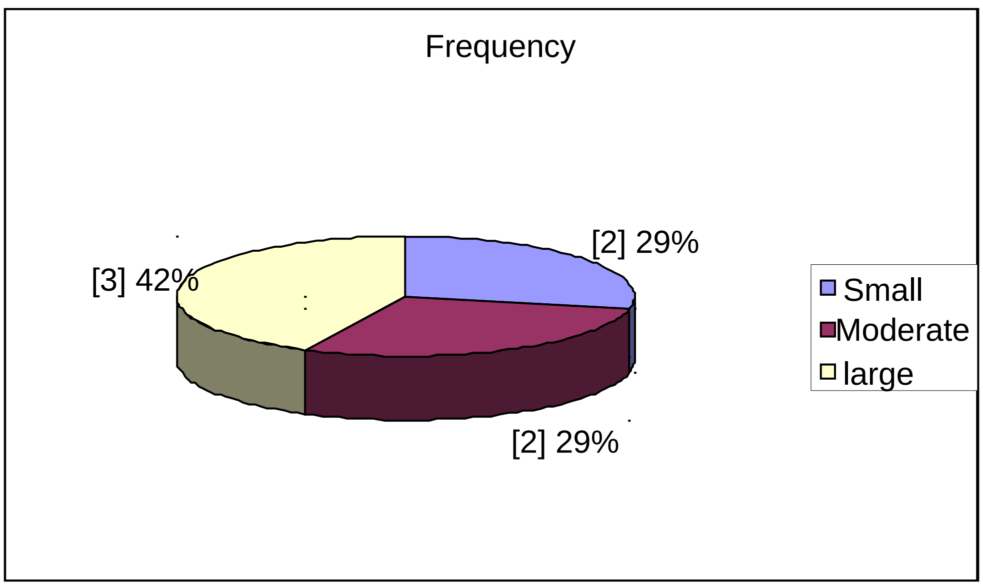


Table (4-13) and Graph show the Size of the axillary lymph nodes

Item	Frequency	Percentage
Small	1	25%
Moderate	3	75%
Large	0	0%
TOTAL	**4**	**100%**

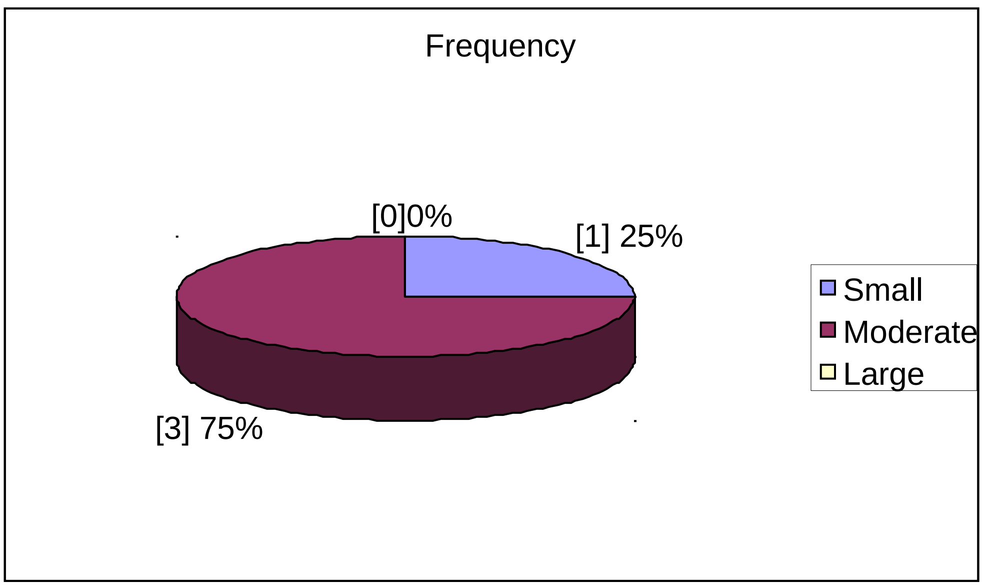


Table (4-14) and Graph Show the Size of the thoracic lymph nodes

Item	Frequency	Percentage
Small	6	50%
Moderate	2	17%
Large	4	33%
TOTAL	**12**	**100%**

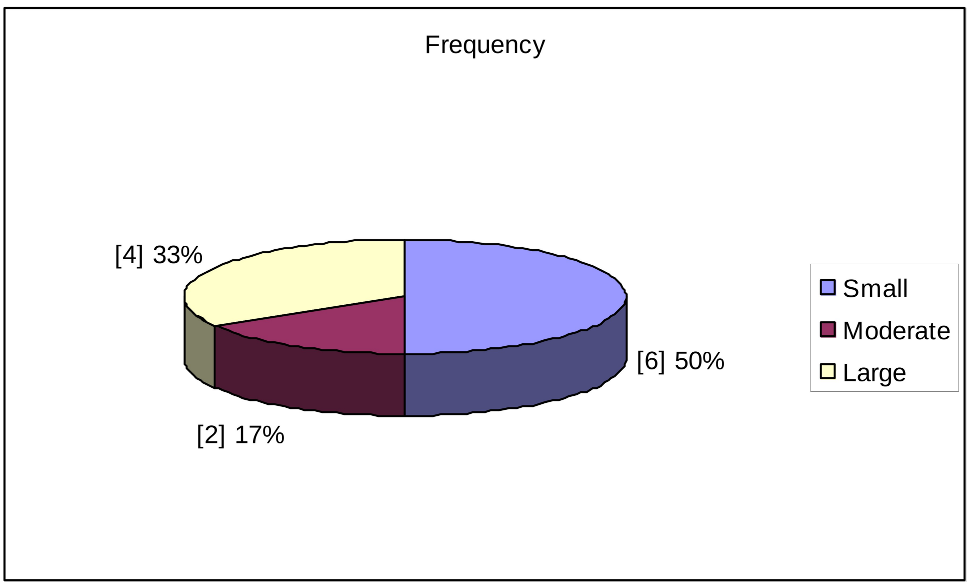


Table (4-15) and Graph show the Size of the abdomen lymph nodes

Item	Frequency	Percentage
Small	5	20%
Moderate	10	40%
Large	10	40%
TOTAL	**25**	**100%**

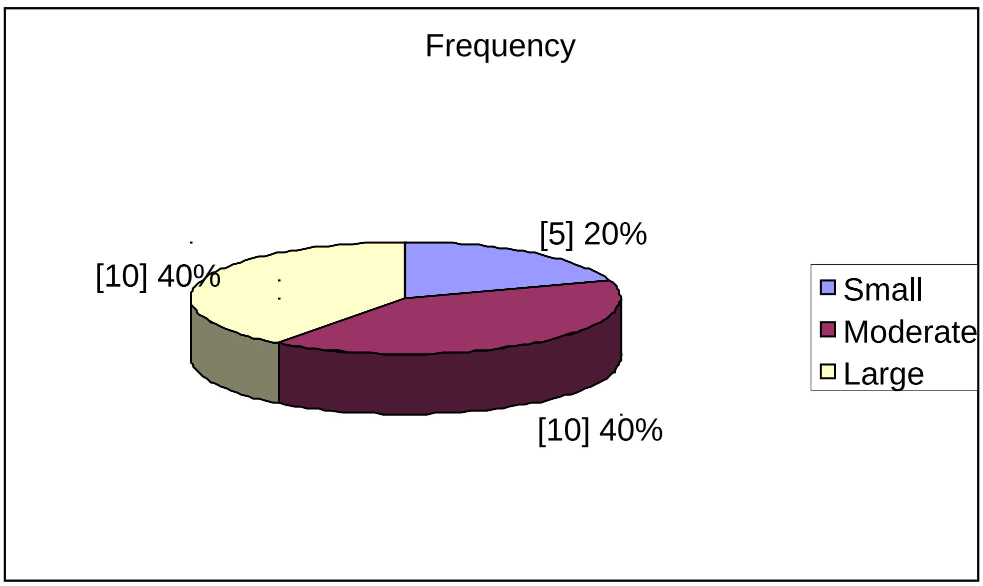


Table (4-16) and Graph show the Size of the pelvis lymph nodes

Item	Frequency	Percentage
Small	1	17%
Moderate	2	33%
Large	3	50%
TOTAL	**6**	**100%**

