بسم الله الرحمن الرحيم

Sudan University of Science and Technology

College of Graduate Studies

Measurement Of Thyroid Isthmus Thickness InYounger Sudanese Adults Using Ultrasonography

قياس سمك برزخ الغدة الدرقية لدى السودانيين البالغين باستخدام الموجات فوق الصوتية

A Thesis Submitted for aPartial Fulfillment for Requirements of M.SC Degree in Medical Diagnostic Ultrasound

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الأية

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيم

قال تعالي :

(رَبِّ أَوْزِعْنِي أَنْ أَشْكُرَ نِعْمَتَكَ الَّتِي أَنْعَمْتَ عَلَيَّ وَعَلَى وَالِدَيَّ وَأَنْ أَعْمَلَ صَالِحًا تَرْضَاهُ وَأَصْلِحْ لِي فِيذُرِّيَّتِي إِنِّي تُبْتُإِلَيْكَ وَإِنِّيمِنَ الْمُسْلِمِينَ)

سوره الاحقاف (الاية 15)

Dedication

I ***dedicate this research:***

To my parent who are priceless

To my husband

To my sisters and family

To all my friend and colleagues who helped me along the way any were the greatest of companion

Acknowledgement

I would like firstly and finally thanks the almighty Allah for giving me the strength to accomplish this work.

I would like to express my gratitude appreciation to my super visor:prof. / **Caroline Edward Ayad**

Who give me much of her time for suggestion and super vision of this work

I thank also to ultrasound department staff in **Military Hospital**

Also I intend our appreciation for all participants who help me in this study

Abstract

Background :Thisdescriptive study deals with the ultrasound finding of thyroid isthmus thickness.

The problem of study is there is no reference value in adult Sudanese ,the isthmus thickness may increase or decrease different pathological condition

The objective of study was to measurement the thyroid isthmus thickness in younger adult Sudanese in different ages (from 18-30 years)using ultrasonography and detectingif there is relationship between the isthmus thickness and volume of thyroid. it was carried in 51person (11 male and 40 female) in Aljazeera state.The study was conducted during the period extended from December 2018 to August2019 . The machine used in the study were Dp - 1100 mindary with 8-10 frMhz , linear probe was used by a dedicated single operator.all volunteers with supine position technique. the data was collected in sheet designed which include age, isthmus thickness, length of right lobe, width of right lobe, depth of right lobe, length of left lobe,width of left lobe, depth of left lobethe data was analyzed by using (SPSS software program version 20) .

In results show the normal values of isthmus thickness were determined according to age groups and show the minimum 2.4,maximum 5.3mean 3.4 and stander deviation is 0.6 in 51 person.

*In conclusion show there is correlation between isthmus thickness and total thyroid volume with age (P*value 0.05)and there is significant correlation between isthmus thickness with age(P*value 0.05).it increasing by 0.039with increasing the age in any five years starting from 2.7mm.*

The researcher recommended to take large sample and using other parameters like body surface area ,body mass index , height and weight of the body and comparing between the two gender.

نبذة مختصرة

الخلفية: تتناول هذه الدراسة الوصفيّة اكتشاف الموجات فوق الصوتية لسمك الغدة الدرقية.

مشكلة الدراسة هي عدم وجود قيمة مرجعية في البالغين السودانيين ، سمك البرزخ قد يزيد أو ينقص الحالة المرضية المختلفة

كان الهدف من الدراسة هو قياس سمك البرزخ في الغدة الدرقية لدى البالغين السودانيين الأصغر سنا في مختلف الأعمار (من 18–30 سنة) باستخدام الموجات فوق الصوتية واكتشاف ما إذا كانت هناك علاقة بين سمك البرزخ وحجم الغدة الدرقية. تم نقله في 51 شخصًا (11 ذكرًا و 40 أنثى) في ولاية الجزيرة. أجريت الدراسة خلال الفترة الممتدة من ديسمبر 2018 إلى أغسطس 2019. كانت الآلة المستخدمة في الدراسة موانئ دبي –1100 ذهنية مع 8–10 الاب ميغاهيرتز ، تم استخدام مسبار خطي من قبل مشغل واحد مخصص. جميع المتطوعين الذين لديهم تقنية وضع ضعيف تم جمع البيانات في ورقة مصممة والتي تشمل العمر وسمك البرزخ وطول الفص الأيمن وعرض الفص الأيمن وعمق الفص الأيمن وطول الفص الأيسر وعرض الفص الأيسر تم تحليل البيانات باستخدام (إصدار برنامج SPSS 20).

في النتائج ، تم تحديد القيم الطبيعية لسمك البرزخ وفقًا للفئات العمرية وإظهار الحد الأدنى 2.4 ، الحد الأقصى 5.3 دقيقة 3.4 والانحراف الواقف 0.6 في 51 شخص.

في الختام ، هناك علاقة بين سمك البرزخ وحجم الغدة الدرقية الكلي مع تقدم العمر (قيمة P * 0.05) وهناك ارتباط كبير بين سمك البرزخ مع تقدم العمر (قيمة P * 0.05) ، ويزداد بمقدار 0.039 مع زيادة العمر في أي خمس سنوات بدءا من mm2.7.

أوصى الباحث بأخذ عينة كبيرة واستخدام معايير أخرى مثل مساحة سطح الجسم ومؤشر كتلة الجسم والطول والوزن في الجسم والمقارنة بين الجنسين.

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Chapter one

Introduction

Chapter one

1.1Introduction:

Thyroid is butterfly shape gland that sits low in front of the neckbelowAdam's apple ,the thyroid has two side lobes ,connected by bridge(isthmus) form with lobe an H shape when the thyroid in normal size .the thyroid brownish red in color(Mosby.S 2009).

The normal thyroid weightapproximately (15-25g)with each lobe(4-6cm) in length and (1.3-1.8cm)in thickness ,the isthmus measure less than (4-5 mm)and varies from nation to nation.The gland is boarded by common carotid arteries and SCM muscle anterolateral The thyroid isthmus has different measurements in its width, height, and thickness, and its location with respect to the tracheal rings has been inconsistent, among the anatomical literature .laterally by the jugular venous ,interiorly by strap muscle and posteriorly by the longs coli muscle it is supplied by superior thyroidal branch of external carotid artery and the inferior thyroid branch of subclavianartery, the recurrent laryngeal nerve runs along the inferior thyroid artery(Hyung.S*et al*2013).

The thyroid secrete several hormone collectivelycalled thyroid hormone ,the main hormone is thyroxine,act through out the body influencing metabolism growth , development and body temperature .

Enlargement of thyroid gland is due to several factors,such as hormonal or immunological stimulation,inflammatory,proliferative,infiltrative,or metabolic disorders(Rogers. WM 1978).A normal thyroid gland volume does not exclude the diagnosis of nodulargoiter(Ueda .D,*et al*2009).

There are numerous studies investigating the length and thickness of thyroid isthmus by a means of age and evaluating the relationship reference values(kosiak W ,SwietonD et al2010).

Thyroid issuitable organ for the investigation with ultrasonography due to it is verysuperficial localization in body .it is also useful in frequent control of the organ.

Ultrasonography is reliable methodfor calculating the thyroid gland (Rojeski and gharib1985).The high resolution property of ultrasonography gives the opportunity ofevaluating the morphology,dimensions ,andparenchymal structure of thyroid gland adequately. Ultrasonography is the basic method to calculate thyroid volume and thyroid isthmus .

Computed tomography or magnetic resonance imaging has limited value in the diagnosis of the thyroid gland diseases(Schlumberger.MJ, *et a*l2003).

1.2 Problem of study

There is no reference values in adult Sudanese and the isthmus thickness may increase or decrease by different pathological conditions.

1.3Questions to be answer

can ultra sound able to detecting if there is different in size of isthmus thickness in different age (18-30 year)? and if there is relationship between isthmus thickness and thyroid volume?.

1.4Objectives of study

1.4.1General objective

To measurement thyroid isthmusthickness in younger Sudanese between 18-30 by ultrasonography.

1.4.2Specific objectives

- To measure the thickness of isthmus in different ages .
- To measure the length,widthand depth of thyroid lobes indifferent ages.
- To compare between isthmus thickness and volume of thyroid

1.4Over view of the study

This study including five chapters. chapter one deal with introduction , chapter two consist of literature review that include thyroid anatomy and physiology , normal ultrasound appearance of it and normal measurement ,and abnormal thyroid , chapter three contain of materials and method , chapter four deal with result of the study and chapter five consist of discussion , conclusion and recommendations.

