Sudan University For Sciences And Technology

College Of Graduate Studies

Measurement of Thyroid Volume in Normal Adult Saudi Women Using Ultrasonography

قياس حجم الغدة الدرقية للنساء السعوديات البالغات السليمات باستخدام
التصويربالموجات فوق الصوتيه

A thesis Submitted For Partial Fulfillment Of Master Degree Requirement
In Medical Diagnostic Ultrasound

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الايه

ٱلۡحَمۡدُ لِلَّهِ رَبِّ ٱلۡعَٰلَمِينَ ٢

سورة الفاتحه

Dedication

This Research dedicated

To my Family

To my Teachers

To my Collogues

To Rahmattalla Albraa and Rofan

Acknowledgement

I would like to express my deepest gratitude to my supervisor Dr: Mona Ahmed Mohammed for giving opportunity to carry out my work

And all my thanks to my collogue Dr: Amel Sami Higazi for her support and help

Abstract

The thyroid gland is a vital endocrine gland in the body, estimation of its volume is generally consider to be an important in several pathologic situations such as iodine deficiency, Goiter, thyroiditis, multinodular goiter and others.

The aim of this study was to measure the thyroid volume in normal adult Saudi female. 50 normal adult Saudi female were scanned with high resolution sonography of the thyroid gland using Toshiba ultrasound machine (7.5 MHZ linear transducer) the volume of each lobes of thyroid gland was calculated automatically in the machine by using Ellipsoid formula (the volume = length×width×depth ×0.479). the total thyroid volume obtained by adding the volume of both lobes the study shows the mean age was 34.6800 years old, the overall mean volume of thyroid gland was 6.3420ml. The mean volume of right lobe was 3.33ml. The mean volume of left lobe was 3.0120 ml. there was no difference of right and left lobe volume among all age groups and medium correlation between thyroid volume and weight . The study concluded that ultrasound has been proven as a useful method for assessment of the thyroid volume for its safety and less expensive. The result can be used as a local reference of thyroid volume in a dult Saudi female

ملخص البحث

تعتبر الغدة الدرقية غدة صماء حيوية في الجسم ، ويعتبر تقدير حجمها بشكل عام أمرًا مهمًا في العديد من الحالات المرضية مثل نقص اليود وتضخم الغدة الدرقية والتهاب الغدة الدرقية وتضخم الغدة الدرقية متعدد العقيدات وغيرها الهدف من هذه الدراسة هو قياس حجم الغدة الدرقية في الإناث السعودية البالغة.

تم فحص 50 أنثى سعودية بالغة عادية باستخدام التصوير فوق الصوتي عالي الدقة للغدة الدرقية باستخدام جهاز الموجات فوق الصوتية من توشيبا (محول طاقة خطي 7.5 ميجا هرتز) تم حساب حجم كل فص من الغدة الدرقية تلقائيًا في الجهاز باستخدام المعادله (الحجم = الطول × العرض × العمق 479.0) ويتم الحصول على الحجم الكلي للغدة الدرقية عن طريق إضافة حجم كلا الفصين أظهرت نتيجة الدراسة أن متوسط العمر كان 34.6800 سنة ، وكان متوسط الحجم الكلي للغدة الدرقية 6.3420 مل. كان متوسط حجم الفص الأيمن 3.33 مل. كان متوسط حجم الفص الأيسر 3.0120 مل لم يكن هناك اختلاف في حجم الفص الأيمن والأيسر بين جميع الفئات العمريةوهناك ارتباط متوسط بين حجم الغده الدرقيه والوزن

وخلصت الدراسة إلى أن الموجات فوق الصوتية قد أثبتت أنها طريقة مفيدة لتقييم حجم الغدة الدرقية من أجل سلامتها وأقل تكلفة. يمكن استخدام النتيجة كمرجع محلي لحجم الغدة الدرقية عند الإناث السعوديات البالغات

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Abbreviations

Abbreviations	Full name
T3	Tri-iodothyroxine
T4	Tetraiodothyroxine
T	Thyroxine
C	Cervical vertebra
H &e	Haematoxylin & eosin
TSH	Thyroid stimulating hormone
T R H	Thyrotropin releasing hormone
LH	Lutenizing hormone
FSH	Follicle Stimulating Hormone
TBG	Thyroxine Binding Globulin
TBPA	Thyroxine Binding Pre Albumin
Na	Sodium
K	Potassium
AP	Antero Posterior
SM	Strap Muscles
LC	Longus Colli
SCM	Sterno-Cleido-Mastoid
Eso	Esophagues
W	Width
D	Depth
L	Length
TGC	Time Gain Compensation
SPSS	Statistical Package for Social Science

Chapter one

Introduction

The thyroid gland weighs about 15−60 g, it consists of two lobes joined by an isthmus and lies below the larynx on each side of the trachea. The gland is enclosed in a connective tissue capsule and is divided into lobules by connective tissue. The lobules are made up of numerous tubular spaces (follicles) of varying size, lined with glandular epithelial cells, in which large quantities of hormone can be stored. When the need arises, the hormone can be taken up again by the epithelial cells of the gland and secreted into neighboring blood vessels. The hormones secreted by the thyroid gland,calcitonin , thyroxine (T4, tetraiodothyronine) and triiodothyronine (T3) are distinguished by their iodine content. Their action is to stimulate cellular metabolism. Triiodothyronine is the actual active thyroid hormone, generated by the splitting of one iodine atom from thyroxine(Chaudhary2016)

Ultrasound of the thyroid gland is the most effective imaging tool. It allows precise measurements of single or multiple thyroid nodules, definition of whether lesions are likely benign or suspect for malignancy, identification of conditions other than nodular change, and adjacent lymph adenopathy, just to illustrate a few common uses of the modality found in ultrasound measurement that different people have different size of thyroid especially in measurement of width, depth and area. So that measurement of thyroid can help in detection of any abnormalities that lead to change size and shape of the gland.(Gharib 2016)

1.2 problem of the study :-

Thyroid is a suitable organ for the investigation with ultrasonography due to its very superficial localization in body. It is also useful in frequent controls of the organ. The thyroid volume is variable among countries and its value in ksa was not clearly demonstrated. In this study we aimed to determine the thyroid volume among Saudi female.

Thyroid volume can be affected by many variable including gender, age, ethnic group and other factor while there is no reference measure for such variations

1-3 Objectives:-

1-3-1 General objective:-

To measure thyroid volume in adult Saudi female using ultrasound

1-3-2 Specific objectives:

- To measure thyroid length, depth and width of right and left lobe of thyroid using ultrasound.
- To measure right and left lobe volume using ultra sound .
- To correlate thyroid volume to age and weight .

1-4 Over view of the study:-

This study contains five chapters , Chapter one: introduction, problem statements, objectives and over view of study . Chapter two: literature review and previous studies Chapter three: materials and methods Chapter four: results. Chapter five: discussion, conclusion and recommendations fallowed by references and appendices .

Chapter two

2-1Anatomy of the Thyroid Gland:-

2-1-1Thyroid Gland Embryology:-

The thyroid develops from a bud that pushes out from the floor of the pharynx; this outgrowth, termed the thyroglossal duct, then descends to its definitive position in the neck. The lower end of the thyroglossal duct proliferates to become the thyroid gland, while the rest of the thyroglossal duct disintegrates and disappears. The origin of the thyroid is, however, commemorated by the foramen caecum, the midline punctum at the junction of the middle and posterior thirds of the tongue, and by the inconstantpyramidal lobe on the isthmus (ellis etal 2013)

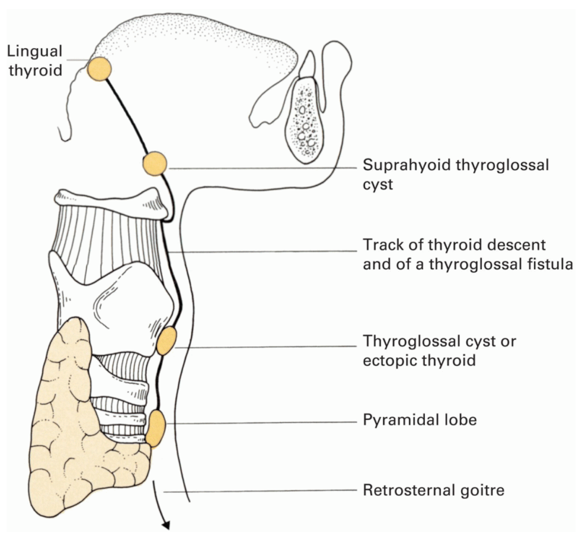


Fig.2- 1 The descent of the thyroid, showing possible sites of ectopic thyroid tissue or thyroglossal cysts, and also the course of a thyroglossal fistula. (The arrow shows the further descent of the thyroid that may take place retrosternally into the superior mediastinum.(ellis et al 2013)

2-1-2Gross Anatomy:

The thyroid gland is a crucial endocrine gland that develops within the third week of gestation. In the embryo, the thyroid begins its initial development at the base of the tongue. It descends down the thyroglossal duct to ultimately rest anterior to the trachea. It is fully functional by the end of the first trimester

1 The thyroid consists of a right and a left lobe. A bridge of tissue, the isthmus, crosses over the midline of the neck anterior to the trachea, providing a link between the two thyroid lobes. Occasionally, individuals may have a superior extension of the isthmus. This normal variant is termed a pyramidal lobe. The hypothalamus, located within the brain, produces thyroid-releasing hormone, which in turn controls the release of thyroid-stimulating hormone by the anterior pituitary gland. The thyroid consists of multiple follicles that contain a fluid called colloid. Colloid is composed of proteins and thyroid hormones. As a result of the thyroid-stimulating hormone that was released by the pituitary gland, the thyroid, in turn, releases the hormones contained within its cells. These hormones are thyroxine (T4), triiodothyronine (T3), and calcitonin (Table 12-1). The thyroid utilizes iodine to manufacture these hormones. Iodine is found in some vegetables, seafood, and within many processed foods that contain iodized salt. Accordingly, the subscripted numbers “3” and “4” found in the thyroid hormones denote the number of iodine atoms contained within each hormone. Thyroxine is the most abundant hormone produced by the thyroid. However, each hormone is vital and they work together to regulate metabolism, growth and development, and the activity of the nervous system.

2 A surplus of these hormones will produce **hyperthyroidism** and a reduction will cause hypothyroidism.

the thyroid gland lies anterior to the cricoid cartilage and trachea, and slightly inferior to the thyroid cartilages. It comprises two lateral lobes joined together by an isthmus. The lateral lobes can be traced from the lateral aspect of the thyroid cartilage down to the level of the sixth tracheal ring. The isthmus overlies the second and third tracheal rings. The entire gland is enclosed within the pretracheal fascia, a layer of deep fascia that anchors the gland posteriorly with the trachea and the laryngopharynx, causing it to move during swallowing. The gland has a fibrous outer capsule, from which septae run into the gland to separate it into lobes and lobules. It is overlapped by strap muscles anteriorly. The carotid sheaths with their contents lie posterolateral to the lobes. Two nerves related to the gland and at risk of damage during thyroidectomy are the recurrent laryngeal and external laryngeal nerves. These supply the larynx and are closely associated with the inferior and superior thyroid arteries, respectively. Other related structures include the superior and inferior parathyroid glands, which lie in close proximity to the middle and lower poles of the thyroid lobes respectively (hillarys 2017)