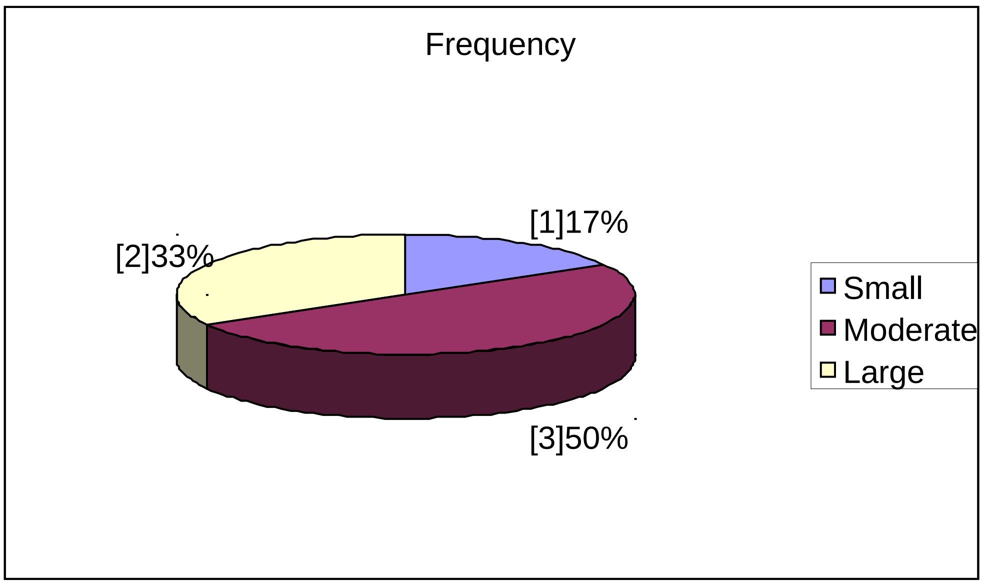


Table (4-17) and Graph show the Size of the neck lymph nodes

Item	Frequency	Percentage
discreate	5	71%
matted	2	29%
TOTAL	**7**	**100%**

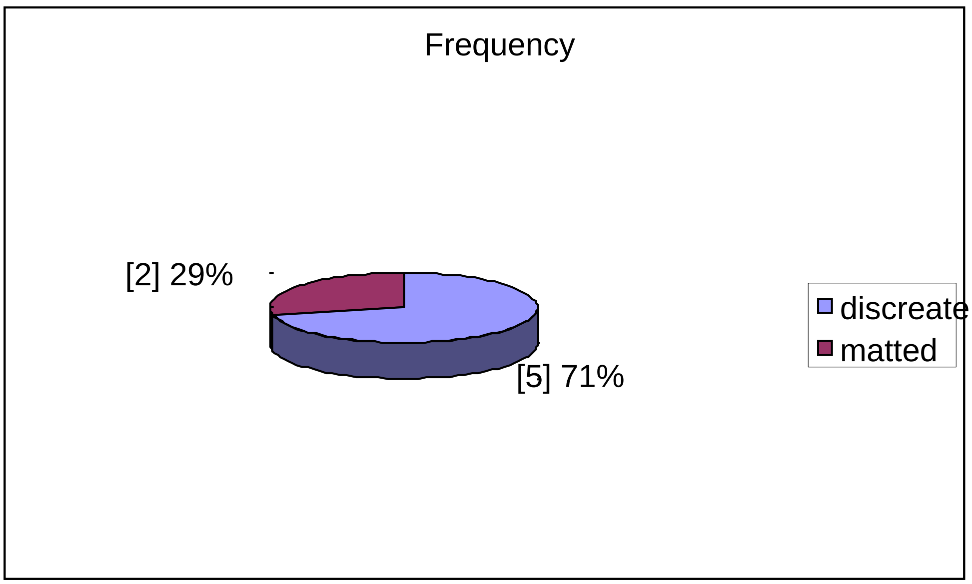


Table (4-18) and Graph show the Shape of the axillary lymph nodes

Item	Frequency	Percentage
discreate	3	75%
matted	1	25%
TOTAL	**4**	**100%**

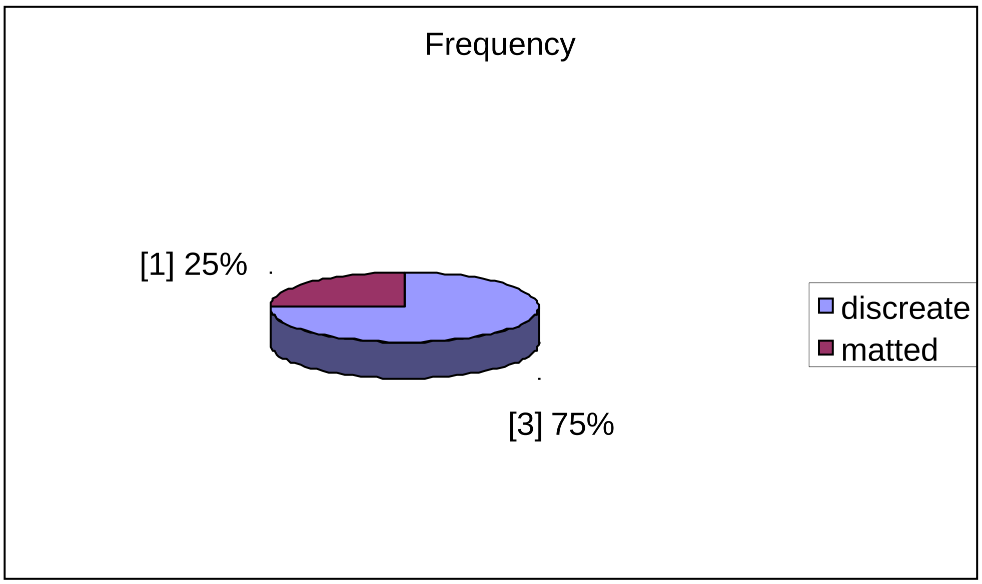


Table (4-19) and Graph show the
Shape of the thoracic lymph nodes

Item	Frequency	Percentage
discreate	9	75%
matted	3	25%
TOTAL	**12**	**100%**

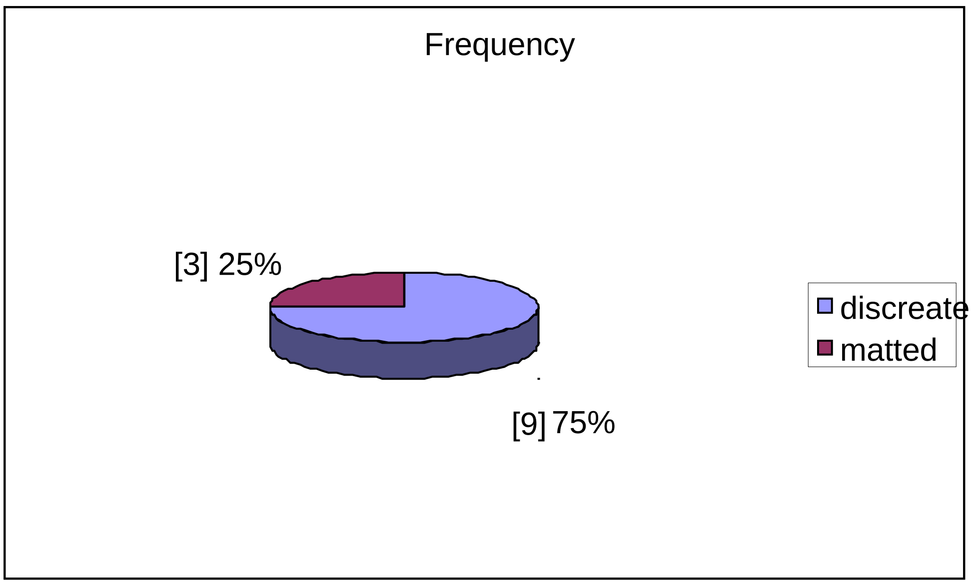


Table (4-20) and Graph show the Shape of the abdomen lymph nodes

Item	Frequency	Percentage
discreate	12	48%
matted	13	52%