Chapter two

Literature reviews and previous studies

Chapter two

2.1Litrature Review

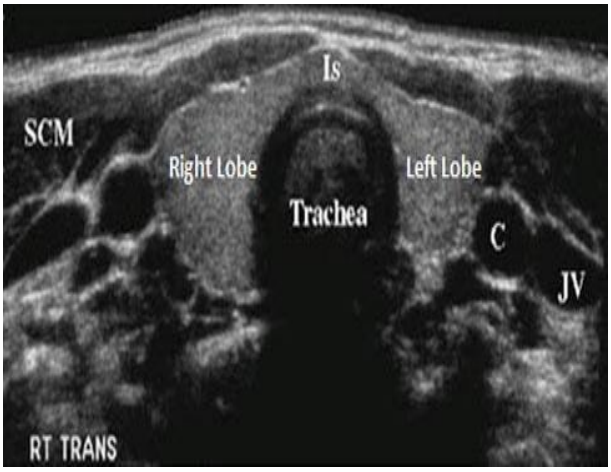
2.1.1 Anatomy of thyroid gland:

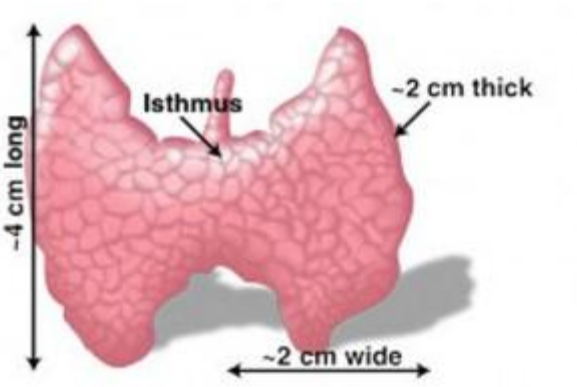
2.1.1.1Embryology

The normal thyroid gland begins as a primitive diverticulum at the base of tongue in the third week of gestation and grows caudally toward its ultimate position anterior to the thyroid cartilage(Hyung.S,*et al* 2013)**.**

2.1.1.2Normal structure of thyroid gland

Vascular is a palpable endocrine gland .the thyroid brownish red and highly lies directly below the larynx , partially in front of the trachea . it is two lateral lobes ,One on either side of the trachea ,joint with narrow tissue bridge ,called the is isthmus to give butterfly shape It is enclosed in the thin pretracheal fascia and also has it is own fibrous capsule , when the gland is enlarged , thestrap muscles are stretched tightly over it and the carotid Sheath is displaced laterally.The thyroid tissue is made up of two types of cells : follicular cells and Para follicular cells . most of the thyroid tissue consist of the follicular cells , which secrete iodine containing hormones called thyroxin (T4) and tri iodothyronine (T3). The Para follicular cells secrete thehormonecalcitonin , the thyroid needs iodine to produce the hormone (Carol.M ,*et al* 2011).





Figure(2.1)Normal thyroid gland. (a) Gray scale ultrasound, transverse scan showing normal thyroid anatomy,(IS)the isthmus,(SCM)subscapularmuscle,(C)carotid artery,(JV)jugular vein.

2.1.1.3Blood supply

Blood supply of the thyroid gland is mainly derived from the thyroid artery , the first branch from the anterior aspect of the external carotid , which pierces the Petrachealfascia as single vessel to reach summit of the upper pole and the inferior thyroid artery , from the thyro cervical trunk , which supply lower pole of the gland.Venous drainageis mainly from the superior thyroid vein, middle thyroid vein and plexus form by inferior vein.Thesuperior and middle thyroid vein enter the internal jugular vein while the plexus drain into the brachiocephalic veins , most of it into the left one , high vascularnature of gland is seen in color flow Doppler as increased color flow(Carol.M ,*et al* 2011).

2.1.2physiologyof thyroid gland

2.1.2.1Thyroid Hormone

Once released from the thyroid gland, thyroid hormone circulates in the bloodstream where free T4 and T3 areaavailable to travel across the cell membrane In the cytoplasm,T4 is deiodinated into T3, the active form of thyroidhormone. T3 combines with its nuclear receptor on thyroid hormone-responsive genes, leading to productionof messenger RNA that, in turn, leads to production of proteins that influence metabolism and development.Effects of thyroid hormone include tissue growth, brain maturation, increased heat production, increased oxygen consumption, and an increased number of _-adrenergic receptors. Clinically, individuals who have excess thyroid hormone (thyrotoxicosis) will have symptoms ofincreased metabolism such as tachycardia and tremor, while individuals with hypothyroidism note symptoms of lowered metabolism like edema and constipation(Carol.M ,*et al* 2011).

2..1.2.2 Function of thyroid gland

The thyroid plays an important role in regulate the body metabolism and calcium balance .T3 and T4 hormones stimulate every tissue in the body to produce proteins and increase the amount of oxygen used by cells . theharder the cell work , the harder and organ work . the calcitonin hormone works together with the parathyroid hormone to regulate calcium levels in the body . Levels of thyroid are controlled by the pituitary glands thyroid stimulating hormones, which in turn is controlled by the hypothalamus .

The size and shape of gland vary widely in normal individuals .Normally in tall individuals , the lopes have elongated shape where in shorter individuals they

are oval . As a result, the normal dimensions of the gland have wide variability (Carol.M ,*et al* 2011).

2.1.2.3Control of Thyroid Function

Understanding of the hypothalamic-pituitary-thyroidaxisis essential for correctly interpreting thyroid functiontesting. This axis is central in the regulation of thyroid hormoneproduction. TRH is synthesized by neurons inthesupraoptic and supraventricular nuclei of the hypothalamusand stored in the median eminence of the hypothalamus.Whensecreted, this hormone stimulatescells in the anterior pituitary gland to manufacture and release thyrotropin (TSH). TSH, in turn, circulates to the thyroid gland and leads to increased production and release of thyroid hormone. When the hypothalamus andpituitary sense that there is an inadequate amount of thyroid hormone in circulation, TRH and TSH secretion increases and will lead to increased thyroid hormone production. If thyroid hormone levels are high, TRH and TSH release will be inhibited, leading to lower levels of thyroidhormone production and visa versa if thyroid hormone levels are low. This feedback loop requires a normallyfunctioning hypothalamus, pituitary, and thyroid gland, as well as an absence of any interfering agents or agents that mimic TSH action (Born and Boulapep2012).

2.1.3 Pathology of the thyroid gland

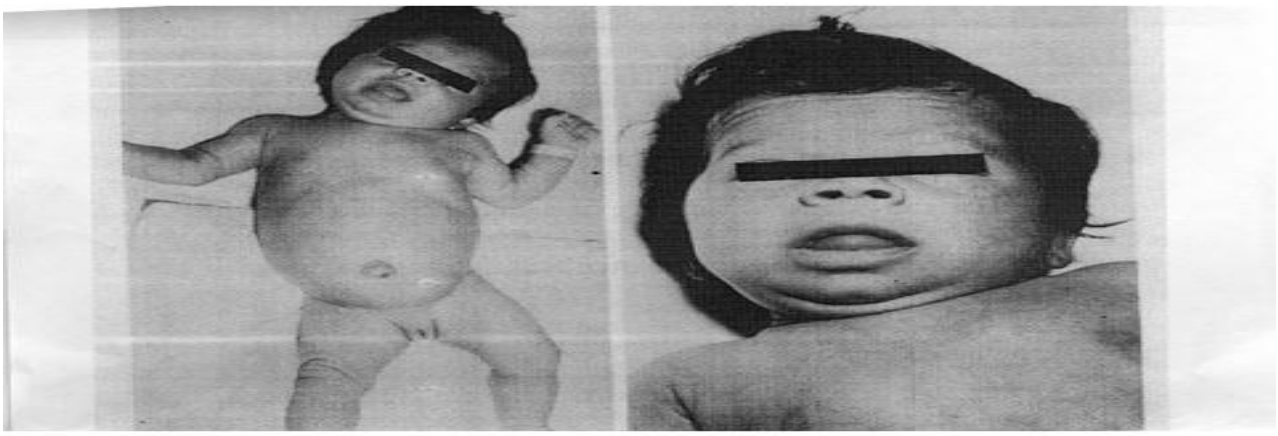
The disease associated thyroid gland classified to Congenital diseases, Nodular Thyroiddiseases[include Infective disease],Neoplasia[Adenoma and Carcinoma]and Diffuse Thyroid disease.

2.1.3.1Congenital diseases

Is the condition of thyroid hormone deficiency present at birth,it is rare condition lead to sever deficiency of thyroid hormone,the condition may occur because of the problem with the thyroid gland of babyor lack of iodinein mother during pregnancy.if un treated forseveralmonths after birth lead to growth familiar.

A-Primary hypothyroidism

Thyroid dysgenesis (aplasia, hypoplasia, orectopic gland),the causeInborn error of thyroid hormone synthesis, secretion, or utilization; m aternalgoitrogen ingestion or radioactive iodine treatment ,iodine deficiency (endemic goiter), autoimmunethyroiditis.other form of congenital hypo thyrodism is thyroid dyshormonogenisiswhere the thyroid is present but not functioning correctly Hemigeness[absence of half of thyroid gland,usually asymptomatic] .`



Figure(2..2) congenital hypo thyrodismshort neck

- Accessory or aberrant thyroid glands[also called ectopic thyroid in which an entire of parts of the thyroid located in another part of the body. completely ectopic thyroid gland located at the base of the tongue and called lingual thyroid if the thyroidfail to descend to even higher degree.

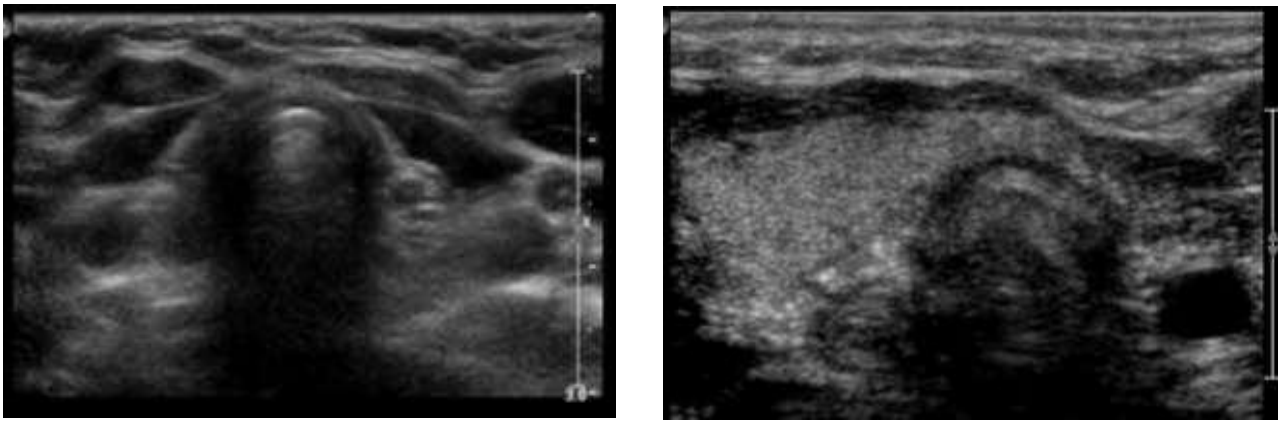
B- Hypoglossal duct cyst

It is fibrous cyst that form frompersistentthyroglossal duct show irregular mass or lump which develop from cells and tissues left over after the formation of thyroid gland during developmental stagelocated lower to hyoid bone at birthmaylead to inflammation(Paul.S and Wui.K measurement in ultra sound 2^{ed}).