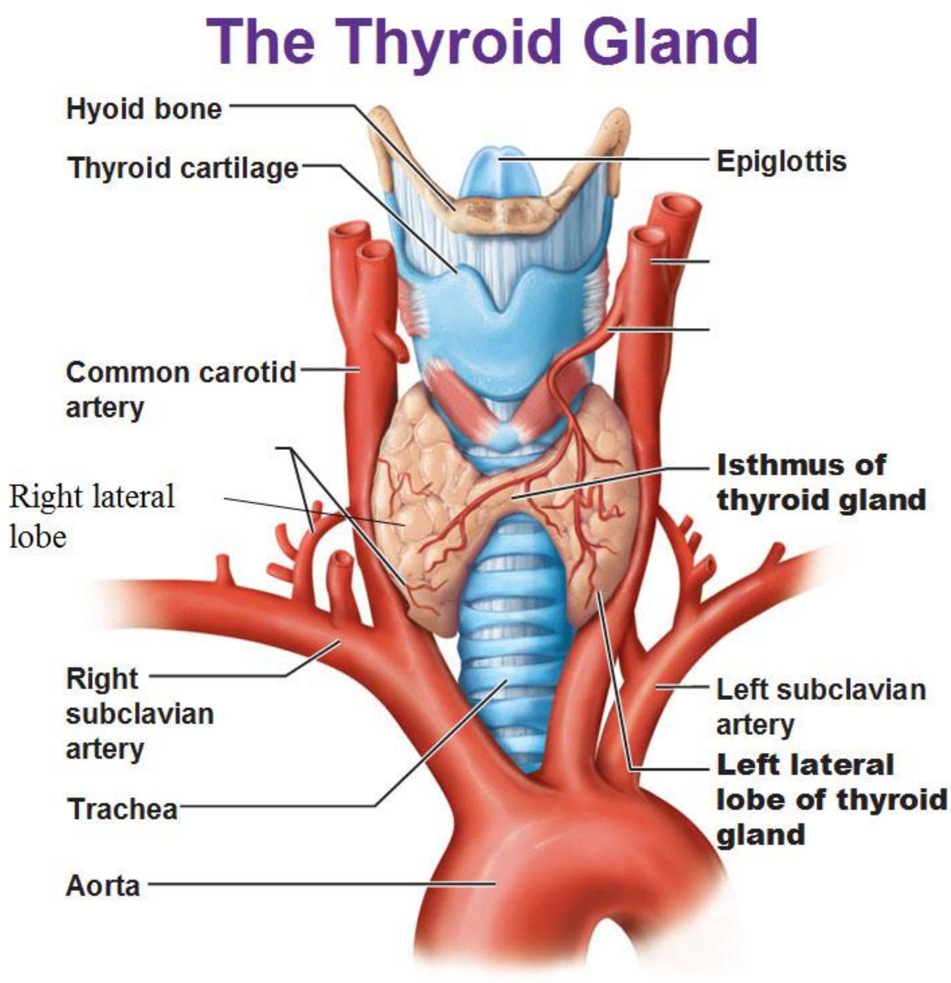


Fig2-2 **Gross anatomy of the thyroid gland, anterior view**

2-1-3Thyroid Gland Histology

The thyroid gland consists of large spherical colloid-filled follicles that contain thyroglobulin. The follicles are lined by a simple cuboidal epithelium. The thyroid follicular cells take up thyroglobulin from the colloid and break them down to form and release thyroid hormones in to the blood stream. Parafollicular cells are located between the follicles. They synthesize and secrete calcitonin. The gland is contained within a fibrous capsule.

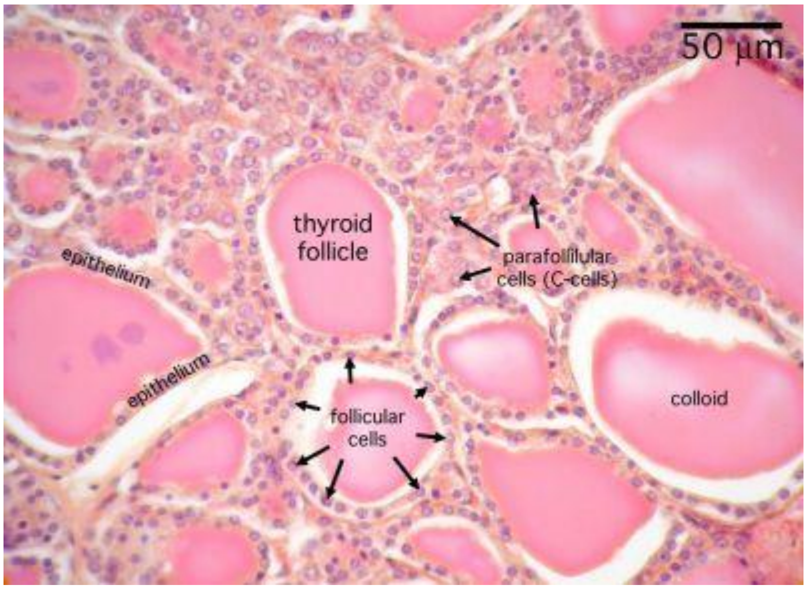


Fig 2-3 histology of thyroid gland

2-1-4 Arterial Supply and venous drainage

The thyroid gland derives its blood supply primarily from the superior and inferior thyroid arteries that are generally constant. A third vessel, thyroidea ima artery, in some cases may replace the inferior thyroid artery and become one of the principle arteries supplying the gland. The venous drainage of the thyroid gland that is paralleled by the lymphatic drainage is supported by the superior, middle, and the inferior thyroid veins.

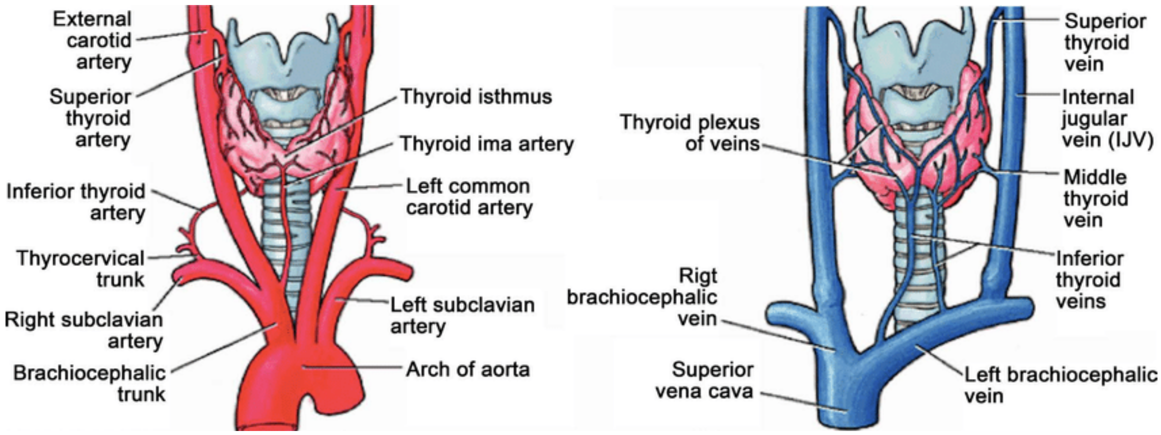


Fig 2-4 arterial supply and venous drainage

2-**1-5Related Structures :-**

StrSurrounding Muscles and Vascular Structures of the Thyroid Gland	
Structure	Relationship to thyroid
Strap muscles (sternohyoid, sternothyroid, and omohyoid)	Anterior to each lobe
Sternocleidomastoid muscles	Lateral to each lobe
Longus colli muscles	Posterior to each lobe
Common carotid artery	Lateral to each lobe
Internal jugular vein	Lateral to each lobe Superior and lateral to each common carotid artery
Esophagus	Most often seen on the left side posterior to the trachea and thyroid

lateral to the thyroid lobes. The longus colli muscles are seen posterior to each lobe. The common carotid artery and internal jugular vein will be seen lateral to each lobe. The esophagus lies posterior to the thyroid gland, most often on the left side, and can often resemble a mass. To differentiate the esophagus from a mass, one can have the patient swallow(penny2011)

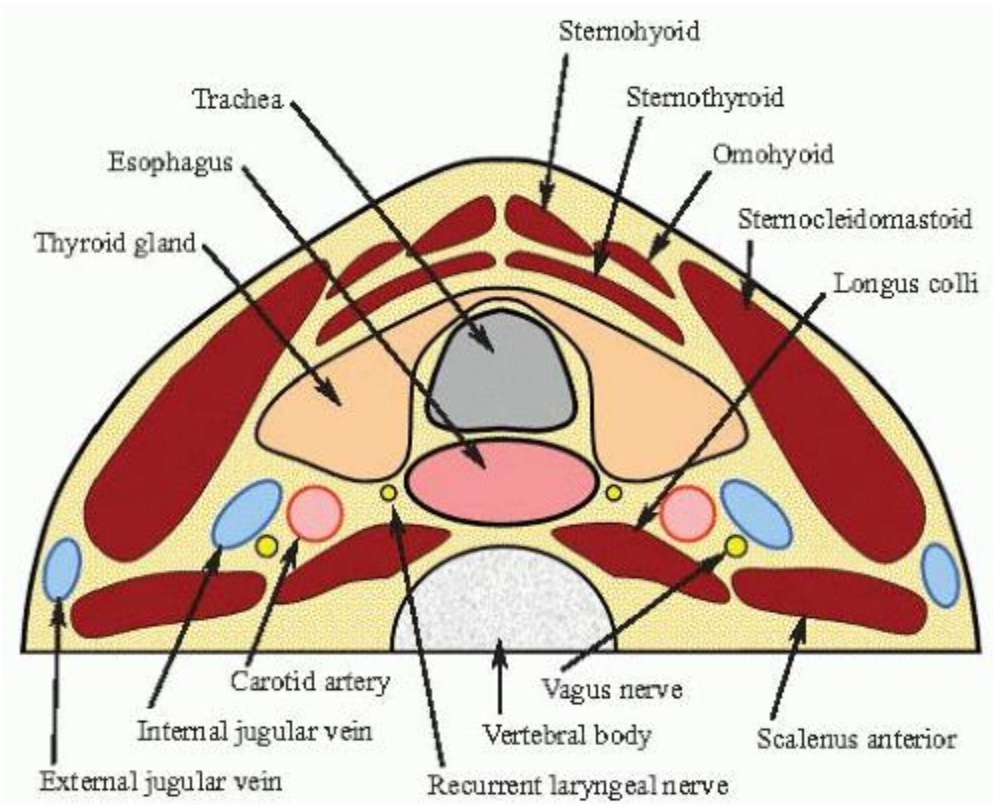


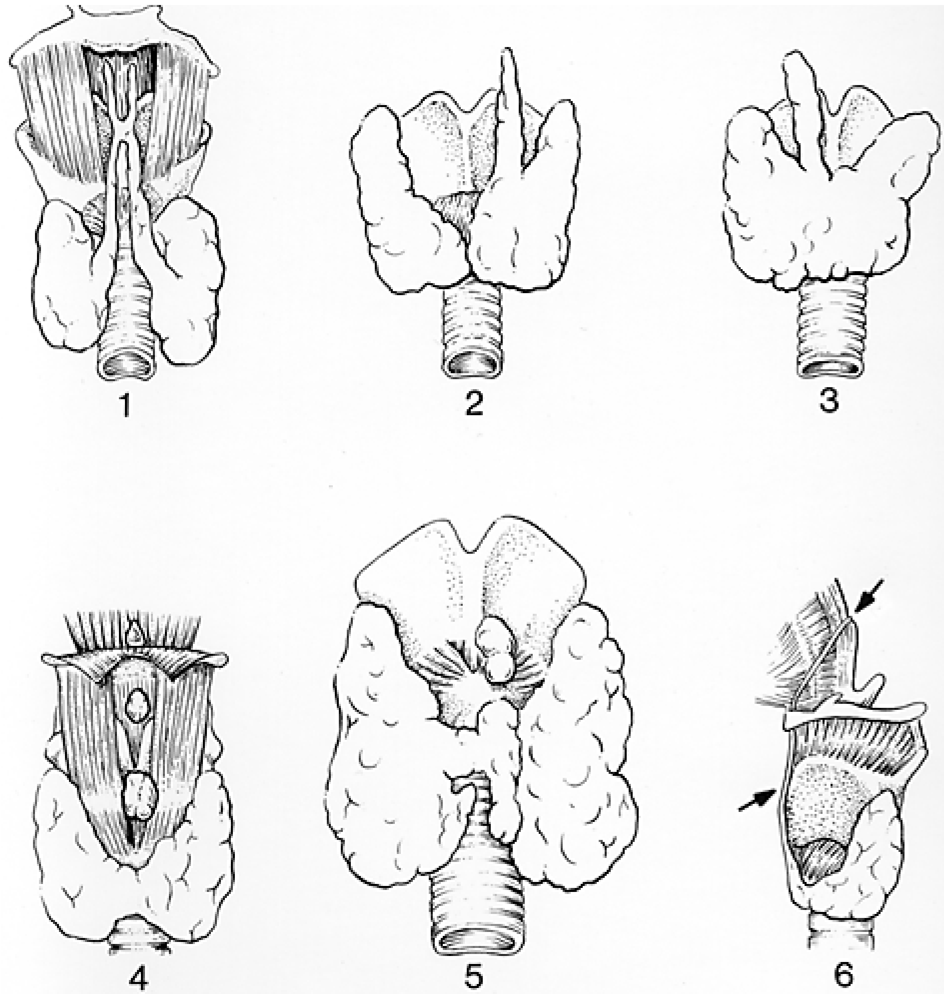
Fig2-5 related structures

2-1-6Thyroid Gland Variations, Accessory Thyroid and the Thyroglossal Duct:-

Most of the variation in the thyroid gland is the pyramidal lobe, which generally arises from the isthmus and lies in the midline, but can also arise from either lobe. It more commonly originates from the left lobe than the right lobe.