TOTAL	**25**	**100%**

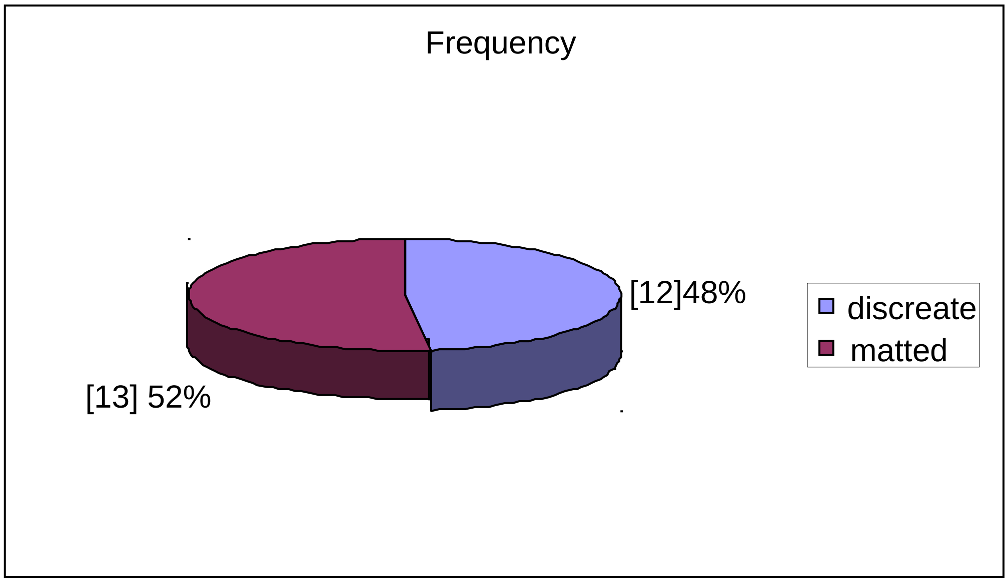


Table (4-21) and Graph show
Shape of the pelvis lymph nodes

Item	Frequency	Percentage
discreate	2	33%
matted	4	67%
TOTAL	**6**	**100%**

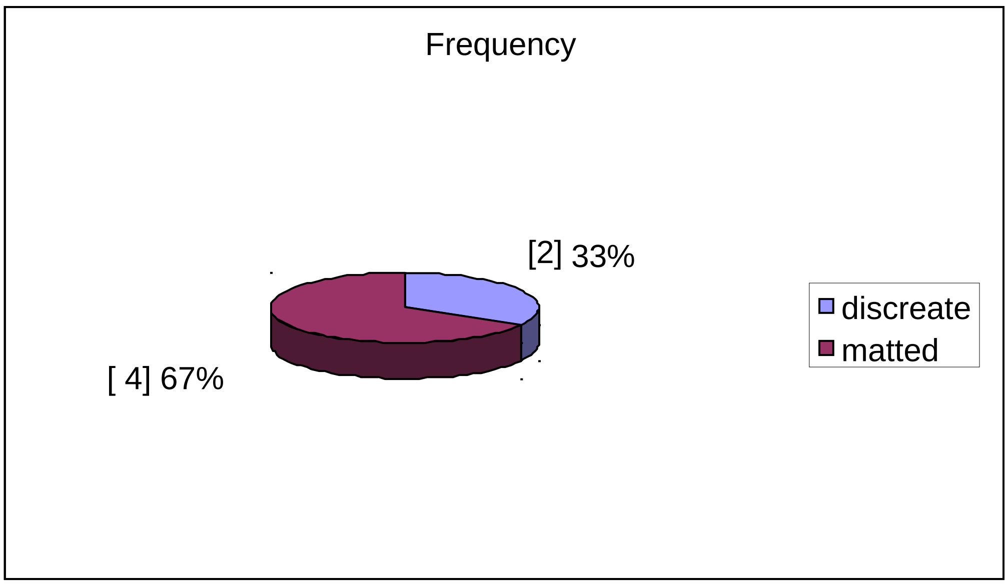


Table (4-22) and Graph show
The diseases which are associated with lymphadenopathy

Diseases	No. of patients involve	Percentage
Splenomegaly	10	19%
Pleural effusion	8	15%
Liver deposit	7	12%
Splenic deposit	5	9%
Hepatomegaly	5	9%
Consolidation	5	9%
Ascites	4	7%
Compression to the Larynx	3	6%
Compression to IVC	2	4%
Bone lesion	2	4%
Renal mass	2	4%
Large thymus	1	2%
TOTAL	**54**	**100%**

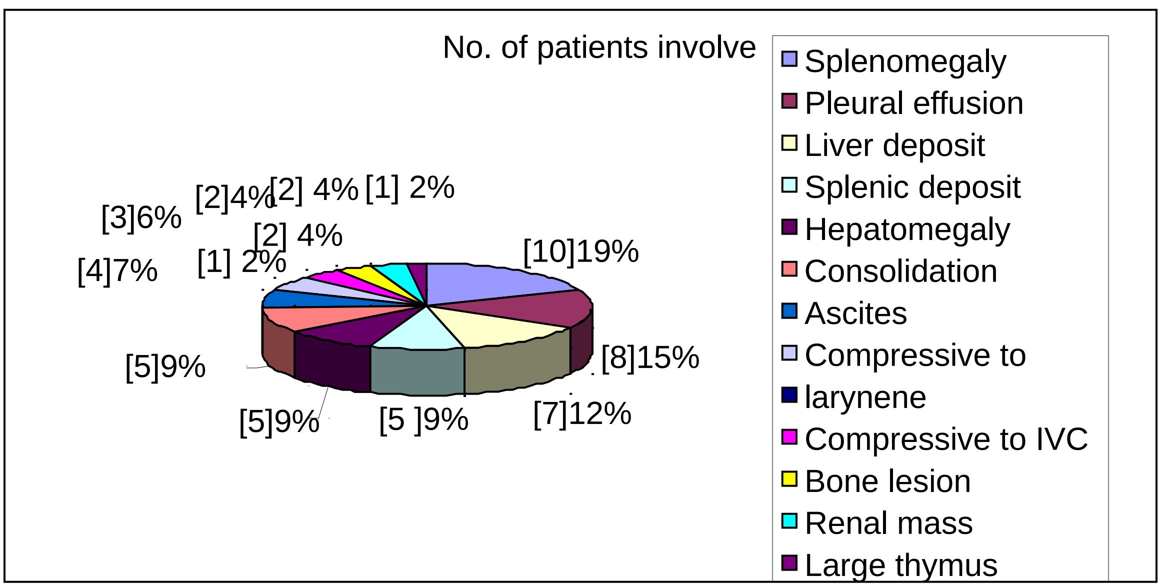
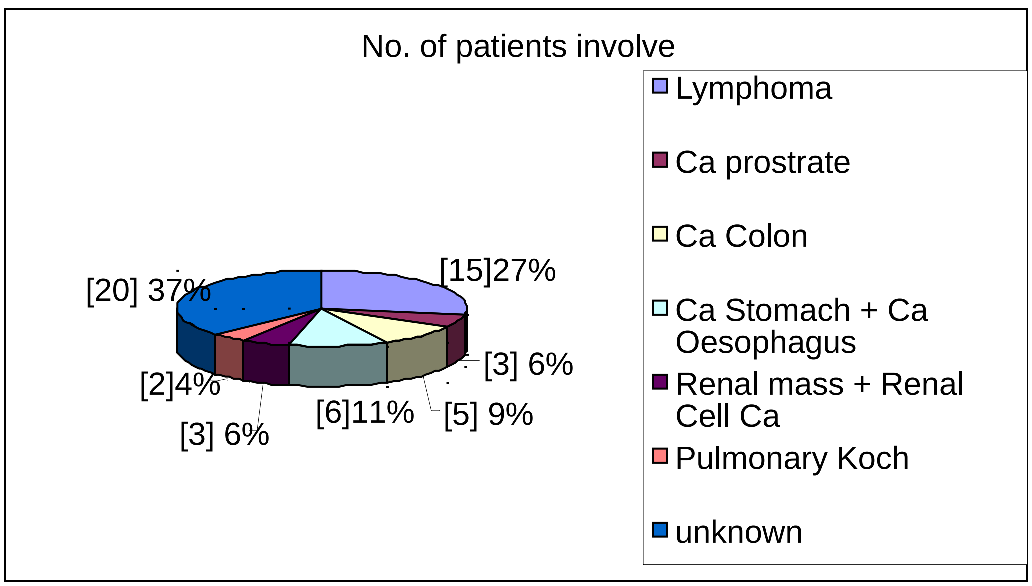