In ultrasound to show presence, absence or abnormal location of thyroid. Measurement of thyroid lobes can be used to differentiateaplasia (absent gland) from goitrous hypothyroidismThyroid scintigraphy in combination with ultrasound however gives the clinician maximal information on anatomic status of the thyroid.

It is less sensitive in detecting ectopic thyroid.radionuclide scans are more often used to detect ectopic thyroid tissue (e.g: in a lingual or suprahyoidposition)(Rogers.WM 1978).

A B



Figure(2.3)(A) thyroid Aplasia(B)Hemiagenesis with small left lobe

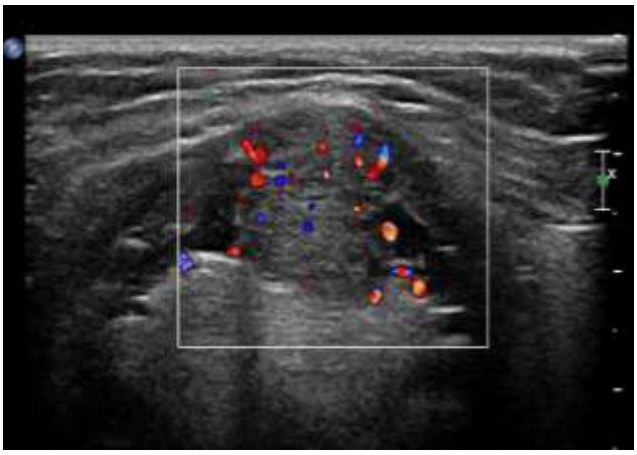


Figure (2.4)Lingual thyroid, the thyroidat the base of tongue

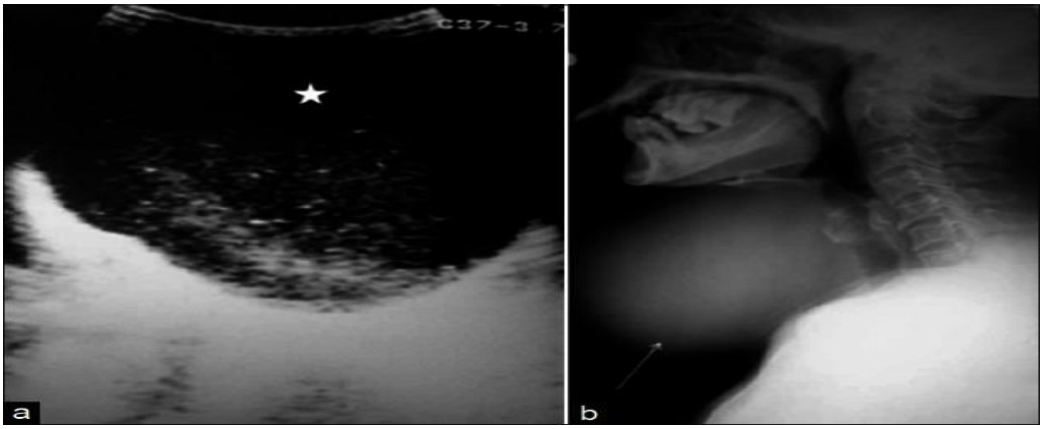


Figure (2.5)Thyroglossal cyst in a patient who presented with midline neck swelling. Ultrasound neck (a) shows a well-defined anechoic cystic lesion with multiple low level internal echoes (asterisk) and posterior acoustic enhancement. Multiple low level internal echoes within the cyst may be due to hemorrhage or infection. X-ray neck lateral view (b) of the same patient shows large, soft tissue/cystic midline swelling (white arrow)

2.1.3.2Nodular thyroid disease

is relativelycommon, women affected more frequently than men,Exposure to ionizing radiation increases the incidence of benign and malignant nodules.

Sonographicevaluation;Determine location of palpable neck mass (e.g., thyroid or extrathyroid)Characterize benign versus malignant nodule featuresDetect occult nodule in patient with history of head andneck irradiation or multiple endocrine neoplasia (MEN)type II syndrome Determine extent of known thyroid malignancy Detect residual, recurrent, or metastatic carcinoma Guide fine-needle aspiration of thyroid nodule or cervicallymph nodes Guide percutaneous-thermal ablation of thyroid nodules,para thyroids, or lymph nodes (Uda .D,*et al*1992).

A-Hyperplasia of thyroid gland

Approximately 80% of nodular thyroid disease is caused byhyperplasia of the glandItis etiology includes iodine deficiency (endemic), disorders of hormonogenesis (hereditary familial forms), and poor utilizationof iodine as a result of medication.

B-Goiter

increase of hyperplasia leadsto an overall increase in size or volume of the gland.t he peak age of patients with goiter is 35 to 50years, and women are affected three times more often than men. the goiter has five types including diffuse non-toxic (simple) goiter, colloid goiter,endemicgoiter, sporadic (dyshormonogenetice)and multi nodular goiter(Rojeski and Gharib1985).

In ultrasound show most hyperplastic or adenomatous nodules are isoechoic compared with normal thyroid tissue but may become hyperechoic because of the numerous inter facesbetween cells and colloid substance5. Less frequently, ahypoechoicspongelike or honeycomb pattern is seen. when the nodule is isoechoic or hyperechoic, a thin peripheral hypoechoic halo is typically seen, Perinodularblood vessels are typically detected with color Doppler sonography;with current high-sensitivity Doppler technology,

intranodularvascularity can also be seen.degenerative processes may also lead to the formationofcalcifications, which may be either thin, peripheral shells(“eggshell”) or coarse, highly reflective foci with associated acoustic shadows, scattered throughout the gland(Schlumberger .MJ , *et al* 2003).The multinodullargoiter(MNG)is the commonest cause of diffuse asymmetric enlargement of the thyroid gland. Females between 35-50 years of age are most commonly affected. Histologically, colloid or adenomatous form of MNG is common. The ultrasound diagnosis rests on the finding of multiple nodules within a diffusely enlarged gland. A diffusely enlarged thyroid gland with multiple nodules of similar US appearance and with no normal intervening parenchyma is highly suggestive of benignity, there by making FNA biopsy unnecessary. Most of the nodules are iso-or hyper-echoic in nature; when enlarged provide heterogeneous echo pattern to the gland. These goitrous nodules often undergo degenerative changes that correspond to their USG appearances: cystic degeneration gives anechoic appearance to the nodule, hemorrhage or infection within the cyst is seen as moving internal echoes/septations, colloidal degeneration produces comet-tail artifact, while dystrophic calcification is often course or curvilinear. Vascular compression due to follicular hyperplasia leads to focal ischemia, necrosis and inflammatory change. The assessment of nodule vascularity is very useful in differentiating MNG from multifocal carcinoma. Nodule with intrinsic vascularity and other features of malignancy can be targeted for biopsy, in preference to other nodules.[10,11]

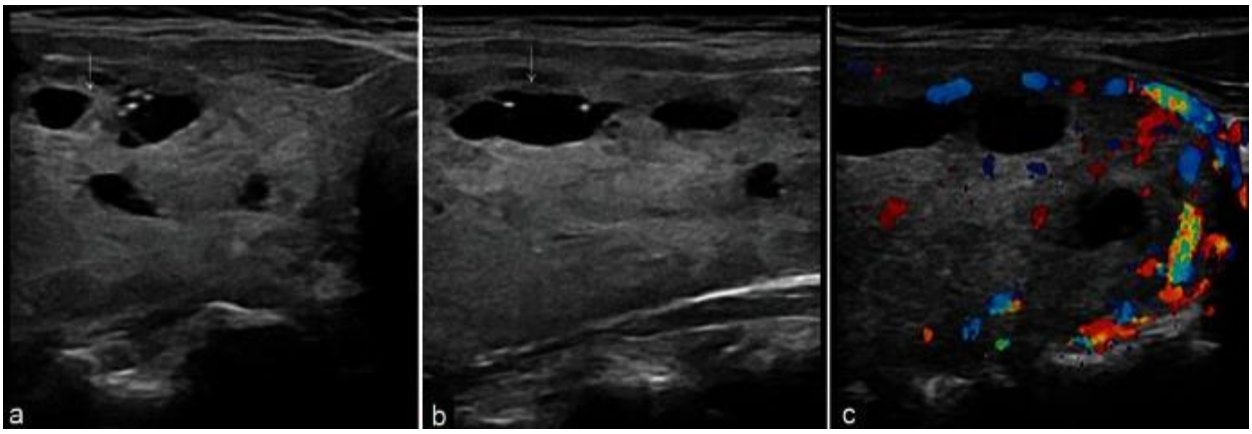


Figure (2.6)Colloidmultinodulargoitre in a 50-year-old female patient.