Thyroid tissue can develop in abnormal locations (Ectopic or accessory thyroid), such as the tongue (lingual thyroid). The entire gland or part of it may descend downward more, and this results in thyroid tissue being located behind the chest 25 bone or between the aorta and pulmonary trunk. It can also develop rarely within the trachea, and if present it may be life threatening.

The two lateral lobes are almost equal, but occasionally they are very unequal in size, and in rare cases one lobe may be absent or the total thyroid may be absent (Athyrosis). The isthmus varies greatly in size and is frequently absent

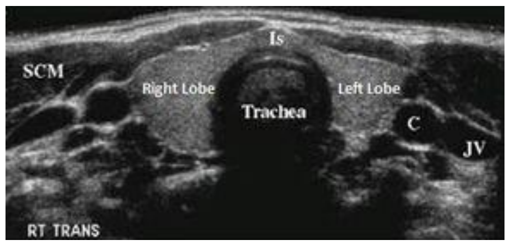


1 Absence of thyroid isthmus. Lateral lobes each have pyramidal lobes
2 Pyramidal lobe arising from the union of the left lobe at the isthmus
3 Pyramidal lobe arising from the isthmus of the gland
4 Accessory thyroids may be located on the trachea, thyroid cartilage, thyrohyoid muscle, geniohyoid muscle, and hyoid bone, under and above the hyoid bone
5 Accessory thyroid gland on cricothyroid muscle. Pyramidal lobe reduced to left interior part of the isthmus
6 Persistent thyroglossal duct in an adult, originating at the foramen cecum

of the tongue(Rande AV2008).

2-1-7Normal ultrasound appearance of thyroid gland

Characteristics of the Normal Thyroid :-
1-Hyperechoic to adjacent muscles
2-Homogeneous
3-Scattered readily detectable internal vessels
4-Diameter of lobes less than 2 cm in AP and transverse views Isthmus less than 4 mm(hertberg 2016).



2-2Physiology:-

The primary function of the thyroid is production of the hormones T3, T4 and calcitonin. Up to 80% of the T4 is converted to T3 by organs such as the liver, kidney and spleen. T3 is several times more powerful than T4, which is largely a pro hormone, perhaps four or even ten times more active.(Nussey and Whitehead 2001)

Actions of Thyroid Hormones Because most body cells have receptors for thyroid hormones, T3 and T4 exert their effects throughout the body.

1. Thyroid hormones increase basal metabolic rate (BMR), the rate of oxygen consumption under standard or basal conditions (awake, at rest, and fasting), by stimulating the use of cellular oxygen to produce ATP. When the basal metabolic rate increases, cellular metabolism of carbohydrates, lipids, and proteins increases.

2. A second major effect of thyroid hormones is to stimulate synthesis of additional sodium–potassium pumps (NaKATPase), which use large amounts of ATP to continually eject sodium ions (Na (from the cytosol into the extracellular fluid and potassium ions (K (from the extracellular fluid into the cytosol. As cells produce and use more ATP, more heat is given off, and body temperature rises. This phenomenon is called the calorigenic effect (ka-lor-i-JEN-ik). In this way thyroid hormones play an important role in the maintenance of normal body temperature. Normal mammals can survive in freezing temperatures, but those whose thyroid glands have been removed cannot.

3. In the regulation of metabolism, the thyroid hormones stimulate protein synthesis and increase the use of glucose and fatty acids for ATP production. They also increase lipolysis and enhance cholesterol excretion, thus reducing blood cholesterol level.

4. The thyroid hormones enhance some actions of the catecholamines (norepinephrine and epinephrine) because they up-regulate beta receptors.

For this reason, symptoms of hyperthyroidism include increased heart rate, more forceful heartbeats, and increased blood pressure.

5. Together with human growth hormone and insulin, thyroid hormones accelerate body growth, particularly the growth of the nervous and skeletal systems. Deficiency of thyroid hormones during fetal development, infancy, or childhood causes severe mental retardation and stunted bone growth (tartora 2019)

Control of Thyroid Hormone Secretion:-

Thyrotropin-releasing hormone (TRH) from the hypothalamus and thyroid-stimulating hormone (TSH) from the anterior pituitary stimulate synthesis and release of thyroid hormones

●1 Low blood levels of T3 and T4 or low metabolic rate stimulates the hypothalamus to secrete TRH

●2 TRH enters the hypophyseal portal veins and flows to the anterior pituitary, where it stimulates thyrotrophs to secrete TSH.

●3 TSH stimulates virtually all aspects of thyroid follicular cell activity, including iodide trapping , hormone synthesis and secretion , and growth of the follicular cells.

●4 The thyroid follicular cells release T3 and T4 into the blood until the metabolic rate returns to normal.

●5 An elevated level of T3 inhibits release of TRH and TSH (negative feedback inhibition). Conditions that increase ATP demand—a cold environment, hypoglycemia, high altitude, and pregnancy—also increase the secretion of the thyroid hormones

Calcitonin The hormone produced by the parafollicular cells of the thyroid gland is calcitonin (CT). CT can decrease the level of calcium in the blood by inhibiting the action of osteoclasts, the cells that break down bone extracellular matrix. The secretion of CT is controlled by a negative feedback system (see Figure 18.14). When its blood level is high, calcitonin lowers the amount of blood calcium and phosphates by inhibiting bone resorption (breakdown of bone extracellular matrix) by osteoclasts and by accelerating uptake of calcium and phosphates into bone extracellular

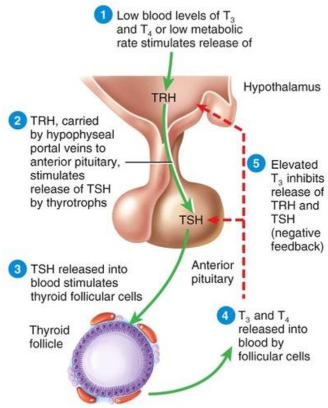


Fig 2-6 Regulation of secretion and actions of thyroid hormones. TRH thyrotropin-releasing hormone, TSH thyroid-stimulating hormone, T3 triiodothyronine, and T4

.

2-3 Pathology:-

2-3-1Congenital Anomalies

Congenital anomalies of the thyroid gland include ectopia, hypoplasia, and aplasia. Ectopic thyroid tissue is most commonly seen in a midline suprahyoid position between the foramen cecum of the tongue and the epiglottis. This is called a lingual thyroid and it occurs in approximately 1 in 3000 to 100,000 healthy individuals. In up to 30% of patients with lingual thyroid, it is the only thyroid tissue present. Other sites of ectopic thyroid include the sublingual, paralaryngeal, intratracheal, and infrasternal regions, and along the tract of the thyroglossal duct . Ectopic thyroid is generally diagnosed with nuclear medicine scans and ultrasound plays very little role in most of these patients. On the other hand, hypoplastic and aplastic thyroids are readily evaluated with ultrasound. With unilateral agenesis, contralateral hypertrophy may be seen. Thyroglossal duct cysts are the most common of the congenital cysts in the neck. During embryogenesis, the thyroid anlage migrates from the foramen cecum of the tongue to the lower neck, leaving an epithelial tract called the thyroglossal duct. This normally involutes in the eighth week of fetal life. Thyroid cells remain in the thyroglossal duct in 5% of cases and can give rise to thyroglossal duct cysts. Despite the embryogenesis, thyroid tissue is usually not detected pathologically in resected specimens. Thyroglossal duct cysts are typically located in the midline between the thyroid gland and the hyoid bone (Fig. 10-3). Approximately 65%, 15%, and 20% occur below, at, and above the level of the hyoid, respectively. Patients most often present in childhood or young adulthood. Sonographically, thyroglossal duct cysts usually appear as somewhat complex cystic lesions with low-level intraluminal reflectors, scattered septations, solid-appearing regions, or irregular walls to. The more caudal the cyst is located, the more likely it is to be lateral to the midline . It is uncommon for thyroglossal duct cysts toappear completely simple. Thyroglossal duct cysts are complicated by malignancy in approximately 1% of cases. Ninety-five percent of malignancies are papillary thyroid cancer and the rest are squamous cell cancer. Both most often appear as cystic lesions with substantial solid components in the form of mural nodules, irregular wall thickening, or multiple thick septations(hertzberg2016)

A B

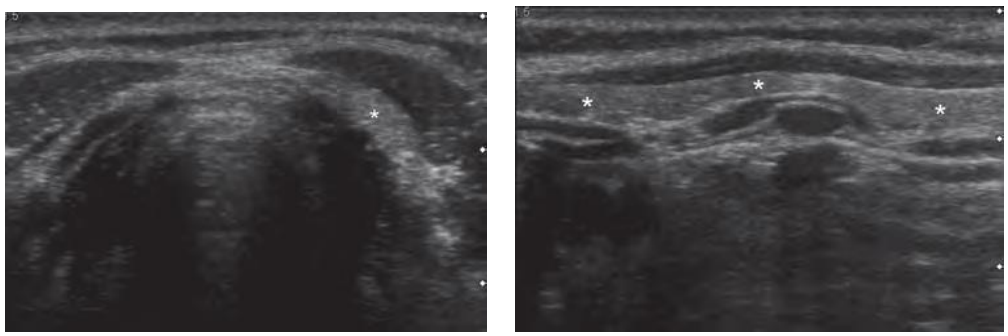


Fig2-7 Pyramidal lobe. **A,** Transverse view superior to the isthmus shows a small segment of thyroid tissue *(asterisk)* posterior to the left strap muscle (S). **B**, Longitudinal view immediately superior to the isthmus shows a long thin strip of thyroid tissue *(asterisks)* anterior to the cricoid cartilage (C) and the thyroid cartilage (T). Normally there is no thyroid tissue anterior to the cricoid or thyroid cartilage

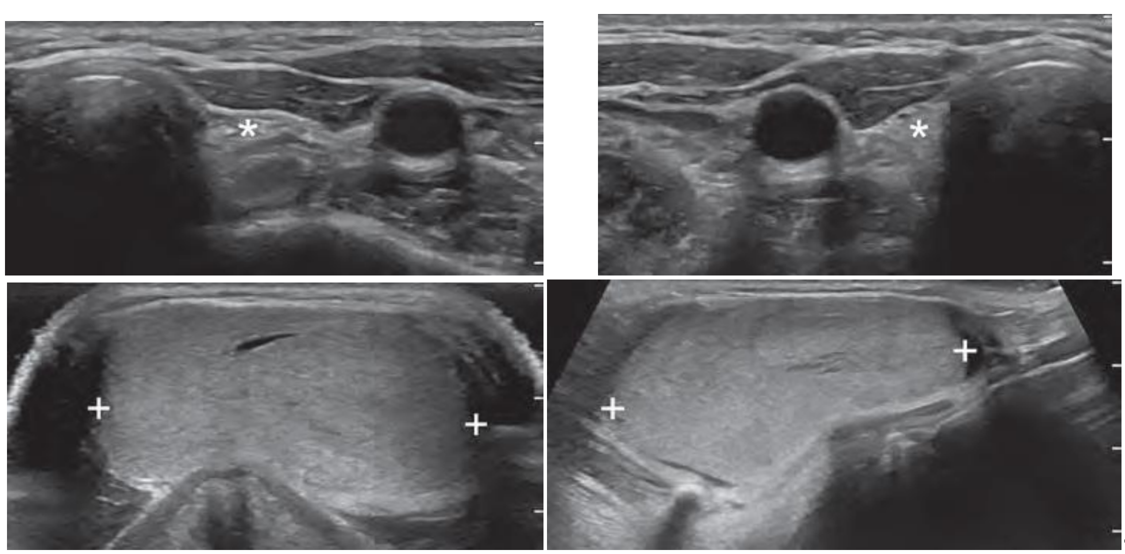


FIGURE 2-8. Ectopic thyroid. Transverse views of the left and right thyroid beds *(asterisks)* show no visible thyroid tissue.

Transverse and longitudinal views of the midline neck superior to the thyroid bed show ectopic thyroid tissue *(cursors)* anterior to
the thyroid cartilage *(arrowheads)* and the hyoid bone *(arrow)*. for transverse video starting at the level of the hyoid bone
proceeding inferiorly, showing the full extent of the ectopic thyroid and the empty thyroid bed.