Table (4-23) and Graph Show
The diseases that led to lymphadenopathy

Diseases	No. of patients involve	Percentage
Lymphoma	15	27%
Ca prostrate	3	6%
Ca Colon	5	9%
Ca Stomach + Ca Oesophagus	6	11%
Renal mass + Renal Cell Ca	3	6%
Pulmonary Koch	2	4%
unknown	20	37%
Total	**54**	**100%**



Chapter five

Chapter (5)

Discussion

This chapter discusses the evaluation and detection of lymphadenopathy by using CT scan examination to show the significance and Role of CT scan.

Table (4-2) and Graph shows the ages distribution,

54 patients investigated by CT

Their ages range from one year up to 10 years (4 patients 7%)

Their ages from 11 up to 20 years (one patients 2%).
Their ages from 21 up to 30 years (2 patients 4%).
Their ages from 31 up to 40 years (12 patients 22%).
Their ages from 41 up to 50 years (12 patients 22%).
Their ages from 51 up to 60 years (9 patients 17%).
Their ages from 61 up to 70 years (8 patients 15%).
Their ages from 71 up to 80 years (6 patients 11%).

This shows the patients from 31 up to 50 are the most affected age group by lymphadenopathy.

Table (4-3) and Graph show the sex distribution
There are 54 patients (33 males 70%) while (16 females 30%)
The number of males is more than females by more than two thirds

Table (4-4) and Graph show the site of lymph nodes involved in this study:
Neck lymphadenopathy 7 patients (13%)
Axillary lymphadenopathy 4 patients (8%)
Thoracic lymphadenopathy 12 patients (22%)
Abdomen lymphadenopathy 25 patients (46%)
Pelvis lymphadenopathy 6 patient (11%)
The finding reflected the abdomen lymph nodes are the most affected and axillary lymph nodes are the least to be affected.

Table (4-5) and Graph show the number of patients demonstrating lymphadenopthy by using contrast medium.

Intravenous contrast media 25 patient (46%)

Intravenous plus oral contrast media 28 patients (52%) only one patients demonstrated without contrast media and no patient used contrast media by rectal route, this shows 25 patients used only intravenous contrast media there are 7 patients had CT neck. 4 patients had CT axilla, 11 patients had CT chest and 3 patients had CT abdomen. There is only one patient (one year) had CT chest demonstrated lymphadenopathy without intravenous contrast media because he was urgent and acomplicated case .

3 patients has CT abdomen used only intravenous contrast media because they were having dysphagia.

28 patients 52% demonstrated lymphadenopathy by using oral plus intravenous contrast media, 22 patients had CT abdomen and 6 patients had CT pelvis.

Table (4-6) and Graph show the slice thickness used in patients who had CT neck 4mm used with 3 patients (48%),
5mm used with one patients (14%) and
7mm used with 3 patients (43%)

Table (4-7) and Graph show the slice thickness used in patients had axillary CT scan.
8mm used with one patient 25%
10mm used with 3 patients 75%

this Shows the number of slice thickness used in axillary are big with comparison to the size of the axillary lymphnodes because the patients that suspected to have axillary lymphadenopathy requested chest CT scan.

Table (4-8) and Graph show the slice thickness used with CT chest
5mm used with 3 patients (25%)
8mm used with 4 patients (33%)
10mm used with 5 patients (42%)

Table (4-9) and Graph show the slice thickness used with CT abdomen
5mm used with 5 patients 20%
8mm used with 9 patients 36%

10mm used with 11 patients 44%

Table (4-10) and Graph show the slice thickness used with CT pelvis
8mm used with 2 patients 33% and
10mm used with 4 patients 67%

Choice of slice thickness is depending on the case under examination

Table (4-11) Shows the range of displayed window used

In CT neck the range of W-W between 360-222 and W-L between 100-40

In CT axilla the range of W-W between 544-300 and W-L between 100-40

In CT chest the range of W-W between 360-114 and W-L between 100-25

In CT abdomen the range of W-W between 370-140 and W-L between 85-11

In CT pelvis W-W between 300 -160 and W-L between 60-2

The result reflected the displayed window is depending on the radiologist and technologist observation

Comment

(The gray level of any image can be adjusted on CRT (Cathode Ray Tube) to compensate for differences in patient size and tissue densities or to display the image as desired for the examination protocol) [1]

Table (4-12) and Graph show the size at the neck lymphadenopathy
Small 2 patients 29%
Moderate 2 patients 29%
Large 3 patients 42%

Table (4-13) and Graph show the size at the axillary lymphadenopathy
Small one patients 25%
Moderate 3 patients 75%

Table (4-14) and Graph show the size at the thoracic lymphadenopathy
Small 6 patients 50%
Moderate 2 patients 17%
Large 4 patients 33%

Table (4-15) and Graph show the size at the abdomen lymphadenopathy
Small 5 patients 20%
Moderate 10 patients 40%
Large 10 patients 40%

Table (4-16) and Graph show the size at the pelvic lymphadenopathy
Small 1 patients 17%
Moderate 3 patients 33%
Large 2 patients 50%

Comment

(Abnormal lymph nodes may be recognized by an increase in size, neck and mediastinal more than 1 cm in diameter are considered abnormal and retroperitoneal nodes greater than 1.5cm consider abnormal [8].

Table (4-17) and Graph show the shape of the neck lymphadenopathy
Discrete 5 patients 71%
Matted 2 patients 29%

Table (4-18) and Graph show the shape of the axillary lymphadenopathy
Discrete 3 patients 75%
Matted only one patients 25%

Table (4-19) and Graph show the shape of thoracic lymphadenopathy
Discrete 9 patients 75%
Matted 3 patients 25%

Table (4-20) and Graph show the shape at the abdomen lymphadenopathy
Discrete 12 patients 48%
Matted 13 patients 52%

Table (4-21) and Graph show the shape of the pelvic lymphadenopathy
Discrete 2 patients 33%
Matted 4 patients 67%

Table (4-22) and Graph can show the diseases which is associated with lymphadenopathy

- Splenomegaly 10 patients 19%
- Pleural effusion 3 patients 15%
- Liver deposits 7 patients 12%
- Splenic deposit 5 patient 9%
- Hepatomegaly 5 patients 9%
- Consolidation 5 patients 9%
- Acites 4 patients 7%
- Compression to larynx 3 patients 6%
- Compression to IVC (Inferior vena cava) 2 patients 4%
- Bone lesion 2 patients 4%
- Renal mass 2 patients 4%
- And large thymus one patients 2%

Table (4-23) and Graph can show the diseases lead to lymph adenopathy
Lymphoma 15 patients 27
Carcinoma prostate 3 patients 6%
Carcinoma colon 5 patients 9%

Carcinoma stomach + Ca oesophagus 6 patients 11%
Renal mass + renal cell carcinoma 3 patients 6%
Pulmonary Koch 3 patients 4% and unknown reasons 20 patients 37% the result reflected lymphoma is a dominant disease.