Transverse (a) and longitudinal (b) gray-scale ultrasound neck images reveal enlarged thyroid gland having multiple hyperechoic colloid nodules with internal cystic areas (arrows) showing ‘ring down’ sign. Color Doppler image (c) shows increased peripheral vascularity, with some intra goitrous vascularity

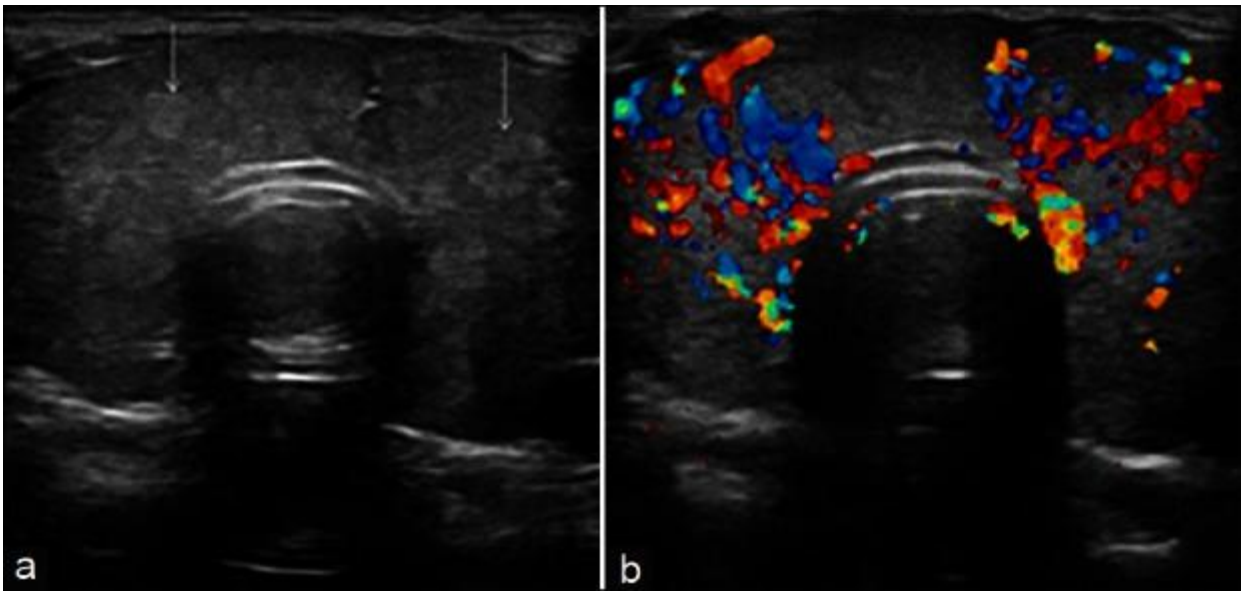


Figure (2.7)Adenomatous multinodulargoiter in a 48-year-old patient with thyrotoxicosis. Transverse gray-scale ultrasound neck (a) shows diffuse enlargement of thyroid gland with multiple small (~5 mm size) echogenic nodules involving both the lobes and isthmus (arrows), with no normal-

appearing intervening parenchyma. Color Doppler sonogram (b) demonstrates diffusely increased parenchymal vascularity. FNA biopsy confirmed the diagnosis of adenomatous multinodulargoitre. However, it should be noted that FNA biopsy is not likely to be necessary in a diffusely enlarged thyroid gland with multiple nodules of similar US appearance and no normal intervening parenchyma

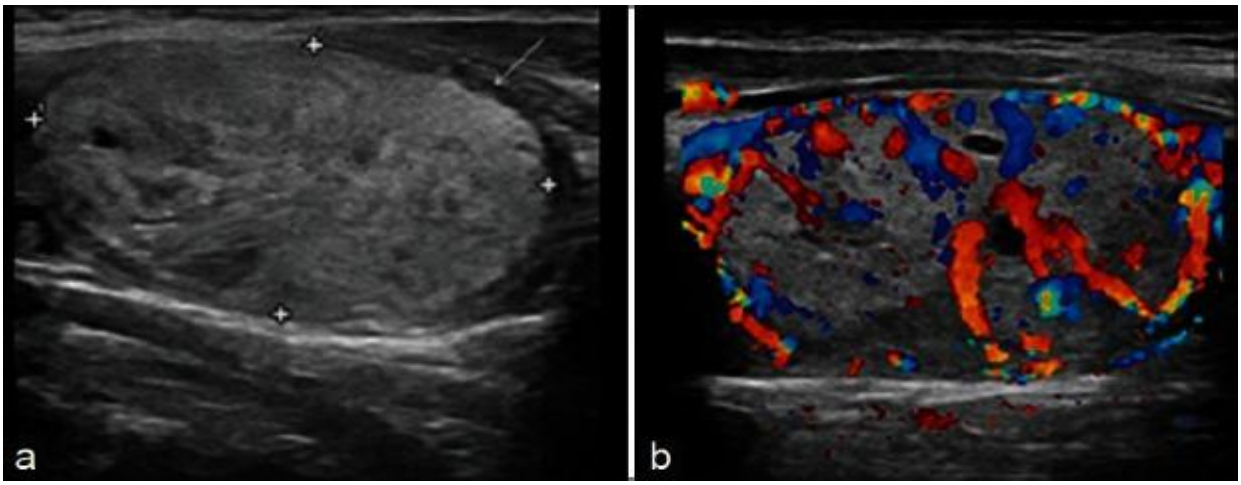
2.1.3.3Neoplasia

2.1.3.3.1Adenoma

more common in women thanmen. Most result in no thyroid dysfunctionminorityhyperfunction, develop autonomy, and may cause thyrotoxicosis.

Most adenomas are solitary, but they may also develop as part of a multi nodular process.it may benign follicular adenoma[is a true thyroid neoplasm, characterized by compression of adjacent tissues and fibrousencapsulation fetal adenoma,Hurthle cell adenoma and embryonaladenoma,each distinguished according to the type of cell proliferation(Park.M,*et al* 2009).

In ultrasound show usually solid masses that maybe hyperechoic, isoechoic, or hypoechoic they often have a thick, smooth peripheral hypoechoichaloresulting from the fibrous capsule and blood vessels, which can be readily seen by color Doppler imaging. Often, vessels pass from the periphery to the central regions of the nodule, sometimescreating a “spoke and wheel”appearance(Kakkos.Sk ,*etal* 2000).



2.1.3.3.2Carcinoma

Most primary thyroid cancers are of epithelial origin and are derived from follicular or Para follicular cells.itis rare condition, as are metastases to the thyroid. the types of carcinoma ispapillary carcinoma (including so-called mixed papillary and follicular carcinoma),medullarycarcinoma,Follicularcarcinoma and anaplastic carcinomas (Kakkos.Sk ,*et al* 2000).

A-Follicular Carcinoma

Second most common form, 10-20%,more in females than Males, average age (45 – 55) year,rare in children;minimally invasive follicular carcinomas are encapsulated, and only the histologicdemonstration of focal invasion of capsular blood vessels of the fibrous capsule itself permits differentiation from follicular adenoma .spread through the bloodstream rather than the lymphatic.

SonographicfeatureIrregular tumor margin Thick, irregular haloTortuous onchaotic a arrangement of internal blood vessels(Park.M, *et al* 2009).

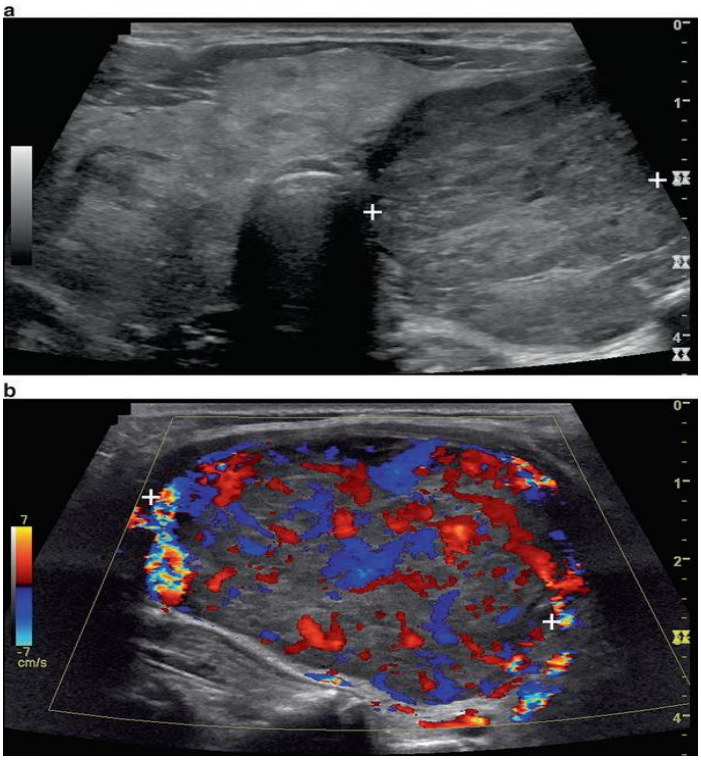


Figure (2.9)Follicular cancer with predominant central internal blood flow.
(a) Transverse gray-scale view shows a large, entirely solid, hypoechoic, intermediatesuspicionnodule (cursors) withsmooth margins and no calcifications. (b)Longitudinal color Doppler view shows readily detectable blood flow throughout the center of the nodule

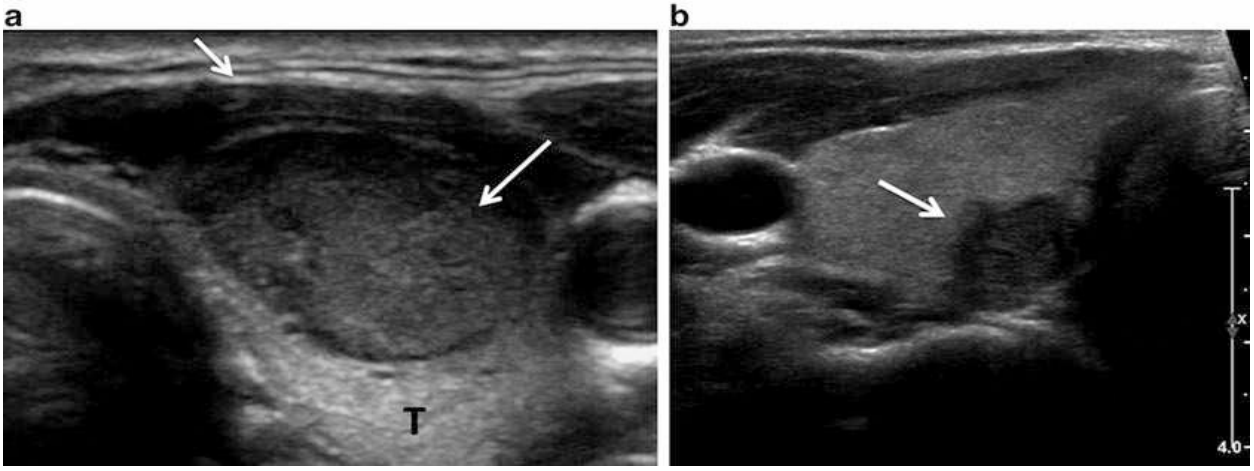
B-Papillary Carcinoma

Commonest thyroid malignancy, Female affected more thanmale,occurinpatients of any age, a patientwith PTC may have enlarged cervical nodes and a palpably normalthyroid gland(Grebe and Hay 1997).thesonographic characteristics isHypoechogenicity (90% of cases), resulting from closely packed cell content, with minimal colloid substance, microcalcifications, appearing as tiny, punctate hyperechoicfoci, either with or without acoustic shadows. In rare but usually aggressive cases of papillary

carcinomas of childhood,micro calcifications may be the only sonographic sign of theneoplasm, even without evidence of a nodular lesion.