2-**3-2 AGOITER**

is defined as an enlarged, hyperplastic thyroid gland. It has many causes, including iodine deficiency, Graves disease, and thyroiditis. Enlargement of the thyroid can be diagnosed by calculating volume measurements or by obtaining an anteroposterior thickness of the thyroid isthmus. An isthmus that measures greater than 10 mm is indicative of thyroid enlargement (Fig. 2-9) Sonographically, the thyroid will appear enlarged and heterogeneous. The enlarged thyroid gland that contains multiple nodules with cystic and solid components may be referred to as a multinodular goiter or adenomatous goiter .

SONOGRAPHIC FINDINGS OF A GOITER

1. Heterogeneous echotexture

2. May contain multiple nodule with cystic and solid components

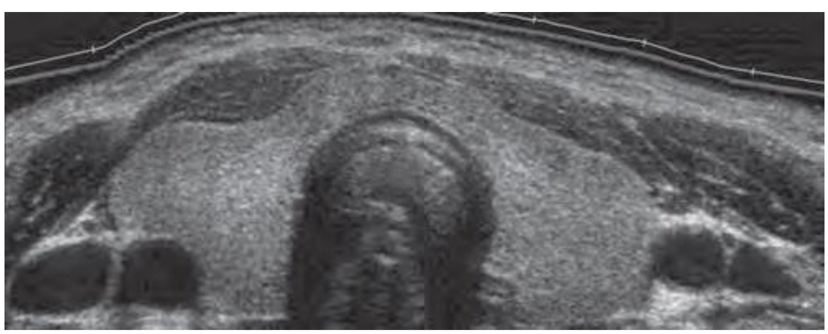


Fig 2-9 Thyromegaly. Transverse panoramic scan shows mild thyromegaly with a right lobe of the thyroid that has

extended anterior to the common carotid artery (C). The jugular veins (V) and the trachea (Tr) are also seen.

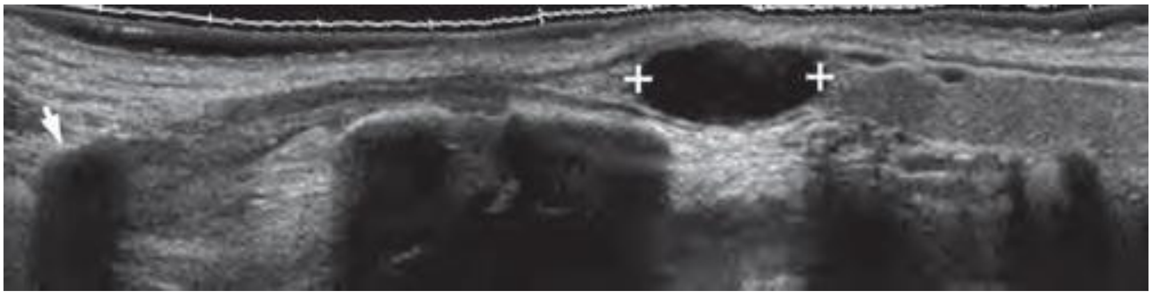


Fig2-10 Thyroglossal duct cysts. Longitudinal panoramic views in different patients show the thyroid isthmus (I), cricoid cartilage (C), thyroid cartilage (T), and hyoid bone (H). A, Thyroglossal duct cyst (cursors) is located in the typical location anterior to the hyoid bone

2-3-3Nodules

Thyroid nodules are extremely common and are the most common indication for thyroid ultrasound. Autopsy studies show that 50% of patients with a clinically normal thyroidhave nodules. Sonography detects nodules in approximately 40% of patients who are scanned for other reasons. The prevalence of nodules increases with age and the percentage of patients with nodules is approximately equal to the age in years minus 10. Despite the high prevalence of thyroidnodules, the percentage of clinically evident thyroid malignancy is very low (2% to 4%). In approximately 80% of patients, thyroid hyperplasia is idiopathic, related to iodine deficiency, familial causes, or medications. An enlarged, hyperplastic gland is called a goiter. The male-to-female ratio is approximately 1 : 3. When hyperplasia progresses to nodule formation, the pathologic designation of the nodules may be hyperplastic, adenomatous, or colloid. Nodular hyperplasia is the most common cause for thyroid nodules. These types of nodules share some common sonographic appearance. They very frequently have cystic components. When the nodule is small, the cystic components are also very small. As the nodule enlarges, the cystic spaces may also enlarge. When cystic elements are predominant, they are usually associated with multiple internal septations, thick walls, solid or partially solid mural nodules, or a combination of these features. Diffusely scattered cystic spaces of variable size with little solid tissue can produce a spongy appearance that is another typical feature of nodular hyperplasia. The echogenicity of the solid components of nodular hyperplasia is variable and may be hypoechoic, isoechoic, or hyperechoic compared with normal parenchyma. Nodular hyperplasia varies in vascularity, but usually has detectable internal flow and is often hypervascular. Crystals that precipitate in colloid are often present in nodular hyperplasia and can produce scattered, tiny, bright, nonshadowing reflections. In some cases there is an associated comet-tail artifact that distinguishes them from microcalcifications . In other cases they are not appreciably different from microcalcifications. Comet-tail artifacts that are recognizable on real-time scanning may be difficult to perceive on static images (e-Fig. 10-3, Video 10-3). In general, tiny, nonshadowing, bright reflections within cystic spaces are more likely to be crystals associated with nodular hyperplasia. Nodular hyperplasia can occasionally simulate follicular neoplasms and papillary cancer (Fig. 10-6). Benign follicular adenomas account for approximately 5% to 10% of all thyroid nodules. A small minority may cause hyperthyroidism due to autonomous function. They are typically solid and range from hypoechoic to hyperechoic. They are usually homogeneous and well marginated and a thin hypoechoic halo is characteristic. They have been described as looking like a testis in the thyroid. Well-defined cystic spaces occur in a minority of these nodules, especially in larger lesions . Follicular cancer accounts for approximately 10% of malignant thyroid nodules and is more common in women(hertzberg et al 2016) .

Benign Characteristics of Thyroid Nodules

Extensive cystic components Cysts

5mm> Cyst

Hyperechoic mass

“Eggshell” calcifications

“Hot” nodule (nuclear medicine finding)

Malignant Thyroid Nodules

Papillary carcinoma is the most common form of thyroid cancer. Other forms of thyroid malignancies include follicular carcinoma, medullary carcinoma, anaplastic carcinoma, lymphoma, and metastases to the thyroid. It is difficult to diagnose malignant thyroid nodules with sonography; however, there are some distinct features that increase the likelihood of the nodule being malignant . It is important to know that the presence of microcalcifications within a thyroid mass seems to increase the likelihood of a malignancy(hertzberg et al 2016).

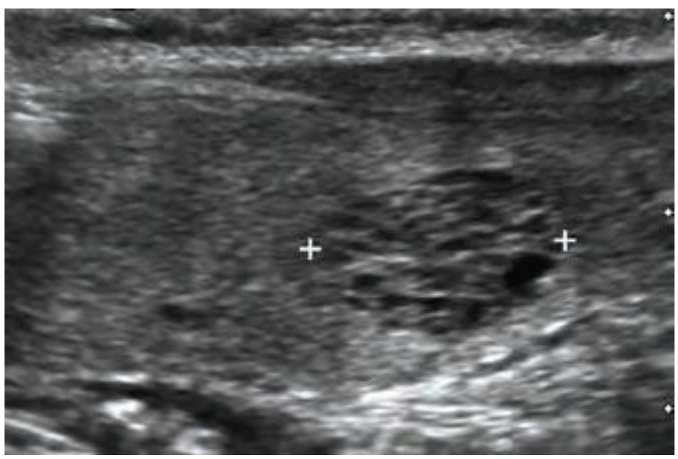


Fig 2-11Spongy lesion

Fig 2-12

Cystic lesion with multiple internal septations andminimal solid components

Fig 2-13 Cystic nodule with solid mural nodule *(arrows)* that contains multiple comet-tail artifacts.

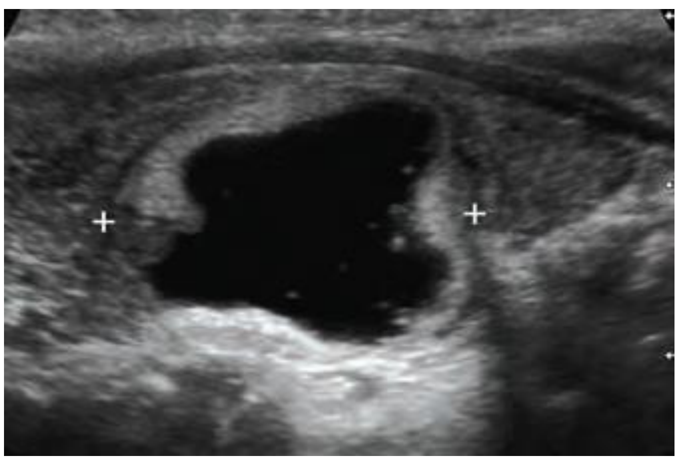


Fig2-14 Cystic nodule with a thick wall

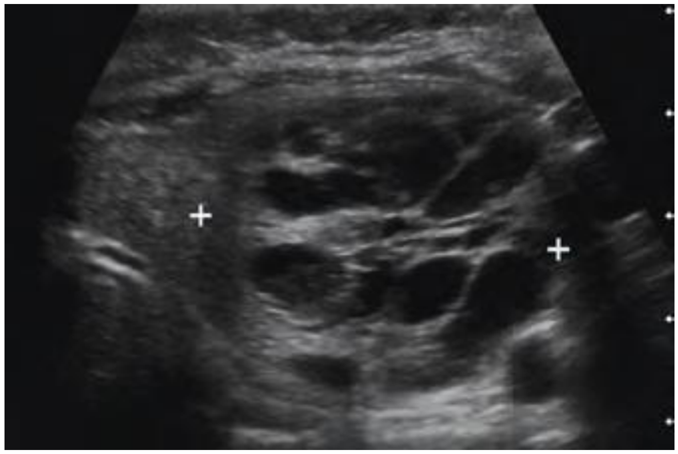


Fig 2-15 Solid nodule with multiple scattered cystic components.

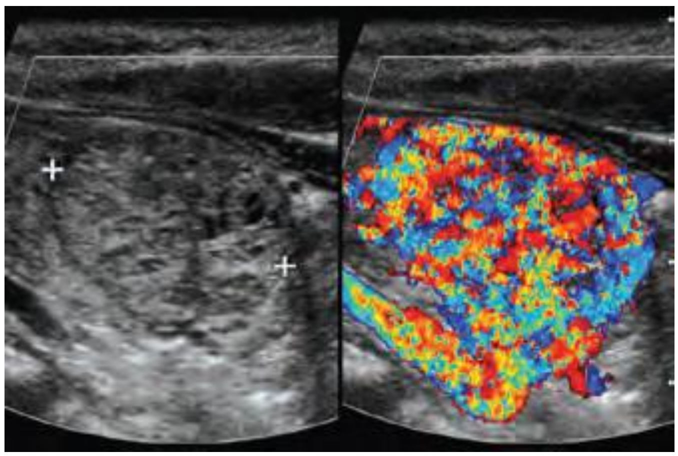


Fig2-16 Dual gray-scale and color Doppler views show a hypervascular

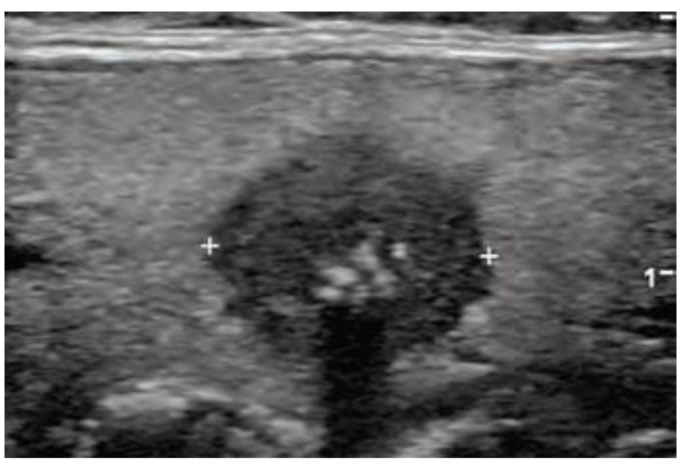


Fig 2-17 Solid, hypoechoic nodule with coarse-shadowing calcification, possibly due to a cluster of microcalcifications