Unknown reasons maybe concern with the patient past history.

From tables and Graphs (4-4, 4-12, 4-13, 4-14, 4-14, 4-15, 4-16, 4-17, 4-18, 4-19, 4-20, 4-21),that Show the sites, sizes, and shapes of lymphadenopathy the CT scan is informative in diagnosing lymphdenopathy and spiral CT is the best technique for demonstrating lymphadenopathy, because spiral CT scan:

1. Improves lesion detection.
2. Lack of motion artifacts (scanning time is reduced)with Removed respiratory misregistration
3. Optimized intravenous contrast (Data are obtained during the peak of enhancement). There is reduced volume of contrast agent.

From tables and Graphs(4-5, 4-6, 4-7- 4-8, 4-9, 4-10)and table(4-11)

The contrast media and slice thickness and the range of display window are shown.

Intravenous contrast media used in the neck and axilla to show the vascular structures and with chest is helpful in assessing the mediastinum and lung hila, with abdomen to detect extranodal diseases and oral contrast media helps to differentiate between loops of bowel and other structures within the abdomen.

Slice thickness is depending on the site under examination, clinical diagnosis and the lesion it self .

Display window is depending on patient size , tissue densities and staff observation.

From all axial CT scan with contrast medium (intravenous, oral and rectal) are suitable techniques.

Chapter six

Chapter (6)

Conclusion & Recommendation

6.1 **Conclusion**

1. CT is now an important method of imaging non palpable lymphadenopathy.

2. Spiral CT is a standard method for detecting the site, size and shape of lymphadenopathy.

3. Axial CT scan with contrast media (I.V, oral and rectal) is the suitable technique for demonstrating lymphadenopathy.

4. Display window is depending on patient's size and tissue densities.

(6.2) **Recommendation**

1. CT examination must be performed during the dynamic infusion of intravenous contrast medium, which allows all the vascular structures to be highlighted, and may demonstrate ring enhancement of lymph nodes with metastatic squamous carcinomas.

2. Co-operation from the patients referrers is needed to make full request form to help the technologist to chose the suitable examination and the radiologist to make the proper diagnosis.

3. The government must establish more CT Centres with low price to help poor patients and follow up of the patients.

References

1. Ballinger-Philip-W Frank – Eugene D. Merrill's Atlas of Radiographic Positions and Radiologic 1999 Ninth Edition ,Copyright 1999 by Mosby Inc.

2. Bontrager, Kenneth L. – 2005 Text Book of Radiographic Positioning and Related Anatomy Volume two – 6th edition Copyright © 2005 Moshy Inc.

3. Bushong-Stewart-C- 1998.Radiologic science for technologist/Mosby-Aharcourt Health Science Company London-Sydney

4. Dean-M-R-f 1987 ,Basic Anatomy and Physiology for Radiographer, Third Edition,Blackwell Scientific Publication London.

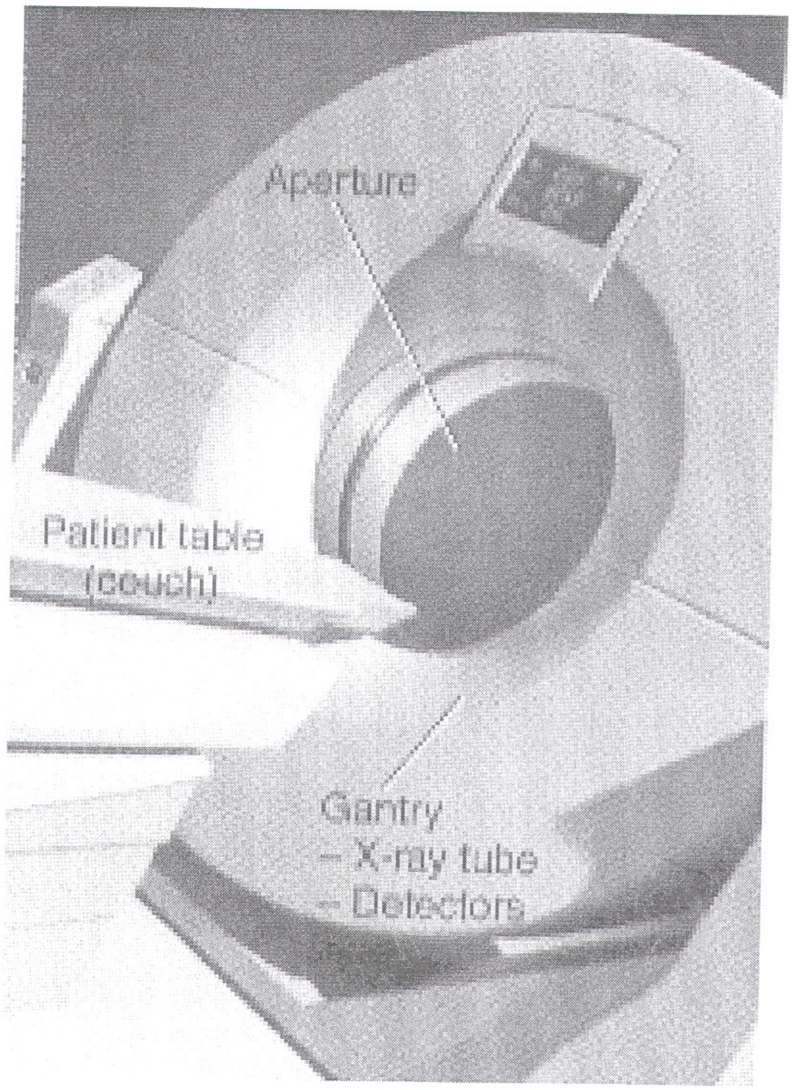
5. Mass-Albert-A 1992,Computed tomography of the body with magnetic resonance imaging/volume Three, Second Edition.