• Hypervascularity (90% of cases), with disorganized vascularity,mostly in well-encapsulated forms . Cervical lymph node metastases, which may contain tiny, punctate echogenic foci caused by microcalcifications(Hay.ID,*etal*2002).

papillary thyroid carcinoma originating in isthmus is most likely to have extra thyroidal extension than those originating from the lobes.



Figure(2.10)Hypoechoic nodules. (a) Transverse view ofthe thyroid demonstrates a nodule (long white arrow) thatishypoechoic or darker than the surrounding thyroidparenchyma (T) but slightly less hypoechoic than theoverlying neck musculature (short arrow). This noduleproved to a benign hyperplastic nodule on FNA. (b)Transverse view of the right lobe of the thyroid in a different patient demonstrates a hypoechoic nodule whichproved to be a papillary thyroid carcinoma. A lobulatedborder is noted in this lesion.

C-Anaplastic Carcinoma

It is Rarecondition,< 5% of thyroid carcinomastypically a disease of elderly persons,and fatal below one year.in females slightly than males. Rapidly enlarging bulky neck mass Large, firm, necrotic mass , Frequently replaces entire thyroid gland andExtends into adjacent soft tissue, trachea and

esophagus.they tend not to spread via the lymphatic's but instead are prone to aggressive local invasion of muscles and vessels.Sonographically show

Large, hypoechoic mass, encase or invade blood vessels and Invade neck muscles. anaplastic thyroid carcinomas are usually Hypoechoic and often encase or invade blood vessels and neck muscle. Often these tumors cannot be adequatelyexamined by ultrasound because of their large size. Instead computed tomography (CT) or magnetic resonance imaging.(MRI) of the neck usually demonstrates the extent of disease more accurately(Net .CJ , *et al* 1985).

D-Medullary Thyroid Carcinoma (MTC)

Histology same for sporadic andfamilial,Solid, lobular or insular growth patterns,Tumor cells round, polygonal or spindle-shaped,Amyloid deposits in many cases. Malignant tumor of thyroid C cells producing calcitonin,5 % of all thyroid malignancies,commoninmiddle-aged adults In Female thanmale,Unilateral involvement of gland,with or without cervical lymph node metastases.sonographicallyis un usually similar to that of papillary carcinoma and is seen most oftenasahypoechoic solid mass. Calcifications are often seen and tend to be more coarse than the calcifications of typical papillarycarcinoma(Chong.GC ,*et al* 1975).

2.1.3.3.3 Lymphoma

It is rare condition affected elder womenis a rapidly growingmass that may cause symptoms of obstruction such as dyspnea and dysphagia. In 70% to 80% of patients, lymphoma arisesfrom a preexisting chronic lymphocytic thyroiditis.

Sonographicallylymphoma of the thyroid appears as anextremelyhypoechoic and lobulated mass. Large areas of cysticnecrosis may occur, as well as encasement of adjacent neckvessels.

On color Doppler imaging, both nodularanddiffuse thyroid lymphomas may appear mostly hypovascularor may show blood vessels with chaotic distribution and AVshunts.t he adjacent thyroid parenchyma may be heterogeneousas a result of associated chronic thyroiditis(kasagi .K, *et al* 1991).

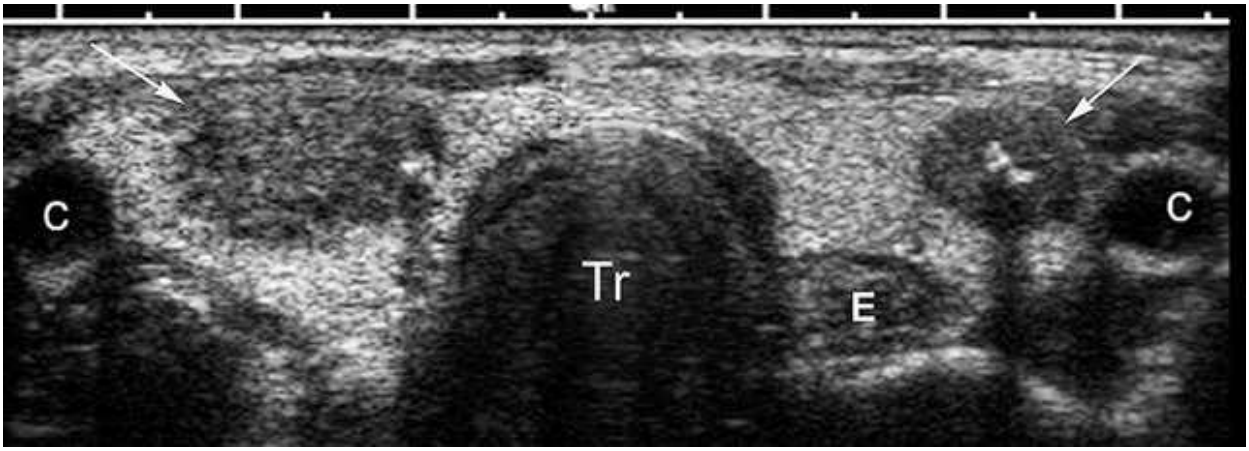


Figure (2.11)Multicentric Medullary Thyroid Carcinoma. Transverse dual image in patient with multiple endocrine neoplasia type II (MEN II)shows bilateral hypoechoic masses (arrows) that contain areas of coarse calcification. C, Carotid arteries; E, esophagus; Tr, trachea

2.1.3.3.4Thyroid Metastases

Metastases to the thyroid are infrequent, occurring late in the course of neoplastic diseases as the result of hematogenous spread or less frequently a lymphatic route. Metastases usually are from melanoma ,breast, and renal cell carcinoma. On sonography,Thyroidtumors are solid, homogeneously hypoechoic masses, without Calcifications .Fine needle aspiration (FNA) biopsy is the most effective method for diagnosing malignancy in a thyroid nodule.

high-resolutionsonographyhas four primary clinical applications firstly

detection of thyroid and other cervical masses before and

after thyroidectomy secondly is differentiation of benign from malignant masses on the basis of their sonographic appearance .thirdly guidance for FNA

biopsy and fourthly is Guidance for the percutaneous treatment of nonfunctionaland hyper functioning benign thyroid nodules and of lymphnode metastases from papillary carcinoma.

Thyroid ultrasound can beuseful to determine the extent of disease,forevaluation ofnearbystructures,used preoperatively to detect an occult ,nonpalpable primary focus within the gland.is the preferred method for follow-up, by detectingresidual, recurrent, or metastatic disease in the neck. Inpatients who have had subtotal thyroidectomy(Scheible .W, *et al* 1979)

Figure (2.12)Fine-Needle Aspiration of Thyroid Nodule Caused by Follicular Neoplasm. Transverse image shows a large nodule replacing the right thyroid lobe. Tr, Tracheal air shadow. The tip of the 25-gauge needle is highly visible (arrow), and the shaft of the needle is faintly visible.

2.1.3.3.5Differentiation of Benign and Malignant Nodule

the fundamental anatomic features of a thyroid nodule onhigh-resolution sonography are as internal consistency (solid, mixed solid and cystic, or purely cystic), echogenicity relative to adjacent thyroid parenchyma, margin ,shape and Presence and pattern of calcification(YU .D, *et al* 2014).

2.1.3.4Diffuse Thyroid Diseases

Divided to acute suppurative thyroiditis Subacute granulomatous thyroiditis, hashimoto thyroiditis (chronic lymphocytic thyroiditis),adenomatous or colloid goiterandpainless (silent) thyroiditis.

2.1.3.4.1Acute suppurative thyroiditis

is a rare inflammatory disease usually caused by bacterial infection and affecting children. Sonography can be useful inselect patients to detect the development of a frank thyroid abscess.the infection usually begins in the perithyroidalsottissues.Onultrasound images; an abscess is seen as a poorly denied, Hypo echoic heterogeneous mass with internal debris, with or without septa and gas. Adjacent inflammatory nodes are often present.