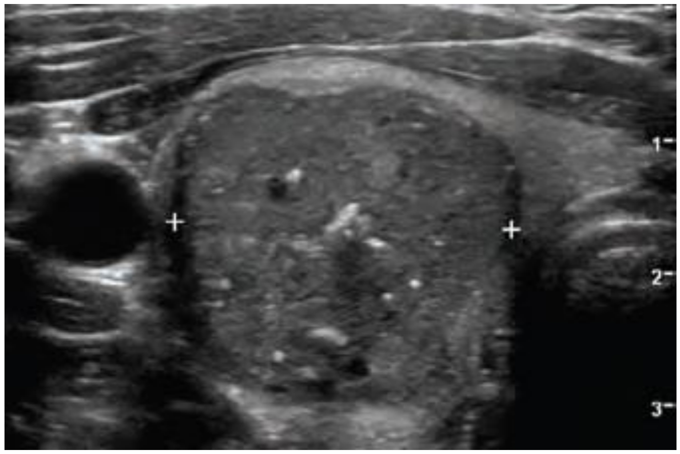


Fig 2-18 Large, solid, hypoechoic nodule with scattered microcalcifications

Typical Ultrasound Features of Different Categories of Thyroid Nodules

Benign	**Indeterminate**	**Malignant**
Simple cysts Spongy Cystic components Crystals with comet tails	Solid, hyperechoic Solid, isoechoic Hypoechoic halo Dense peripheral calcifications	Solid, hypoechoic Microcalcifications Lobulated margins Taller than wide interrupted peripheral calcifications Extracapsular Invasion

2-3-4 Parenchymal Disease

Graves Disease and Hyperthyroidism

Hyperthyroidism is a condition that results from the overproduction of thyroid hormones. Clinical findings in individuals suffering from hyperthyroidism include bulging eyes, heat intolerance, nervousness, weight loss, and hair loss. Graves disease, which may also be referred to as a diffuse toxic goiter, is the most common cause of hyperthyroidism.Sonographically, the thyroid may appear diffusely heterogeneous or hypoechoic. Hypervascularity may be noted with color Doppler imaging within the thyroid gland. This is termed the "**thyroid inferno**." (Penny2011)

CLINICAL FINDINGS OF GRAVES DISEASE

1. Bulging eyes
2. Heat intolerance
3. Nervousness
4. Weight loss
5. Hair loss

Thickened thyroid isthmus. A. The thyroid isthmus measured 13 mm (between calipers), which is indicative of a goiter. B. A normal thyroid gland and thyroid isthmus (2 mm) (

SONOGRAPHIC FINDINGS OF GRAVES DISEASE

1. Enlarged gland
2. Heterogeneous or diffusely hypoechoic echotexture
3. Thyroid inferno

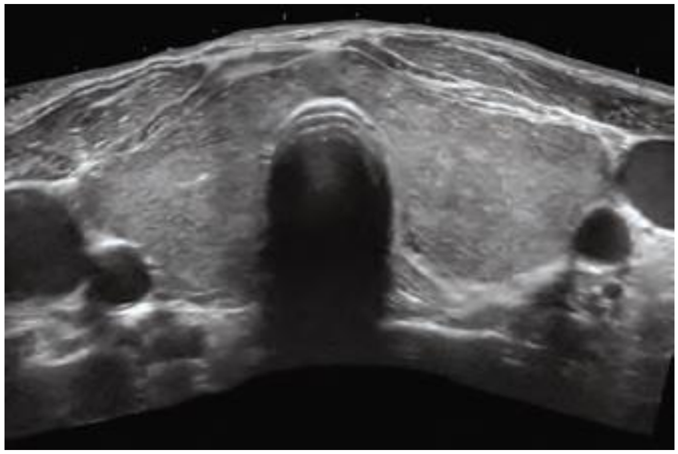


Fig 2-19Transverse panoramic view shows a diffusely enlarged, slightly hypoechoic, homogeneousthyroid Graves' disease

Hashimoto Thyroiditis and Hypothyroidism

Hypothyroidism is a condition that results from the underproduction of thyroid hormones. Hashimoto thyroiditis is an autoimmune disease that is the most common cause of hypothyroidism in the United States. It may also be referred to as chronic autoimmune lymphocytic thyroiditis. In Hashimoto disease, the thyroid becomes inflamed, and, as a result, the thyroid produces smaller amounts of thyroid hormones. Trying to compensate, the pituitary gland releases more thyroid-stimulating hormone, which causes the thyroid to become enlarged. Clinically, many patients are asymptomatic in the early stages of the disease. However, as the disease progresses they may present with slight weight gain, depression, increased cold sensitivity, and elevated blood cholesterol levels. Sonographically, the thyroid will appear diffusely heterogeneous, mildly enlarged, and will have increased vascularity within the gland)penny 2011)

CLINICAL FINDINGS OF HASHIMOTO THYROIDITIS

1. Depression

2. Increased cold sensitivity

3. Elevated blood cholesterol levels

4. Slight weight gain may occur

SONOGRAPHIC FINDINGS OF HASHIMOTO THYROIDITIS

1. Mild enlargement of the thyroid gland

2. Heterogeneous echotexture

3. Hypervascular gland

"Hot" nodule (nuclear medicine finding)

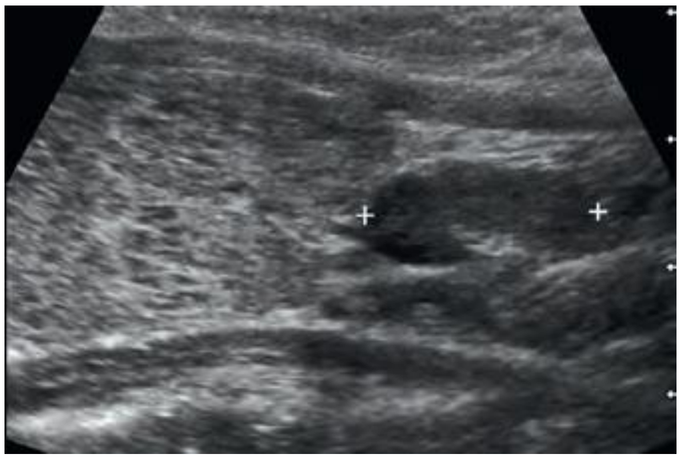


Fig 2-20 Hashimoto's thyroiditis Longitudinal view of the thyroid (T) shows multiple tiny, hypoechoic nodules scattered throughout an enlarged gland. An enlarged central compartment lymph node *(cursors)* is seen immediately inferior to the thyoid

2-4Physics and equipment of ultrasound:-

What Is Sound? Sound is a form of energy. It is a pressure wave, created by a mechanical action, and is therefore referred to as a mechanical wave. Sound is produced when a vibrating source causes the molecules of a medium to move back and forth. This back-and-forth movement of the molecules creates waves of sound energy that travel, or propagate, through a medium. Therefore, although nothing physical is traveling through the medium, it is energy-in the form of sound-that is being moved from one point to another. Amedium is any form of matter: solid, liquid, or gas. Sound requires a medium through which to propagate. Because it is composed of different forms of matter, the tissues of the human body provide a basis through which sound is allowed to propagate. It is important to note that sound cannot travel in a vacuum. When sound energy propagates through a medium, it does so in longitudinal waves, meaning that the molecules of the medium vibrate back and forth, parallel to the direction in which the wave is traveling (Figure 1-2). In summary, sound is a mechanical, longitudinal wave that propagates through a medium. Longitudinal waves should not be confused with transverse waves, where molecules in a medium vibrate at 90° to the direction of the traveling wave (Figure 1-3). Sound can be categorized as infrasound, audible sound, or ultrasound based on frequency. Frequency can be measured in hertz (Hz)

Production of Sound :-

One or more piezoelectric elements are attached to a wire in the transducer. Applying electricity to the element causes it to resonate, or alternatively expand and contract. The frequency, or rate at which the material resonates, is related to two factors: the thickness of the piezoelectric element and the propagation speed of the element itself . In pulsed-wave (PW) operation, the thickness of the element is the primary determinant of the resonating frequency of the transducer. Athicker element will produce a lower frequency, whereas a thinner element will produce a higher frequency . The operator cannot change the resonating frequency of a piezoelectric element.

There are two methods of sending out scan lines to form an image using real time: mechanical scanning (via mechanical transducers) and electronic scanning (via electronic transducers). Both methods provide a means for sweeping the ultrasound beam through the tissue repeatedly and rapidly. Although electronic scanning is most often the method employed today, a brief review of mechanical transducers will be provided in the next section . Mechanical Transducers Mechanical scanheads are largely obsolete, though fundamental knowledge of the technology may be required for the national certification examinations. These transducers typically had one or more piezoelectric elements connected to a motor, or a fixed element with a mirror connected to a motor . The motor, or a mirror, steered the element to produce thelines that made up the image. This produced a sector image pattern. The piezoelectric element and motor were inside of a protective housing. Oil was used as a coupling medium to prevent air from forming within the housing. Air within the housing would hamper the transmission of the sound. These transducers were fixed frequency and fixed focus. That is, in order to change the frequency or the location of the focal zone, one had to change the entire scanhead. Focusing of the beam was achieved by either the shape of the element or the use of a lens. The major advantages of the mechanical transducer were that they were inexpensive and typically had a small footprint. These transducers were fragile and their mechanical elements were easily broken. Today's modern-day equivalent version of mechanical transducers are three- and four-dimensional transducers. These transducers consist of an entire array transducer mounted to a motor and enclosed within a housing. Some similar specialty transducers, like endorectal and intravascular transducers, also use a single element mounted on a motor (penny2018)

ElectronicTransducers:-

Electronic scanning is performed with transducers that have multiple active elements. This is referred to as an array. An array is formed by taking a single slab of PZT and slicing it down into multiple subelements. Each subelement is connected to a wire, so it may fire independently. The system can selectively excite the elements as needed to shape and steer the beam. With most array transducers, no motors are needed for beam steering. Arrays may be either sequenced or phased and can produce various image shape.

Linear Sequenced Array

The linear sequenced array, also referred to as the linear sequential array or linear array, is a transducer that is often used in vascular or high-resolution imaging (Figure 2-21). This transducer produces a rectangular-shaped image (Figure 2-21). With the linear sequenced array, the elements are arranged in a line, next to each other, but are fired in small groups in sequence. For example, the elements are not fired 1-2-3-4-5 but are fired (1-2-3) . . . (4-5-6) ... (7-8-9). Linear sequenced arrays do not need any beam steering to produce a rectangular image. However, should beam steering be needed, whether for Doppler or to create a vector image, the beam can be electronically steered) (

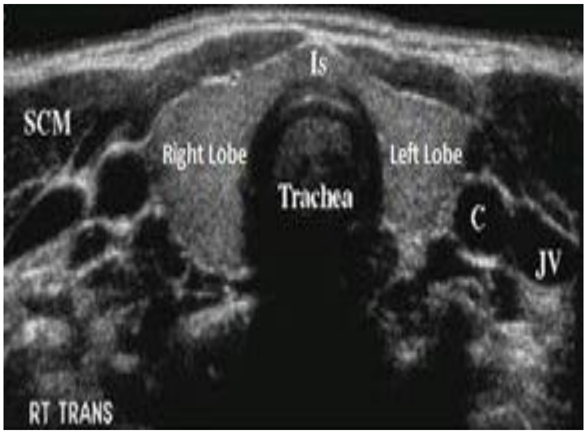


Figure 2-21 Linear sequenced array transducer. A. The image footprint of the linear sequenced array transducer. B. Image of a linear sequenced array transducer

Linear sequenced array. .

• Also referred to as linear sequential array or linear array

• Rectangular-shaped image
• Firing is sequenced
• Electronic steering available
• Electronically focused
• Used for vascular and high-resolution imaging

Curved Sequenced Array

The curved sequenced array transducer, also referred to as a convex, curvilinear, or curved sequential array, is based on the same technology as that of the linear sequenced array but with a curved face . As with the linear sequenced array, the elements are fired in groups . Phased Arrays The phased array is more commonly known as a sector or vector transducer . The sector/vector transducer typically has a small footprint, also referred to as the "face" of the transducer, and it may be used for cardiac imaging, neonatal brain imaging, with some endocavitary transducers, and any other application where a sector or vector image shape is desired . In order to create a sector image, electronic steering is needed for every scan line. Unlike the curved and linear sequenced arrays, where the shape

Curved sequenced array.