6. Gyton-Arthur- 1986,Text book of Medical Physiology, Seventh Edition
W.B Saunders Company Mass-Albert-A 1992

7. Ulphat Shaikh 2003 emedicine Lymphadinitis .

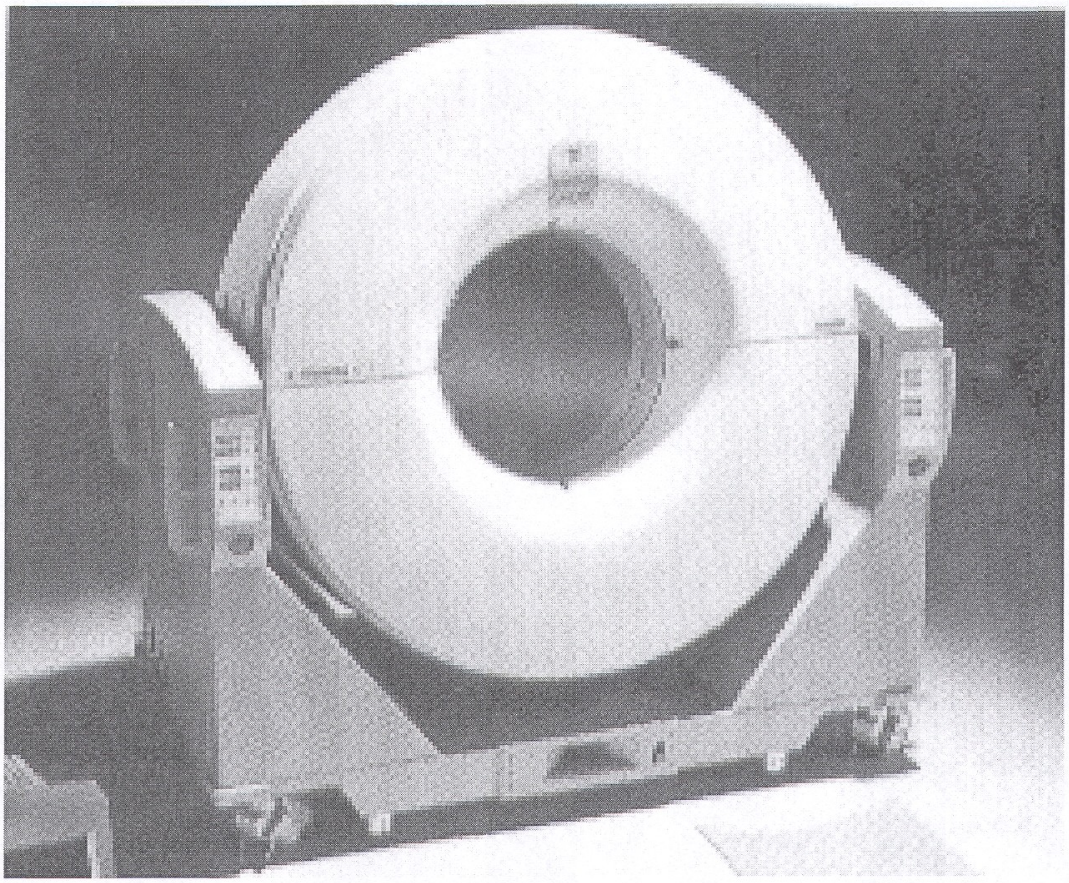
8. Sutton-David 1998 ,Textbook of Radiology and Imaging Produce by Longman Asia Lt Hong Kong

9. Warrick - C.K 1976 Anatomy and physiology for Radiographer by Edward Arnold ltd. 41 Bedford square , London .

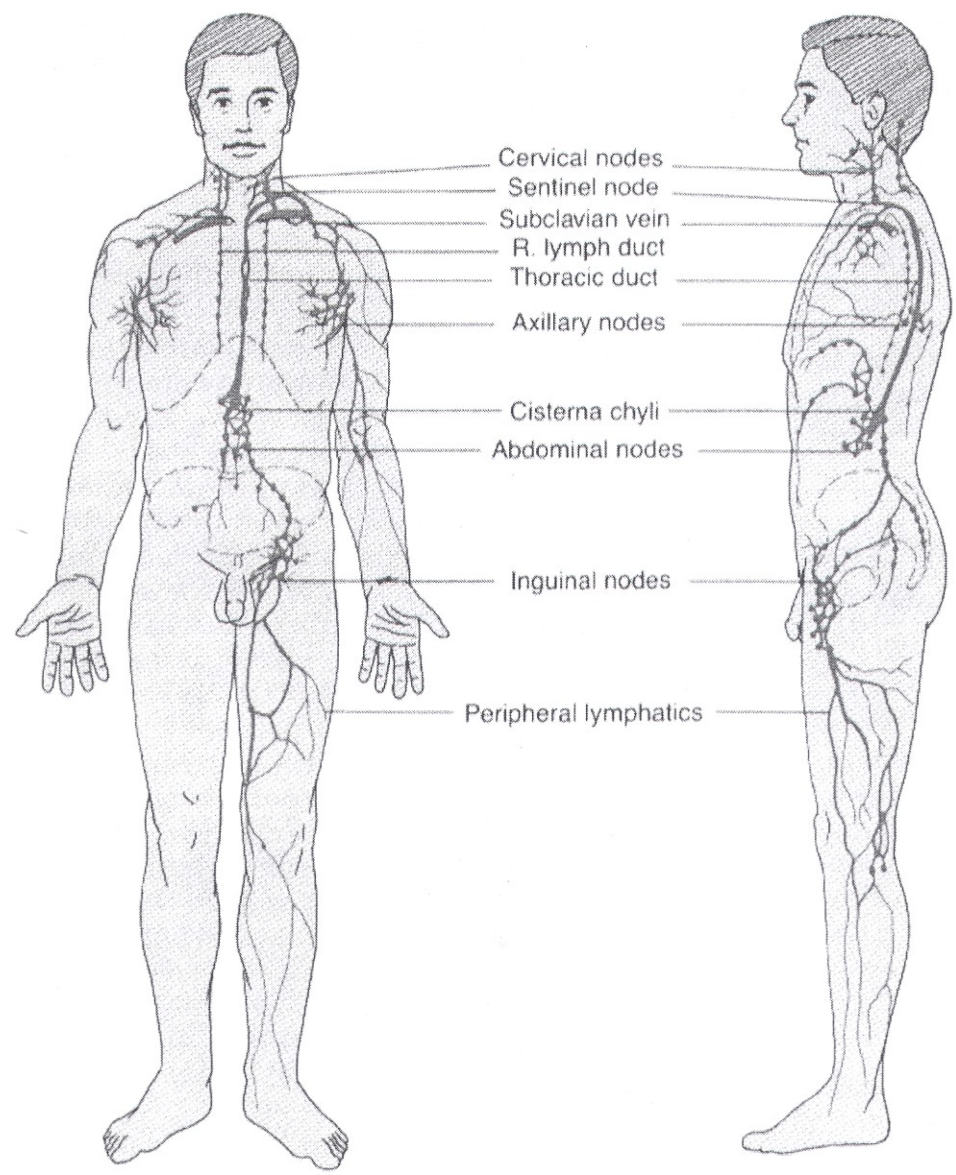


Figure(1) CT Scanning unit-patient table- and gantry.

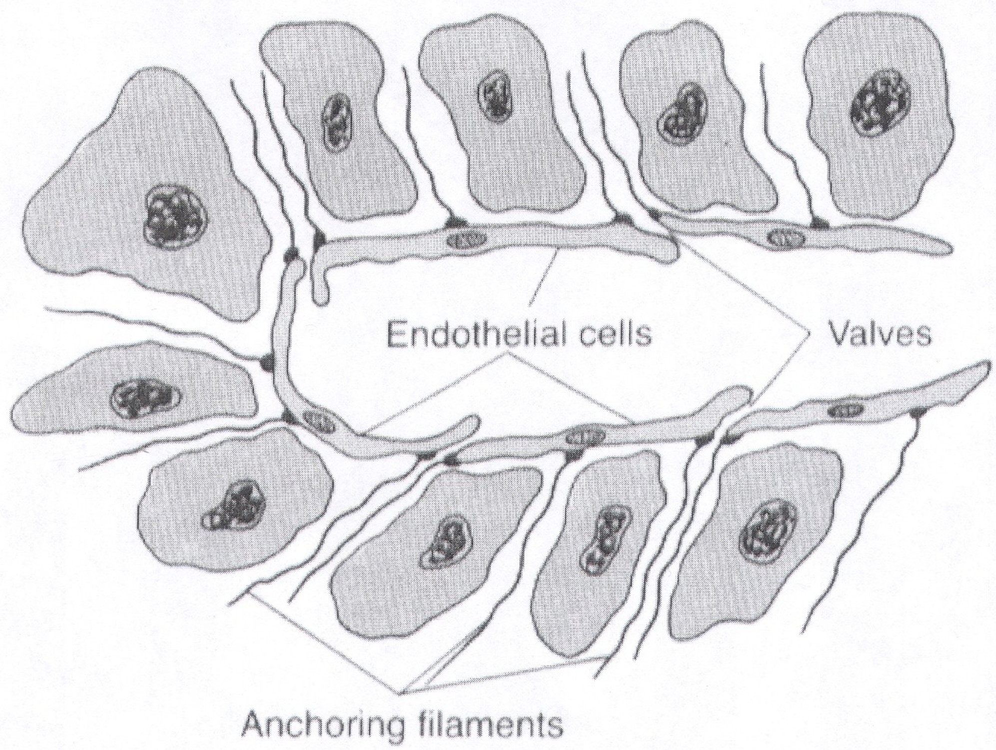
Figure(2) Operator-control console.