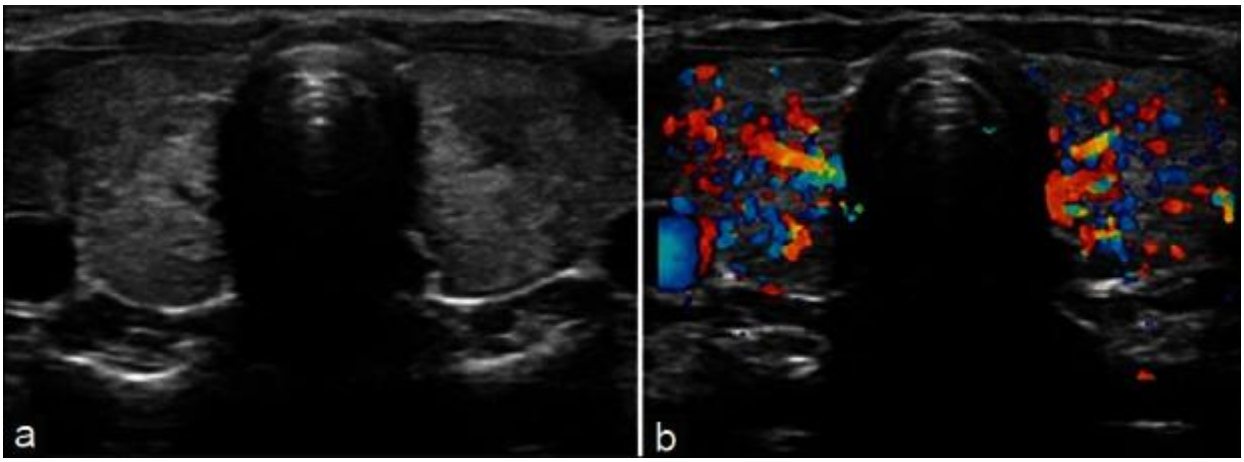


Figure (2.13)Acute thyroiditis in a 12-year-old female patient, who presented with acute onset fever, neck pain and swelling. Transverse gray-scale ultrasound neck (a) shows bilaterally enlarged thyroid lobes with heterogeneous echo pattern. Color Doppler sonogram (b) demonstrates increased parenchymal vascularity in both lobes of the thyroid

2.1.3.4.2Subacute granulomatous thyroiditis or De Quervain disease

is a spontaneously remitting inflammatory disease probably caused by viral infection.t he clinical findings include fever,enlargement of the gland, and pain on palpation.sonographically show the gland may appear enlarged and hypoechoic, with normal ordecreased vascularity caused by diffused edema of the gland, or the process may appear as focal hypo echoic regions.. Although usually not necessary, sonography can be usedtoassess evolution of de Quervain disease after medical therapy.

2.1.3.4.3chronic autoimmunelymphocytic thyroiditis, or Hashimoto thyroiditis;

Isthe most common type of thyroiditis is It typicallyoccurs as a painless, diffuse enlargement of the thyroid gland ina young or middle-aged woman, oftenassociated with hypothyroidism.. Patients with this autoimmune disease develop antibodies to their own thyroglobulin as well as to the major enzyme of thyroid hormone genesis, thyroid peroxidase.

Typicalsonographic appearance of Hashimoto thyroiditis is diffuse,coarsened, parenchymal echo texture, generally more hypoechoicthan a normal thyroid. In most cases the gland isenlarged. Multiple, discrete hypo echoicmicro nodulesfrom 1to 6 mm in diameter are strongly suggestive of chronic thyroiditis(Takashma .S,*et al* 1992).

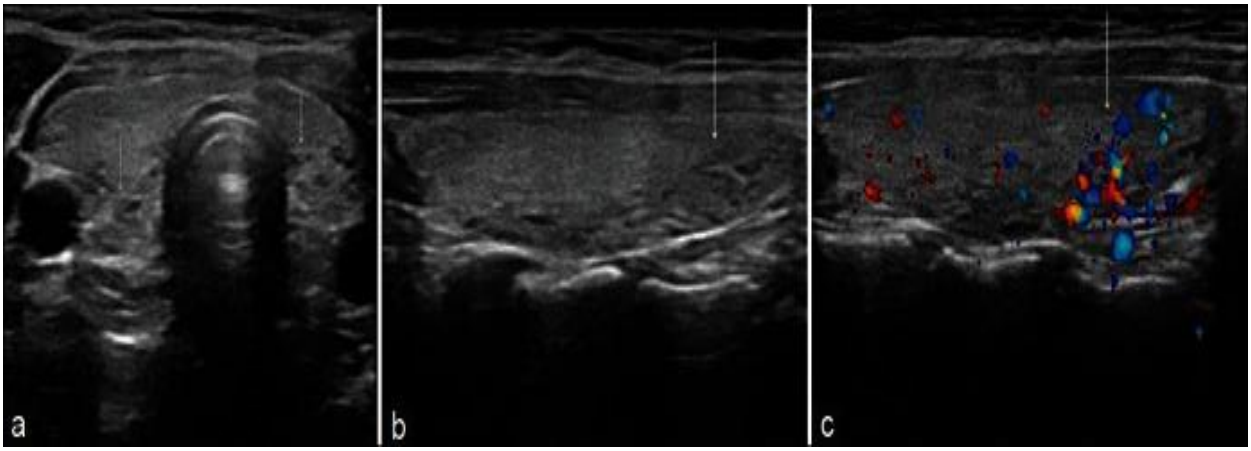
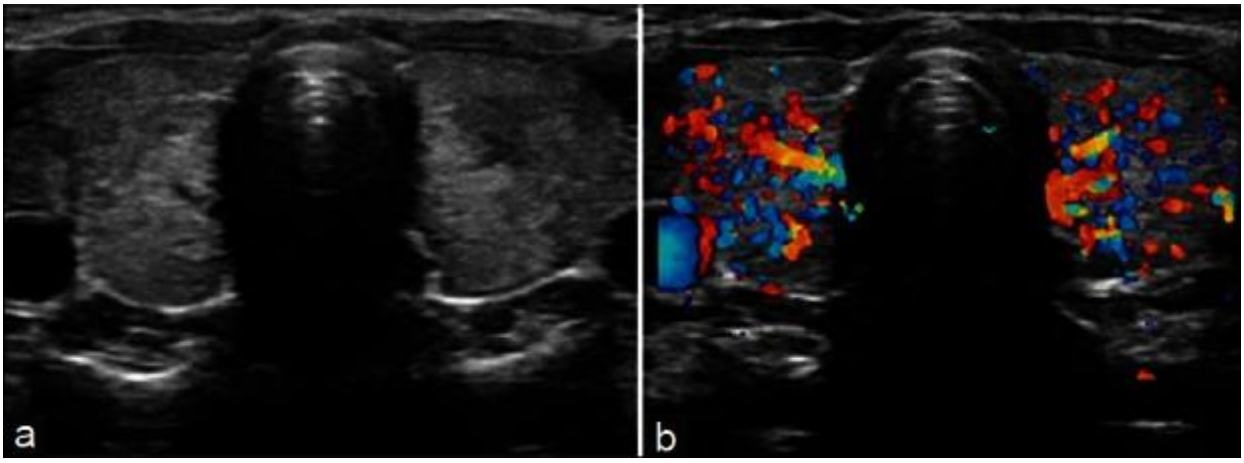


Figure (2.14)Focal Hashimoto's thyroiditis in a 35-year-old female patient, who presented with features of hypothyroidism and had anti-thyroid antibodies positive for the disease. Transverse gray-scale ultrasound neck (a) demonstrates ill-defined heterogeneous hypoechoic areas localized to postero-inferior aspect of thyroid lobes bilaterally (arrows). Longitudinal scan (b) left lobe thyroid (of same patient) clearly depicts the abnormal area which also shows increased vascularity on color Doppler sonogram

2.1.3.4.4Painless (silent) thyroiditis

has the typical histologic and sonographic pattern of chronic autoimmune thyroiditis(hypoechogenicity, micronodulation, and fibrosis), but clinical findings resemble classic subacutethyroiditis, with the exception of node tenderness. Moderate hyperthyroidism with thyroid enlargement usually occurs in the early phase, in some cases followed byhypothyroidism of variable degree. Inpostpartumthyroiditis the progression to hypothyroidism is more common.In most cases the disease spontaneously remits within 3 to 6months, and the gland may return to a normal appearance Although the appearance of diffuse parenchymal inhomogeneityandmicronodularity is typical of Hashimoto thyroiditis, other diffuse thyroid diseases, most frequently multinodular or

adenomatous goiter, may have a similar sonographic appearance (Carol.M ,*et al* 2011).

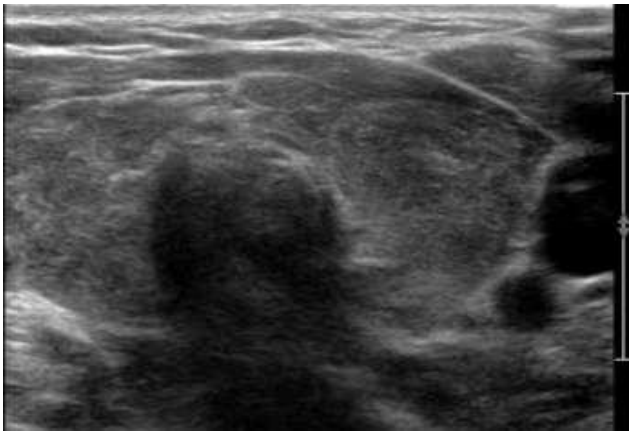


Figure(2,15)Acute thyroiditis in a 12-year-old female patient, who presented with acute onset fever, neck pain and swelling. Transverse gray-scale ultrasound neck (a) shows bilaterally enlarged thyroid lobes with heterogeneous echo pattern. Color Doppler sonogram (b) demonstrates increased parenchymal vascularity in both lobes of the thyroid

2.1.3.5Graves disease

Graves diseaseIs auto immune disease ,it is a common diffuse abnormality of the thyroidgland and is usually biochemically characterized by hyper function(thyrotoxicosis).t heechotexture may be more in homogeneousthan in diffuse goiter, mainly because of numerous large, intraparenchyma l vessels. Furthermore, especially in young patients ,the parenchyma may be diffusely hypo echoic because of the extensive lymphocytic infiltration or the predominantly cellularcontent of the parenchyma, which becomes almost devoid ofcolloid substance. Color Doppler sonographyoftendemonstratesahypervascular pattern referred to as the thyroid

inferno. Spectral Doppler will often demonstrate peak systole velocities exceeding 70 cm/sec(Castagnone .D,*et al* 1996).