• Also referred to as a convex, curvilinear, or curved sequential array
• Curved-shaped image
• Firing is sequenced
• Electronically focused
• Used for abdominal, gynecology, and obstetrics imaging

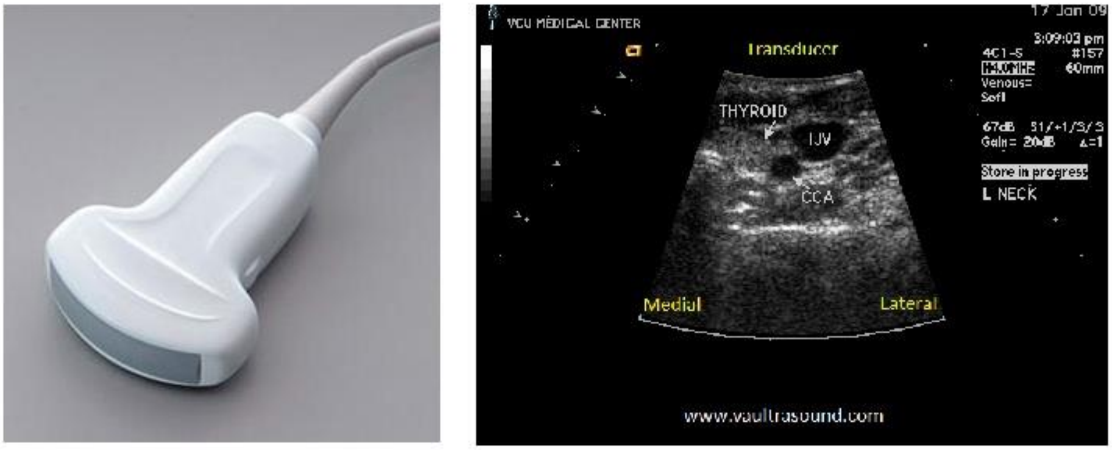


Fig 2-22 Curvilinear array transducer. A. The image footprint of the .curvilinear array transducer. B. Image of a curvilinear array transducer

Phased Arrays:-

The phased array is more commonly known as a sector or vector transducer (Figure 2-17). The sector/vector transducer typically has a small footprint, also referred to as the "face" of the transducer, and it may be used for cardiac imaging, neonatal brain imaging, with some endocavitary transducers, and any other application where a sector or vector image shape is desired (Figure 2-18). In order to create a sector image, electronic steering is needed for every scan line. Unlike the curved and sequenced array

Fig 2-23 Phased array transducer. This phased array transducer (A) will yield a sectorshaped image (B

2-5 Technique :-

Technique of Thyroid Ultrasound:-

General Assessment of the Thyroid Gland Special preparation of the patient for thyroid US is not required. The patient is advised to remove clothes and jewelry from the neck. The positioned is supine with a pillow under the shoulders to maintain neck extension (Fig2-24). Seriously ill patients can be seated upright in a hard-backed chair with their back and shoulders straight, neck mildly hyperextended, and head turned slightly away from side of interest

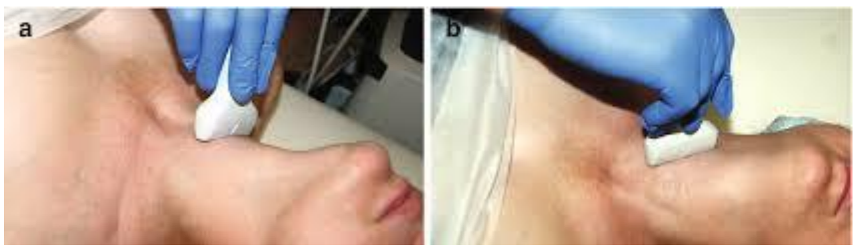


fig. 2-24 ultrasound examination of the thyroid gland. the position of the .ultrasound probe. (a) transverse thyroid scan

A linear probe with a frequency of 5–18 MHz (usually 7.5–12 MHz) is necessary for thyroid US. A 3.5–5 MHz convex probe is sometimes more suitable for measurements of large thyroids. A sector probe with a frequencyof 2.5–5 MHz may be required for the substernal thyroid.

An outline of an US examination is provided below

The thyroid as a whole .1

• Location (typical, dystopia, ectopia)
• Dimensions and volume (also in comparison with the norm)
• Margins (regular/irregular, accurate/indistinct)
• Shape (typical; congenital anomalies: lobed

constitution, aplasia,
hypoplasia;
goiter)
• Echodensity (normal,
increase, decrease)
• Echotexture
(homogeneous,
heterogeneous)
• Elasticity
• Blood vessels of the
thyroid parenchyma
(intensity, symmetry)
2. Thyroid abnormalities .2
• Character of changes
(diffuse, focal, mixed)
• Location (in lobes and
segments)
• Number of lesions
• Margins of lesions
(regular/irregular,
accurate/indistinct)
• Lesions size (in three
mutually perpendicular
planes)
• Echodensity, echostructure
of lesions
• Elasticity of lesions
• Vascularity of lesions
3. Mutual relations of the
thyroid with the surrounding
structures
4. The status of regional
lymph nodes

Sufficient amount of ultrasound gel is applied to the neck to provide good contact of the US probe with the skin. The probe is positioned on the front surface of the neck, moved from the breastbone to the hyoid bone, and backward. The probe should produce minimal pressure in order to avoid both shape distortion of the thyroid anatomy and dislocation of the adjacent structures. The location of the thyroid gland is defined followed with measurements of the dimensions and volume calculation. Several scanning planes should be considered: transverse, longitudinal, and oblique for the right and the left lobes . Thyroid size assessment is based on the linear dimensions and the volumes of the lobes. It is important to measure the linear dimensions only in the transverse or longitudinal scans of the thyroid lobes that show the maximum value . When choosing the cross section, it is necessary to follow the anatomical transverse plane and position the probe perpendicular to the skin with no angle. The longitudinal lobe dimension (the length) is the largest size of the lobe. It is actually obtained in the plane that deviates from the anatomical longitudinal plane

Fig 2-25 Ultrasound examination of the thyroid gland. Basic scanning planes. Transverse scan, scheme. Transverse scan,

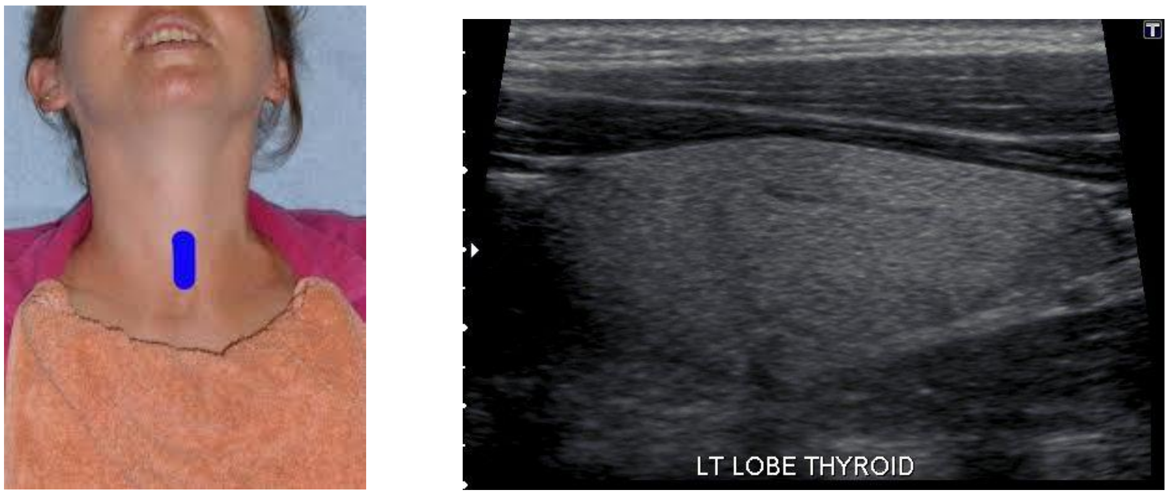


Fig 2-26 longitudinal scan

the neck. The optimal position of the probe is close to parallel with the inner edge of the sternomastoid musles

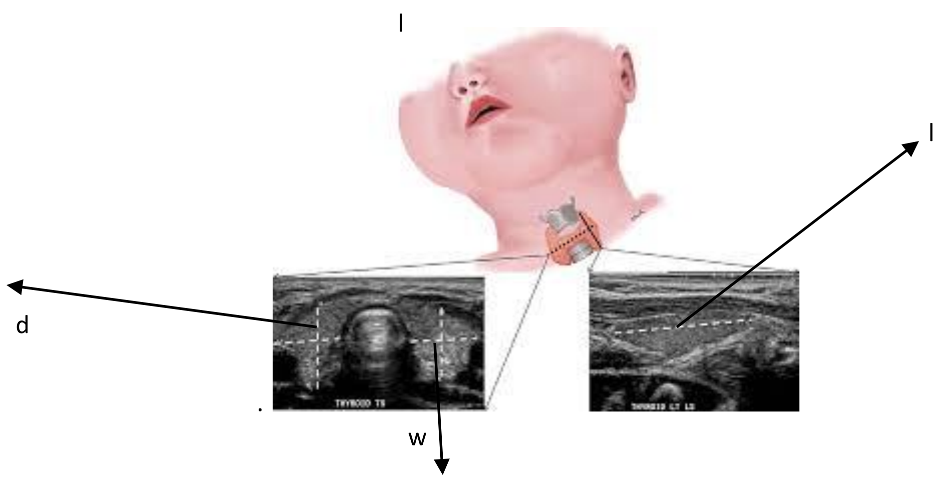


Fig 2-27 measurements of thyroid

Longitudinal and transverse scans are performed allowing the measurements of the depth (d), the width (w), and the length (l) of each lobe. The volume of the lobe is calculated by the formula: V (ml) = 0.479 × d × w × L (cm). The number 0.479 in the formula is the correction factor for determining the volume of structures of the ellipsoid shape. The thyroid volume is the sum of the volumes of both lobes. The volume of the isthmus (thickness less than 10 mm) is not included. The normal US dimensions of an adult thyroid can vary. A thyroid lobe is about 13–18 mm wide, 16–18 mm deep, and 45–60 mm long, while the isthmus is 2–6 mm deep. Usually, there is no significant difference in US dimensions between the right and left thyroid lobes. Separately defined linear parameters are of no value. It is important to note that only the total volume of the glandular tissue characterizes the size of the organ (soni etal 2019)

2-6 Previous studies:-

Sze May Nga,et al .,2017 : Thyroid ultrasound is a non-invasive imaging tool and provides good evaluation of thyroid anatomy, location, vascularisation, and echogenicity. The aim of this study was to assess thyroid function and thyroid volume in extremely preterm infants born before 28 weeks' gestation evaluated at 36 weeks' corrected gestational age (CGA) compared to term infants' normative data in the literature. Design: In this largest prospective UK study of extremely premature infants born at less than 28 weeks' gestation, thyroid volume measurement was assessed at 36 weeks' CGA. Fiftyfive extremely preterm infants (28 males) who were born before 28 weeks' gestation were recruited to the study. All infants had ultrasound assessment of the thyroid gland at 36 weeks' CGA. We also prospectively measured thyroid stimulating hormone (TSH) and free thyroxine (FT4) in all infants at the time of recruitment (within 5 days of birth), at days 14, 21, and 28, and at 36 weeks' CGA. Results: The mean thyroid volume was measured at 0.57 mL (SD ±0.18). There was no association between mean thyroid volume and thyroid function (TSH or FT4). No associations were found between mean thyroid volume and gestation or birth weight in these infants. Conclusions: Our findings provide a reference range with a mean thyroid volume of 0.57 mL (SD ±0.18) in this extremely preterm age group if less than 28 weeks gestation. Thyroid volume at birth can vary from country to country due to variations in iodine intake as well as gestational age.

MOHAMED YOUSEF2018 Abstract:
This study was carried out to describe the thyroid volume in Healthy Sudanese's subjects aged 6-18years by ultrasound and to correlate this volume with some anthropometric measures.
Methods: Sonographic studies of thyroid volume and anthropometric measures were recorded in a sample of 400 healthy subjects 186 boys and 214 girls aged 6–18 years, from four towns (Khartoum, Gedaref, Port Sudan, and Kassala), Sudan.
Results: The overall mean volume ± SD of the thyroid gland in all the patients studied was 4.66± 1.23ml; it was higher in boys (4.73ml) than in

girls (4.60ml), The mean volume of the right and left lobes were 2.30± 0 .61 mL and 2.16± 0 .60 mL, respectively. The mean of thyroid volume for Khartoum, Gedaref, Port Sudan, and Kassala population, 5.73± 0. 60ml, 4.45± 1.15, 4.5± 0. 1.32ml, 3.96± 0. 96ml, respectively. Thyroid volume was found to significantly correlate with weight and age.