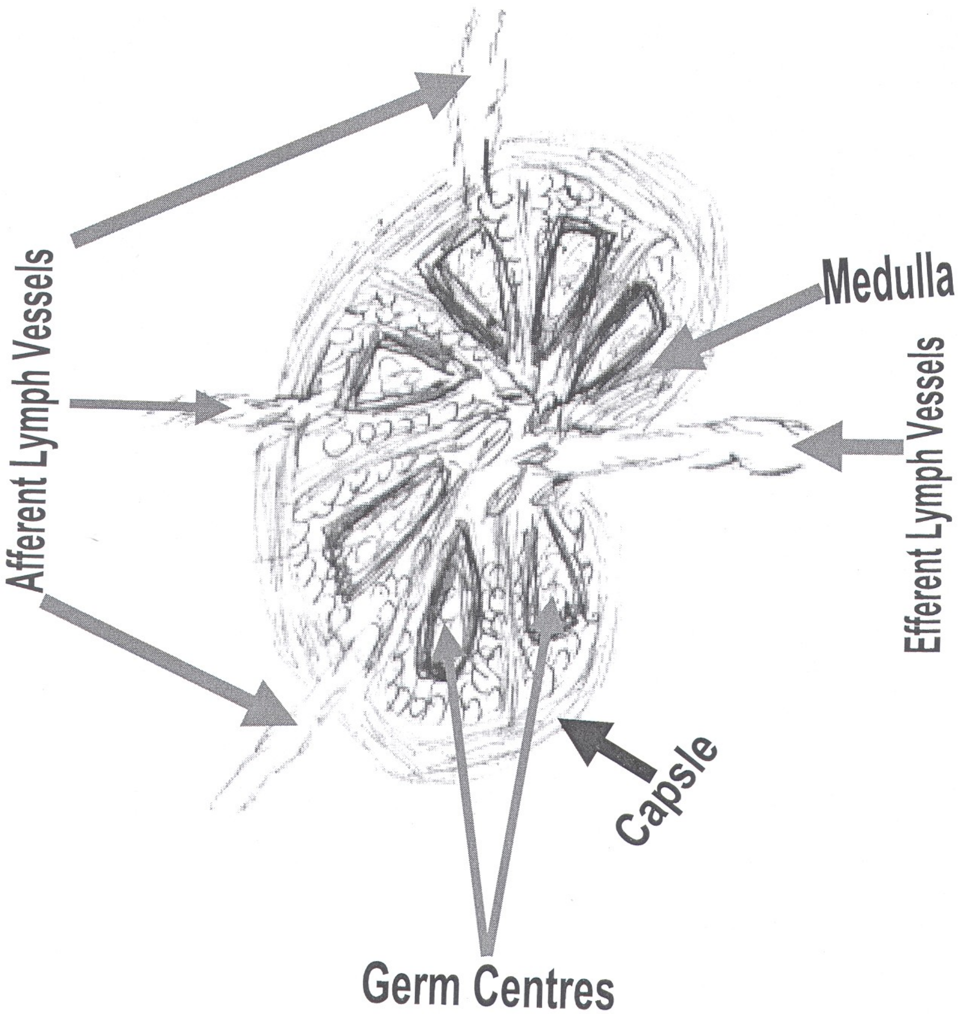
Figure(3) Mobile CT unit.