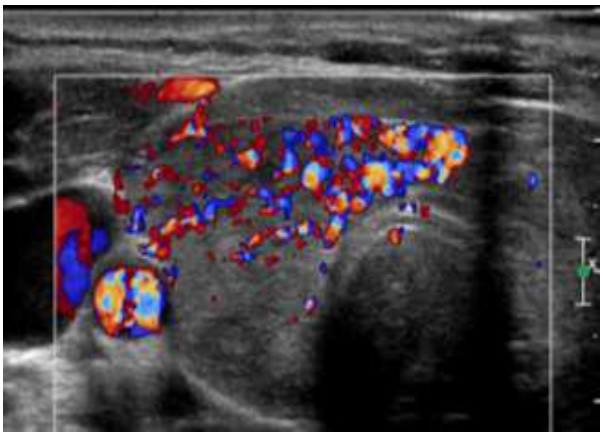


Figure (2.16) graves diseasesthe thyroid enlarge hypo echoic tecuture

Figure(2.17) color Doppler flow of graves diseases increasing vascularity

2.1.3.6invasive fibrous thyroiditis

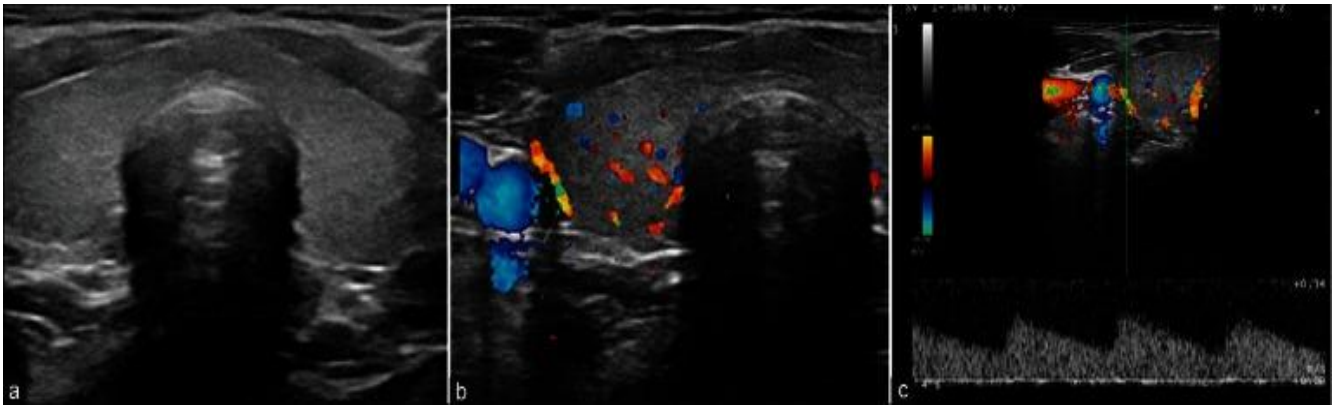
also calledriedelstrumaie rarest type of inflammatory thyroid disease is primarily affects women and often progresses to completedstruction of the gland. Some cases may be associated withmediastinal or retroperitoneal fibrosis or sclerosing cholangitis. In the few cases of invasive fibrous thyroiditis examined .sonographically show the gland was diffusely enlarged and had an inhomogeneous parenchymal echo texture.the primary reason for sonography is to check: for extrathyroid extension of the inflammatory process, with encasement of the adjacent vessels .Such information can be particularly useful in surgical planning. Open biopsy is generally required to distinguish thiscondition from anaplastic thyroid carcinoma. Thesonographicfindings in these two diseases may be identification .

2.1.4ThyroidUltrasound

The significance of thyroid ultrasound in the assessment of thyroid anatomy and characterization of palpable thyroid abnormalities has progressively increased in the last several years. Thyroid ultrasounds are capable of detecting even thyroid nodules of such a small size as to be of unclear or even no clinical significance; in up to 50% of clinically normal thyroid glands, small (1cm) thyroid nodules can be seen(Carol.M ,*et al* 2011).

2.1.4.1Normal thyroid parenchyma

Has a homogeneous, medium- to high-level echogenicity that makes detection of focal cystic or hypo echoic thyroid lesions relatively easy in most cases.t he thin, hyper echoic line around the thyroid lobes is the capsule,(Carol.M ,*et al* 2011)which is often identifiable on ultrasound.



Figure(2.18)Normal thyroid gland. (a) Gray scale ultrasound, transverse scan showing normal thyroid anatomy, (b) Arterial vascularization of the thyroid gland. On color Doppler, the inferior thyroid artery (arrow) is seen, (c) Blood flow pattern in normal thyroid gland. On spectral display, a low resistance flow with a high peak systolic velocity is obtained

2.1.4.2Scanningtechnique:

No preparation, supine position with the neck extended,7.0–14.0 MHz linear transducer used. transducer held at a 90-degree angle to skin, using only minimalpressure so as not to distort the gland anatomy,transverse and Longitudinal images obtained in the lower half of the neck from the midline.In,transverse scan best done on a split screen, visualizing both lobes per screen.the trachea with its echogenic cartilage rings and air shadows appearsin the midline; the echo-free Lumina of the carotid arteries (pulsation)and jugular veins (distension on Valsalva) delineate the lateralaspect. begin with the transducer perpendicular in the transverse plane abovethe sternal notch; move the transducer superiorly to view the entiregland from inferior to superior aspect; return to image which shows the lobe at its greatest depth and width; and freeze the image.change to other side of the screen, repeat scan on opposite lobe, and freeze. measure the maximal width (mediolateral) and depth (antero posterior)of the transverse section of each lobe, with the depth measurementat a 90-degree angle to the skin surface and the width measurement at90 degrees to the depth measurement. the measurement should not include the thyroid capsule (hyper echoic to the gland tissue) or the thyroid isthmus. note that the carotid, particularly in a subject with an enlarged thyroid,may indent the posterolateral aspect of the gland.

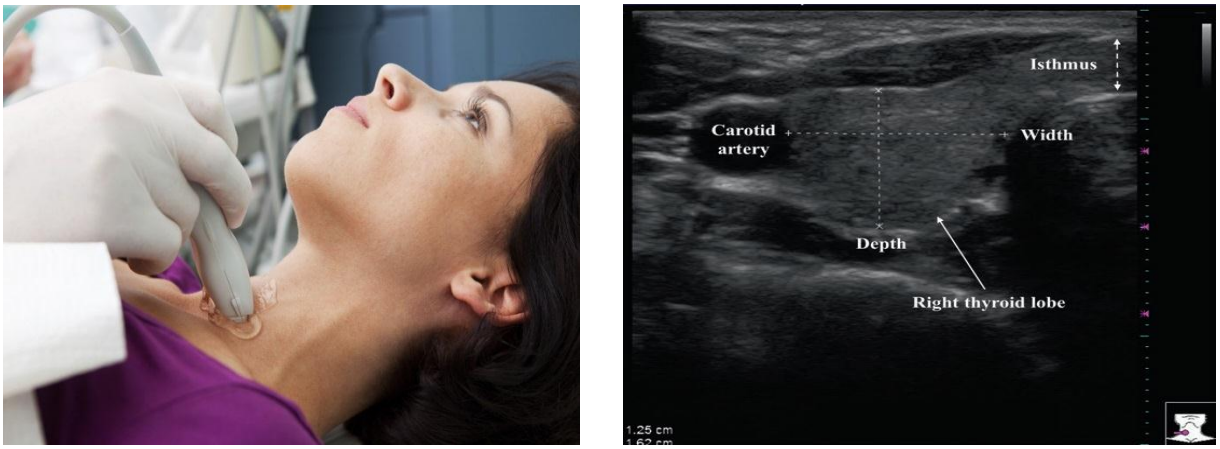


Fig.(2.19) Measurement of width anddepth of the right lobe on thetransverseview.

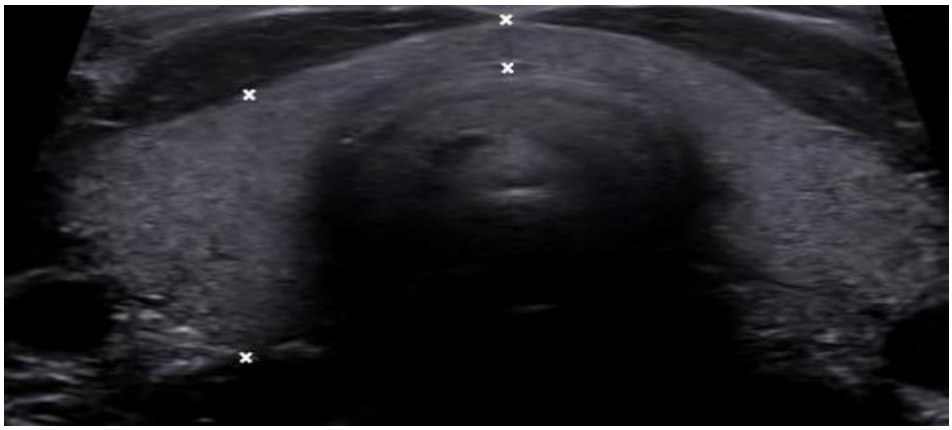


Fig (2..20)Transverse image at the level of the thyroid isthmus, with a depth measurement of the isthmus, and a depth measurement of the right lobe.

Secondly done Longitudinal Scan One thyroid lobe is measured per screen. The strap muscles appearanteriorly as hypoechoic structures relative to the thyroid. Posteriorto the medial portion of the thyroid, the trachea with its echogeniccartilage and air shadows is often seen. Posterior to the lateral portionof the thyroid, venous structures and the common carotid appear asecho-free tubular structures. begin with the transducer perpendicular in the sagittal

plane abovethe sternal notch, move the transducer superiorly to view the entireglandfrom inferior to superior and medial to lateral aspect, return toimage which shows the lobe at its greatest length (craniocaudal), and freeze.to obtain the greatest length, because of the inferior convergence ofthe lobes, the transducer is often oriented with its superior end slightly diverging from the midline. measure the maximal length of the longitudinalsection of the lobe.repeat scan on opposite lobe and again measure the maximal lengthof the longitudinal section. .if the length of the gland exceeds the length of the transducer, thelongitudinal measurement is done by splitting the lobe length in twoscans, measuring to an internal (preferable) or external landmark,and summing the measurements to obtain the length.