Rashidah ali 2017 The result of the study showed that the mean age was 44.33 ±10.076 years old, the overall mean volume of thyroid gland was 7.465 ± 0.8028ml. The mean volume of right lobe was 1.813 ± 0.4296ml. The mean volume of left lobe was 1.733± .4617ml. The right lobe volume was significantly differing from left lobe volume. Furthermore, a significant correlation was observed between thyroid volume, weight and age of the subject

Müller-Leisse, C., Tröger, J., Khabirpour, F., & Pöckler, C. (1988)Thyroid gland volume was calculated from ultrasound data (using the ellipsoid formula) in 1080 apparently healthy schoolchildren, aged 7-20 years, from Speyer and Neckargemünd in the Federal Republic of Germany. Thyroid volume was found to increase with age: mean of 4.34 ml (single standard deviation [SD] 1.55) in seven-year olds, 13.6 ml (SD 6.2) in 16-year olds. No measurable increase was found from the 16th year onwards. No sex-related differences in size were found before the age of ten years, with a slight size increase in girls at the time of puberty. The right lobe was significantly larger than the left one (mean difference of 0.8 ml) in all age groups. There was a weakly positive correlation between thyroid volume and age, body weight, height and surface area, respectively, the best correlation for both sexes being between thyroid volume and body surface area. Among the 1080 children and juveniles of both ages there were eight with abnormal findings, all of them girls aged 16-18 years old.

Chapter three

Materials and methods

3-1Materials:

3-1-1 Subject:

This descriptive, cross-sectional study where the data were collected conveniatly. This study consist of normal 50 Saudi female aged between 12-55 years old, in Ksa the period extendeded from December 2020 to February 2021 any subject had abnormalities in thyroid tissues or thyroid hormone and any congenital anomalies in thyroid and neck are excluded.

3-1-2 Machine:

The study done in Suwair general Hospital WITH Toshiba ultrasound machine made in China and using 7.5MHZ linear probe

3-2 Method

3-2-1 Technique:

There is no specific preparation done except that the area must be free from overlapping materials. All patient scanning in supine position with pillow under shoulder and hyperextended of the neck slightly to allow head to rest in examination table, and scan whole thyroid, start the scan from sternal notch and then scan each lobe separately. The scan start by placing transducer over the neck and then angled the beam as necessary and adjust the Time Gain Compensation (TGC) with adequate sensitivity setting to allow uniform acoustic pattern, thus obtain the best image of thyroid gland.

3-2- 2 Image measurement and presentations

The measurement done for each lobe in three plane length, wide and depth (L,W,D) and the volume

3-2-3 Statistic method

The data analysis by frequency table and using computer program, Statistical Package for Social Science (SPSS)

3-3-4 Ethical considerations

Hospital and all patient had permission for this scan.

Chapter four

Chapter (4)

Results

The study sample were 50 Saudi females with healthy tissue thyroid gland the variables considered in this study was Rt lobe volume, Lt lobe volume, age and weight for participants, all the included participants were married considering their social status.

Table (4-1): frequency for the sample age groups

Age group	frequency	percentage
10 - 19	2	4 %
20 – 29	13	26 %
30 – 39	23	46 %
40 – 49	8	16 %
50 - 59	4	8 %
Total	50	100 %

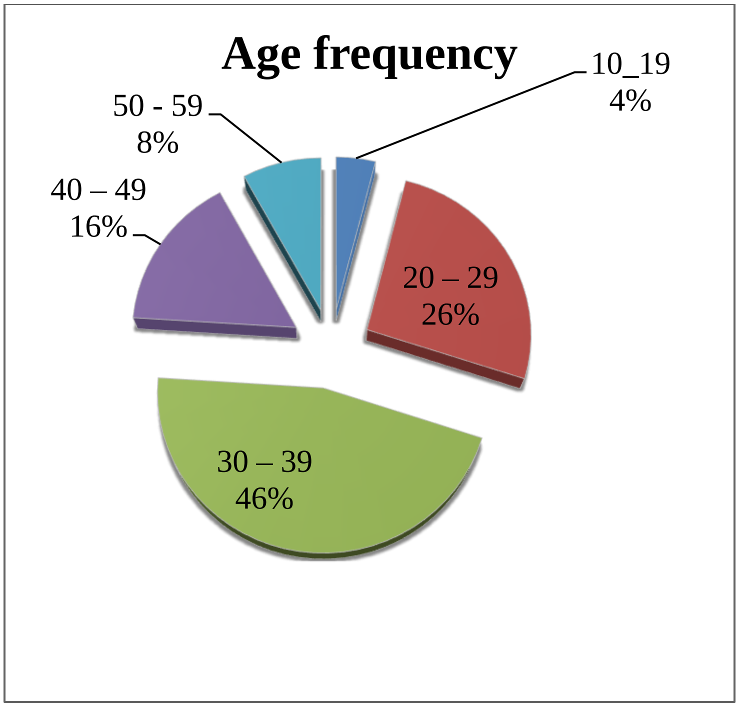


Figure (4-1): Pie chart shows the age frequency for the chosen sample

Table (4-2): shows summary statistics for age

N	Mean	Minimum	Maximum	Range	Std. Deviation
50	34.6800	14.00	55.00	41.00	9.20612

Table (4-3): shows Summary statistics for weight

N	Mean	Median	Maximum	Minimum	Range	Std. Deviation
50	72.0600	74.5000	115.00	44.00	71.00	17.05383

Table (4-4): shows Summary statistics for Right thyroid lobe volume

N	Mean	Median	Minimum	Maximum	Range	Std. Deviation
50	3.3300	3.1000	1.50	5.80	4.30	.88416

Table (4-5): shows Summary statistics for Left thyroid lobe volume

N	Mean	Median	Minimum	Maximum	Range	Std. Deviation
50	3.0120	2.8500	1.40	5.50	4.10	.98554

Table (4-6): shows Summary statistics for thyroid volume

N	Mean	Median	Minimum	Maximum	Range	Std. Deviation
50	6.3420	6.1500	2.90	11.00	8.10	1.70271

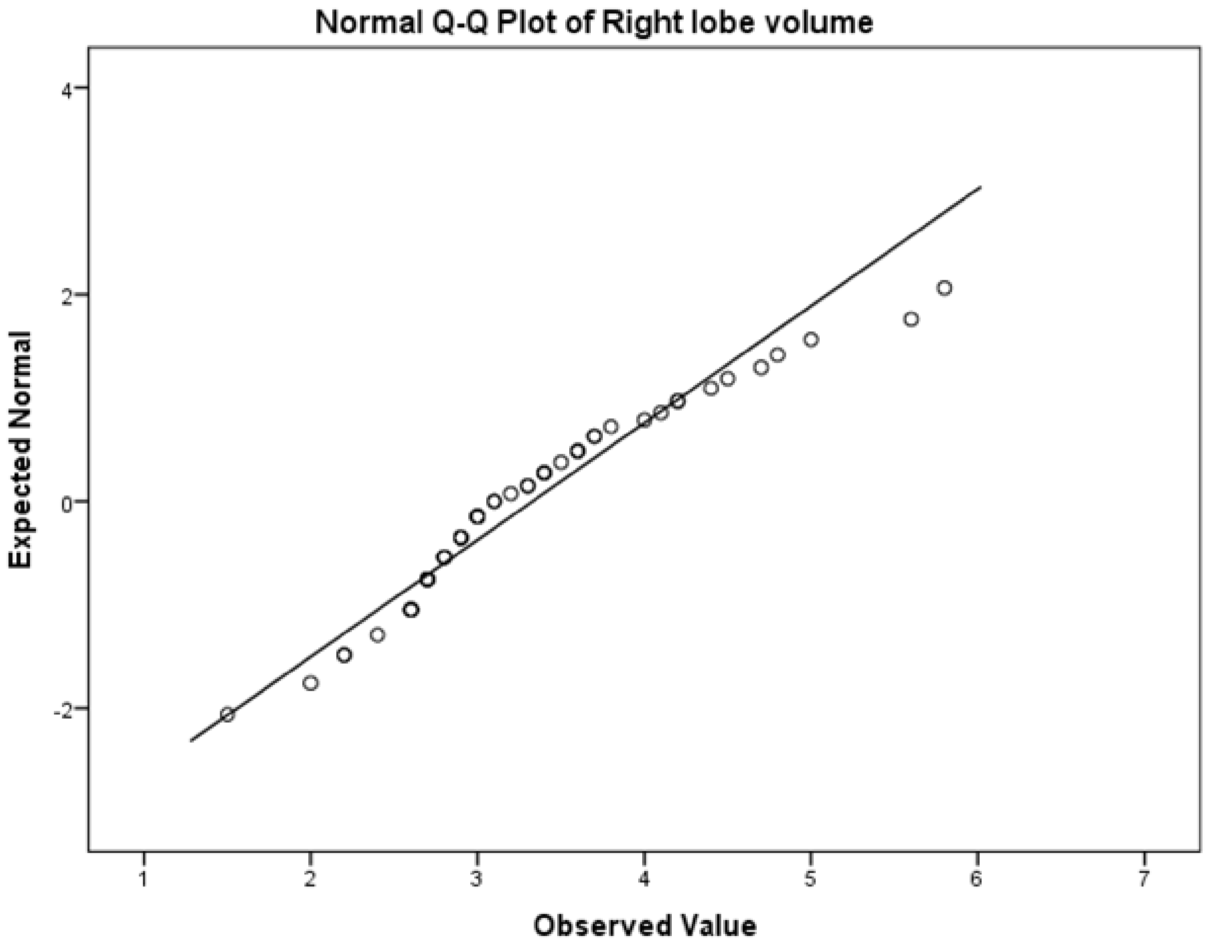


Figure (4-2): scatter plot shows the normality test (line of best fit) for the right thyroid lobe volume.

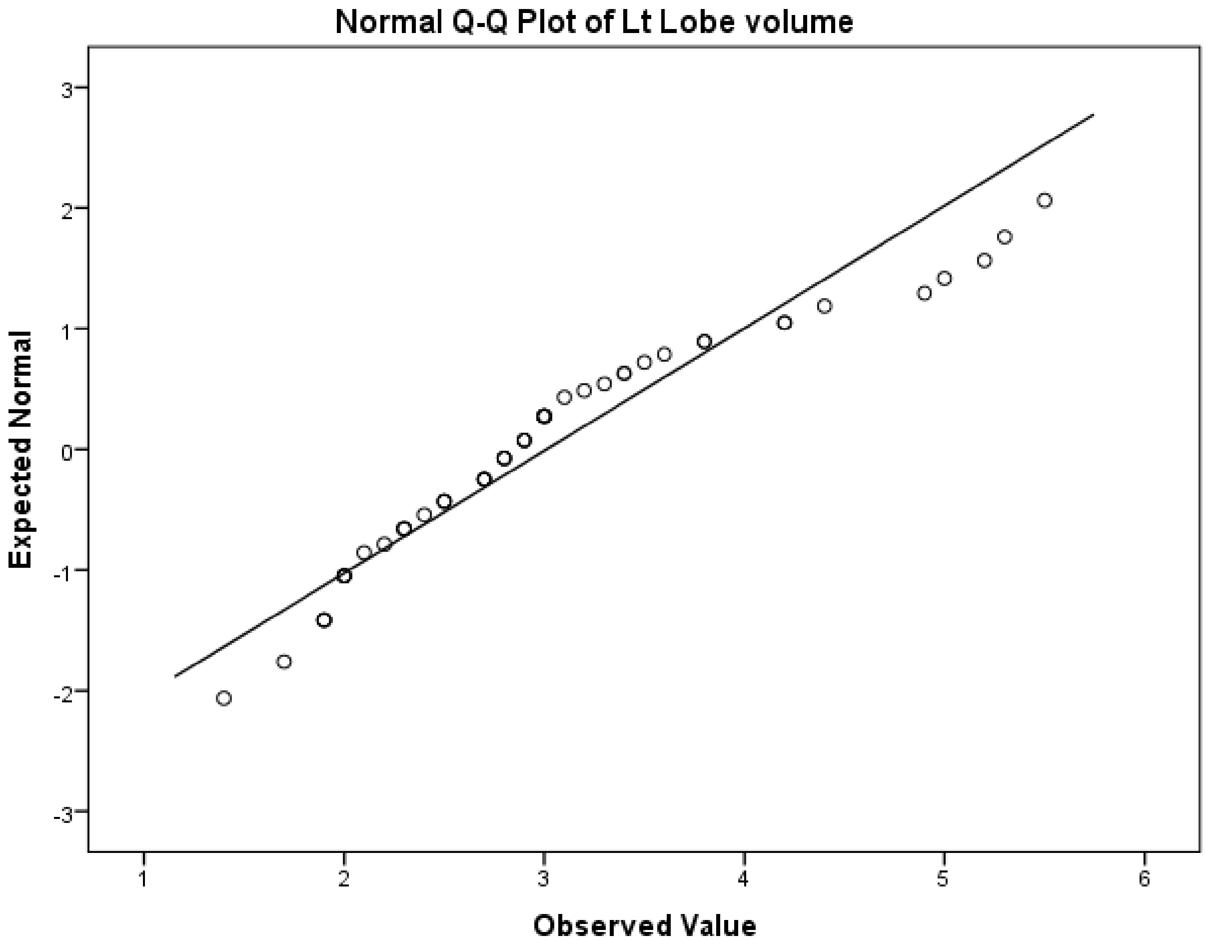


Figure (4-3): scatter plot shows the normality test (line of best fit) for the left thyroid lobe volume.