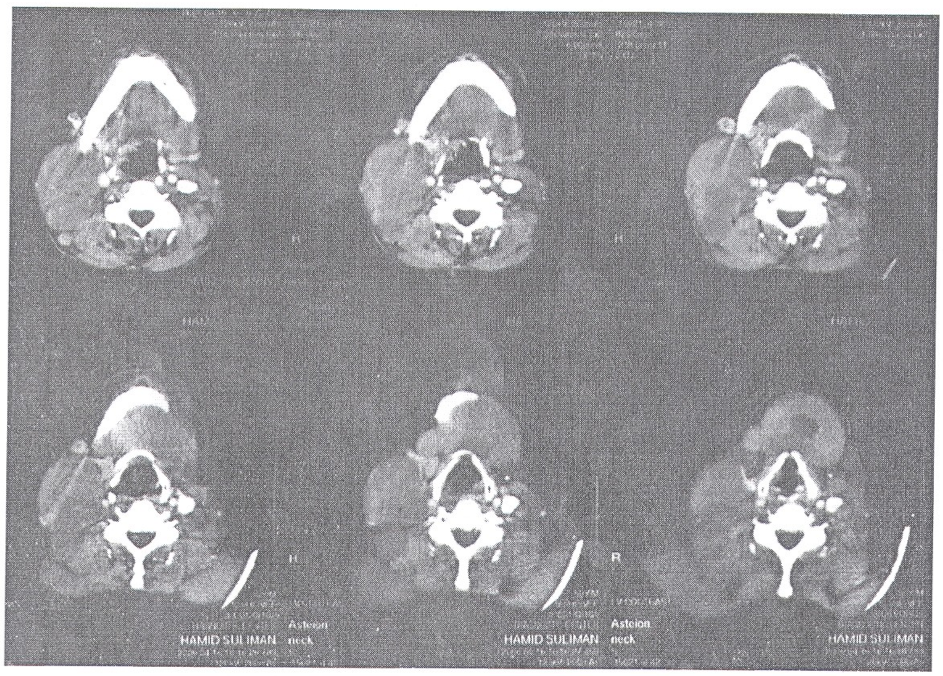
Figure(4) The lymphatic system



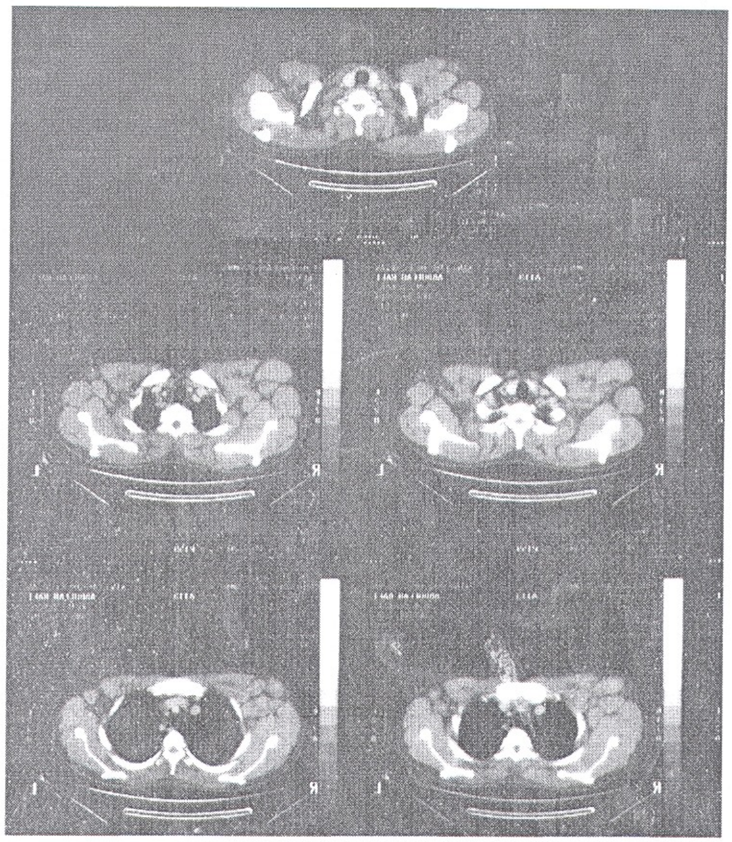
Figure(5) The lymphatic capillaries



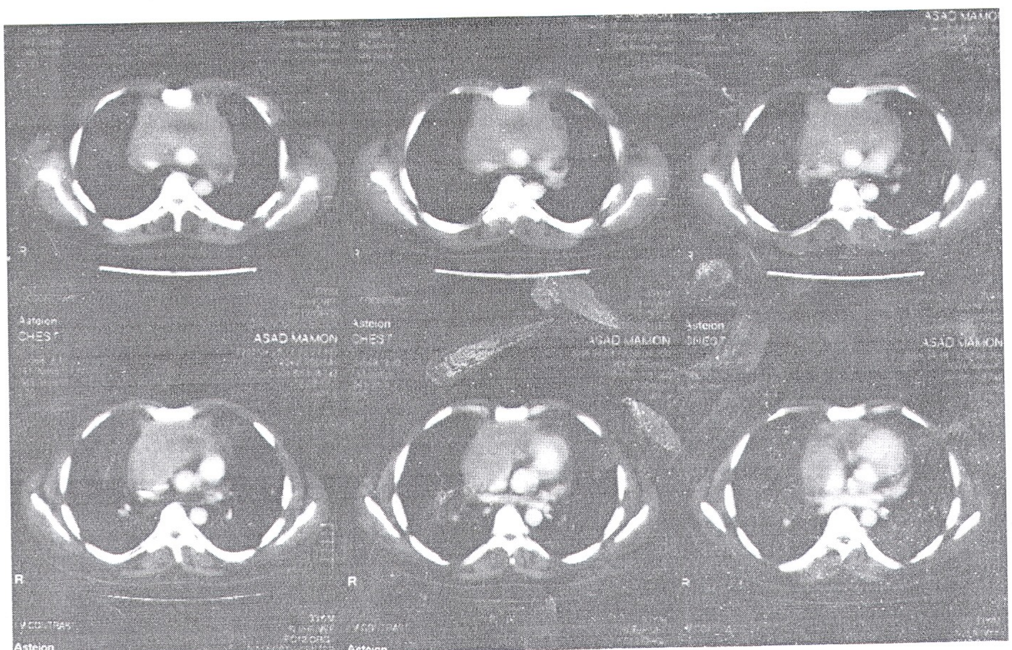
Figure(6) lymphnode On Section



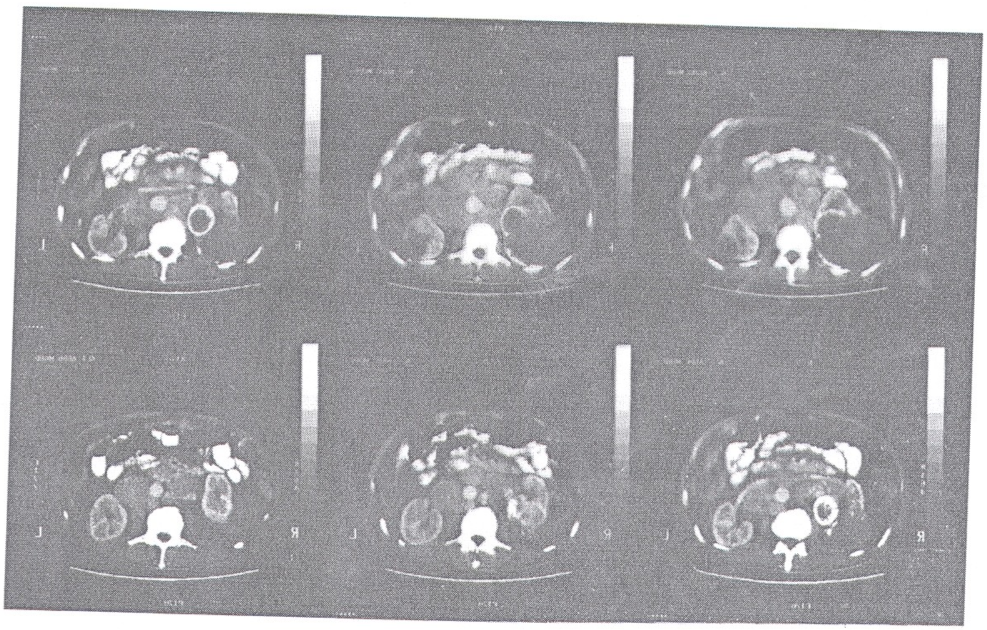
Figure(7) Right Neck lymphadenopathy



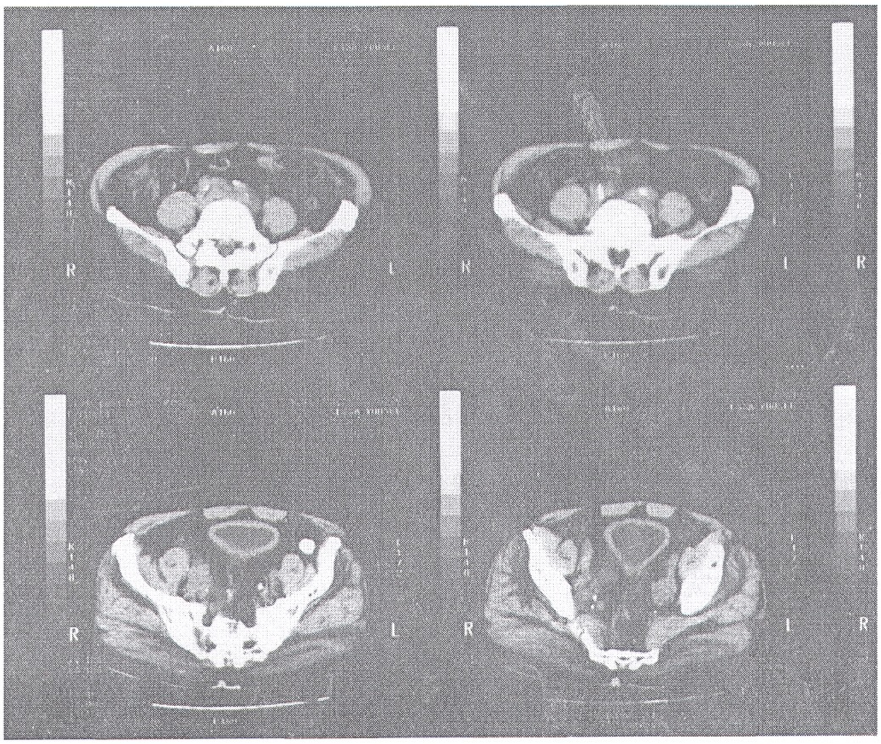
Figure(8) Axillary lymphadenopathy



Figure(9) Mediastenal (thoracic)lymphadenopathy



Figure(10) Para aortec (Abdomen) lymphadenopathy



Figure(11) Iliac (Pelvic) lymphadenopathy

Form of Data Collection

Hospital Name:
...
Pt. Name:
...
Sex: ....Age:
..
Tribe:...Date of Examination:
....
Provisional clinical diagnosis:
..
..
Type of CT scan:
..
..

Imaging film processing: (1) manual (2) automatic

Type of film: (1) Digital (2) Conventional

Type of Camera:
...
...
Protocol used:
..

Thickness	Interval	Scan Time	Contrast	Type of Contrast			Display	
				I.V	Oral	Enema	W.W	W.L.

Appearance:

Lymph Nodes	Size	Discrete	Matted	Association
Neck L/N				
Axillary L/N				
Thoracic L/N				
Abdomen L/N				
Pelvic L/N				

C.T. Diagnosis:
..

....
....