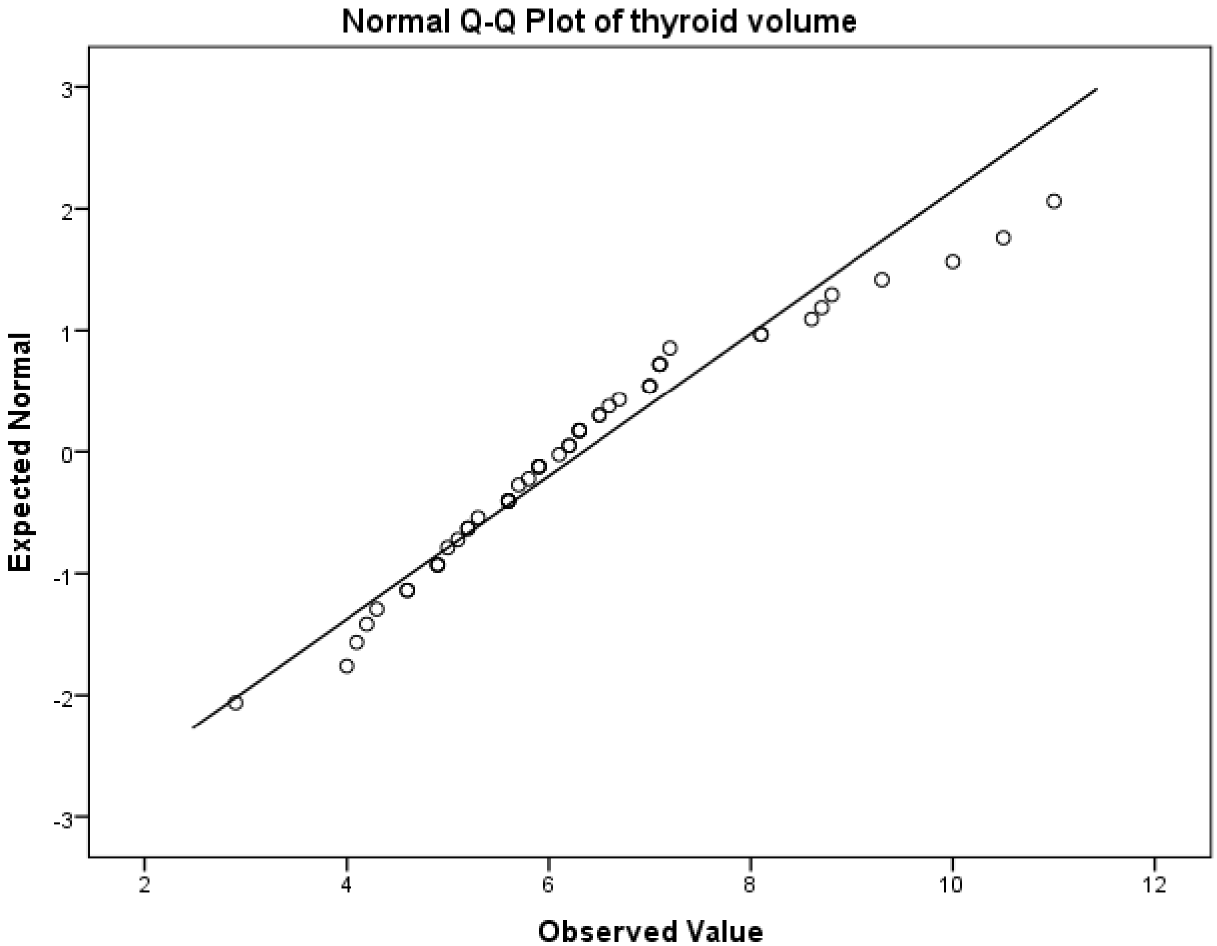


Figure (4-4): scatter plot shows the normality test (line of best fit) for the thyroid volume.

Table (4-7): shows the results of mann-Whitney U test for examining the difference in values between the right and left thyroid lobe volume measurements.

Test Statistics[a]

	Lt Lobe volume	Rt lobe volume
Mann-Whitney U	3.500	2.000
Wilcoxon W	13.500	5.000
Z	-.235	-.926
Asymp. Sig. (2-tailed)	.814	.355
Exact Sig. [2*(1-tailed Sig.)]	.800[b]	.533[b]

a. Grouping Variable: Age group

b. Not corrected for ties.

Table (4-8): shows the results of Spearman's rank correlation test for examining the relationship between the age and right or left thyroid lobe volume.

			Lt Lobe volume	Rt lobe volume	age
Spearman's rho	Lt Lobe volume	Correlation Coefficient	1.000	.641**	.191
		Sig. (2-tailed)	.	.000	.183
		N	50	50	50
	Rt lobe volume	Correlation Coefficient	.641**	1.000	.265
		Sig. (2-tailed)	.000	.	.063
		N	50	50	50
	age	Correlation Coefficient	.191	.265	1.000
		Sig. (2-tailed)	.183	.063	.
		N	50	50	50

**. Correlation is significant at the 0.01 level (2-tailed).

Table (4-9): shows the results of Spearman's rank correlation test for examining the relationship between the weight and right or left thyroid lobe volume.

Correlations

			weight in Kg
Spearman's rho	Lt Lobe volume	Correlation Coefficient	.299*
		Sig. (2-tailed)	.035
		N	50
	Rt lobe volume	Correlation Coefficient	.362**
		Sig. (2-tailed)	.010
		N	50
	weight in Kg	Correlation Coefficient	1.000
		Sig. (2-tailed)	.
		N	50

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table (4-10): shows the results of Spearman's rank correlation test for examining the relationship between the age and thyroid volume.

Correlations

			thyroid volume	age
Spearman's rho	thyroid volume	Correlation Coefficient	1.000	.246
		Sig. (2-tailed)	.	.085
		N	50	50
	age	Correlation Coefficient	.246	1.000
		Sig. (2-tailed)	.085	.
		N	50	50

Table (4-11): shows the results of Spearman's rank correlation test for examining the relationship between the weight and thyroid volume.

Correlations

			thyroid volume	particpant weight
Spearman's rho	thyroid volume	Correlation Coefficient	1.000	.377**
		Sig. (2-tailed)	.	.007
		N	50	50
	particpant weight	Correlation Coefficient	.377**	1.000
		Sig. (2-tailed)	.007	.
		N	50	50

**. Correlation is significant at the 0.01 level (2-tailed).

Chapter five

Discussion conclusion and recommendations

Discussion:-

The purpose of this study was to measure the thyroid volume in 50 Healthy married Saudi female aged 15-55years by ultrasound and to correlate this volume with age and weight

The study found that the mean thyroid volume was 6.3420,the median 6.1500,the minimum 2.90,the maximum 11.00,the range 8.10 and the stander diviation 1.70271

For Right lobe volume The study shows the mean 3.3300,the median 3.1000the minimum 1.50 ,the maximum 5.80 .the range 4.30 the std .88416

For left lobe the study shows mean 3.0120 ,the median 2.8500,the minimum 1.40 ,the maximum 5.50,the range 4.10and std deviation .98554

The results found that there is no correlation between thyroid volume and age this result was in line with previous study of (sze may nga et al 2017)in age correlation , and medium correlation between thyroid volume and weight and there is no difference in thyroid volume between right and left lobe

Medium correlation between weight and volume this result in line with previous study of(mohammed yousif 2017)

Conclusion:-

This study aim to establish a local reference of thyroid volume in normal adult Saudi female which will be useful in the clinical practice especially for the diagnosis of thyroid diseases.

50 healthy adult Saudi female were scanned in supine position with full extended neck by using Toshiba with 7.5 MHZ. linear transducer there is no special patient preparation for thyroid scan sonograms were analyzed by SPSS. The estimated mean thyroid volume in our population is seen to be significantly higher compared to the thyroid volume in the other previous study.

Recommendations :-

The study recommended that :

Further studies of thyroid gland volume with large sample volume

Further study should be done in correlate to ethnic factor (race, height, residence) . Establishing thyroid volume in other age group like pediatrics and elderly

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Appendices

Data collection sheet

	RT LOBE					LT LOBE				
N	weight	depth	width	length	volume	depth	width	length	volume	Total volume

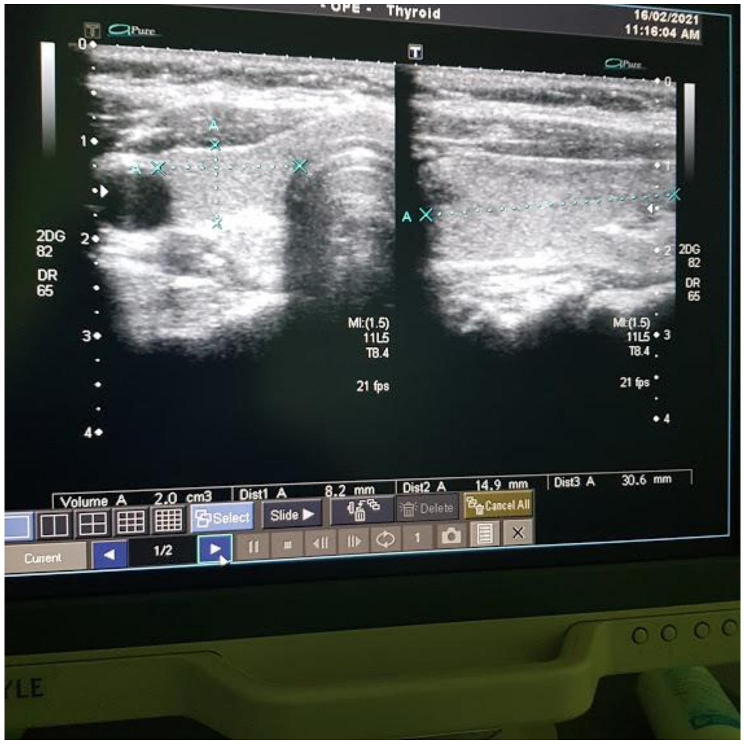

Image of right thyroid lobe with it is measurements in 35 years old female weight 80kg

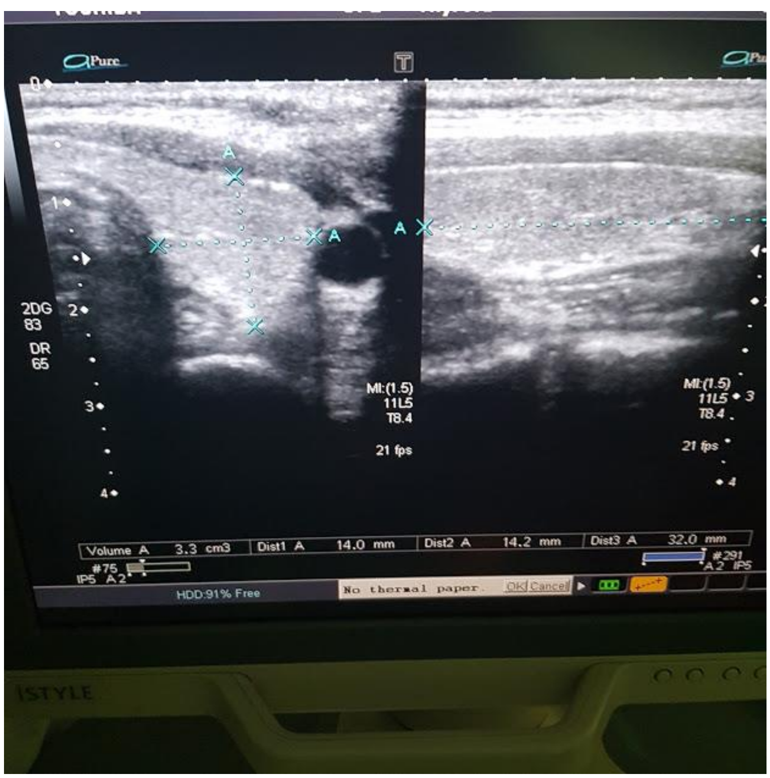

Image of left thyroid lobe with it is measurements in 35 years old female weight 80 kg