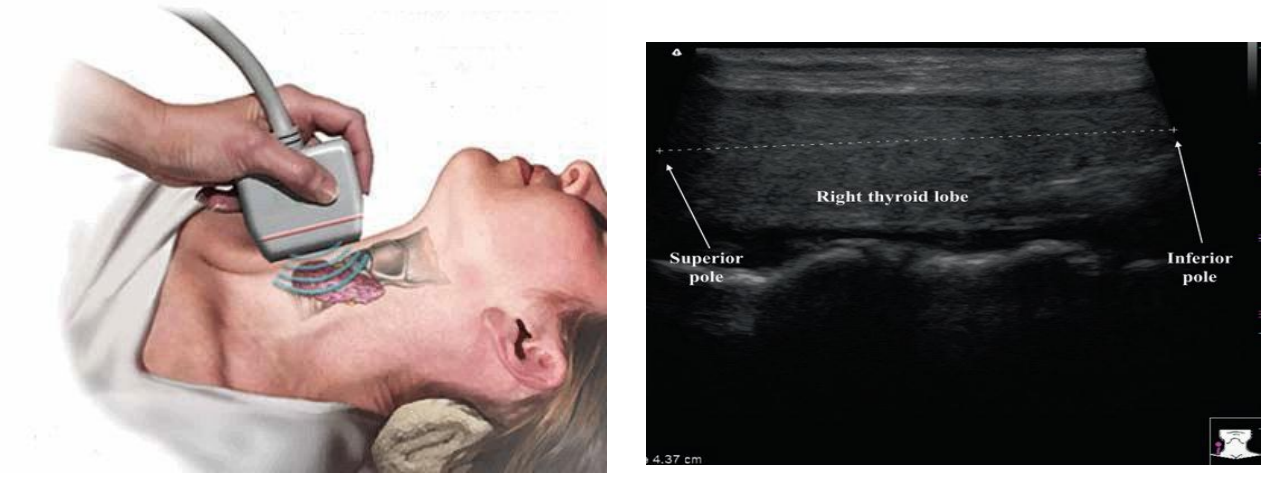


Fig.(2.21) Measurement of length of the right lobe in sagittal vie

Table (2.1)show the measurement of thyroid gland in different age

Age	Length	Anteroposterior diameter
Newborn	**18_20mm**	**8_9mm**
1year	**25mm**	**12_15mm**
Adult	**40_60mm**	**13_18mm**

The mean thickness of the isthmus is 4–6 mm .

BSA reference is recommended. The volume usually large in iodine deficiency regions and in patient suffering from acute hepatitis or chronic renal failure and small in patient suffering from chronic hepatitis or treated with thyroxin or radio activeiodine(Born and Boulapep 2012).

2.2Previous studies:

This descriptive study deals with the ultrasound finding of thyroid isthmus thickness.

This study from Van and DrMuhittinÜlker Emergency and Traumatolgy Education and Investigation Hospital, Department of Radiology, Ankara, Turkey (İsmetTaş 2010) A total of 251 volunteers without any complaint or physical examination finding regarding the thyroid disease were included in the study in which 105 man and 146 women, age range between 15 and 78. Patients with prior thyroid disease history or the patients in whom nodule, heterogeneity or agenesis were discovered in the ultrasound examination were excluded from the study. They investigated any relation between the dimension, volume, or the thickness of isthmus of the thyroid gland and length, age, gender, BMI, or BSA. Relations between the parameters mentioned above and volume or dimensions of the thyroid gland has been investigated by many investigators, who have reported various results. Moreover, the volume of the thyroid gland varies fron nation to nation.BSA was correlated with total thyroid volume, right lobe volume, left lobe volume, all dimensions of the thyroid and isthmus thickness.

WojciechKosiakDominikSwiętonMaciej 2010sudy presented the reference values for thyroid isthmus thickness in prepubertal healthy children. Ultrasound evaluation of the isthmus seen to be very useful in the diagnostic process and monitoring of thyroid diseases, especially the diffuse ones. In our study, we evaluated isthmus thickness in a healthy population of prepubertal children from a seaside region. A total of 402 healthy children (214 boys and 188 girls) aged 7–12 years, underwent ultrasound examinations of the thyroid. We propose the following maximum values for isthmus depth: from 2.6 mm for

boys at the age of 7–9 years to 3.3 mm for those aged 10–12 years and from 2.7 mm to 3.5 mm for girls, respectively.

Hyung-sun won and seung-hohan (2013) in adult Korean cadavers reported that location and morphometric characteristics of the thyroid isthmus. One hundred thyroid isthmuses of adult Korean cadavers (gender 58 males and 42 females, mean age 62.9 years, range 19–94 years) were used for this study. The distances from the inferior border of the cricoid cartilage to the superior and inferior margins of the isthmus were 4.9 ± 3.7 and 20.8 ± 5.8 mm, respectively. The width, height, and thickness of the thyroid isthmus were 11.1 ± 6.2, 15.9 ± 5.8 and 3.4 ± 1.7 mm, respectively. The thyroid isthmus was located on the 2nd to 4th, 1st to 3rd, and 1st to 4th tracheal rings, in 22, 18 and 18 % of the specimens, respectively. These results are expected to further the current knowledge of the location and morphometry of the thyroid isthmus and provide helpful information for surgical procedures in this region.

Abu sadatmohammednurunn, university of Toronto 2013 morphometric study of the isthmus of thyroid gland in bangladshicadaverthe sample size(60) and age group (10->50) and the isthmus was cut of thyroid gland . the isthmus of thyroid gland found 82.2% casesmorphological difference was found with increasing age but not with sex .

In other study Sultana 2011 north south university morphometric bangladshi (48 male 12 female in 11-70 years) there was insignificant difference of isthmus of thyroid gland among different age(in age under19 and above to50) .and significant at age (19 -45).

Another study about agenesis of thyroid isthmus in patient with graves disease and solitary nodules (Omer Faruk,MohamedAsikandMuammerKaraayvaz)That reported the geneticfactors,mutations in the geneand defect in embryological development seen to play an important role in thyroid isthmus agenesis.They

take 41 year –old was admitted to the endocrinology department with a history of palpation .the history relieved graves' disease ,in surgery operating finding s confirmed that the right and left lobes were completely separated due to isthmus agenesis.

Another study for thyroid isthmus done by Hanhn SY et al 2009 .Ultrasound findings ofpapillary thyroid carcinoma originating in the isthmus . comparison with lobe originating papillary thyroid carcinoma .48patientsofpapillarythyroidcancer located in isthmus and 96 patient of papillary thyroid cancer located in lobes.allofthemhad undergone preoperative ultrasound of the neck. Total thyroidectomy with by lateral central lymph node dissection and postoperative follow-up for at least two years.

EunSookKo and JungHee Shin2014Ultrasound finding s of papillary carcinoma originating in the isthmus comparison with lobe originating papillary thyroid carcinoma ,noted that the papillary thyroid carcinoma originating in isthmus is most likely to have extra thyroidal extension than those originating from the lobes.

Chapter three
Materials and methods

Chapter three

Material and Methods

3.1Materials

.3.1.1study design

This descriptive study research .designed to evaluate isthmus thickness in different age(between 18-30years) and comparing with thyroid volume.using ultrasound B-mode scan for thyroid .

3.1.2study area

This study was conducted inAlmasoudia Hospital , at the AlgaziraState .Republic of Sudan .

3.1.3Study duration

This study is conducted during the period extending from December 2018to March2019.

3.1.4 Study subjects

3.1.4.1 Inclusion criteria

All volunteers examine for thyroid ultrasound scan and their result were normal echo texture without nodule or any masses affected it .

The sample include both gender in age between (18-20)years.

3.1.4.2 Exclusion criteria

Any volunteer have abnormal thyroid,elderly ,children and age below 18 year and above 30 years were excluded from this study .

3.1.5 Sample of study

This study was conducted on 51 person (11 male and 4o female) with normal thyroid condition in age between (18-30) years .

3.1.6 Ultrasound equipment

The ultrasound device is Mindary 1100 is a black-and-white system withlinear probe 7-9 MHz and personal computer for data storage and analysis.

3 1.7Sampling technique

The study samples were selected by convenience technique.

3..2Methods

3.2.1Scanning technique

In this research This is the first scanning technique using linear probe in the following sequences :the patient lying supine , with pillow,underneath the shoulders to extend the neck slightly , allowing the head to rest on the examination able . the normal thyroid gland is uniformly echogenic relative to the over line strap muscles of the neck .

A highly frequency (10-15MHZ)liner transducer is used .the highest frequency is used while still allowing adequatesonographicpenetration .

The technique was applied according to stander protocol of scanning(Hyung.S.,*et al* 2013).

3.2.2 Data collection

Demographic data were obtained from all participants direct interview and data sheetwas designed which include many variablesof ages , isthmus thickness,right lobevolume (depth , weight and length) and left lobe volume (depth ,weight and length) and total volume of thyroid.

The data collected in the data sheet and then storage in the computer in form of Excel sheet.

3.2.3 Statistical analysis

All data were analyzed by using statistical package for social science (SPSS) version 16 , the results was expressed as mean+/- SD, T-test was used to compare between means and the levels of significance was detected at P*value of< 0.05 .

3.2.4Method of interpretation

-The measurements was done by one sonologist withexperience of one year

-The measurement were evaluated once

-The relation between values of isthmus thicknesswereevaluated in different age(between 18-30 years)and compare it with thyroid volume .

3.2.5Ethical consideration

Permission of this study was approved by completely ethical , permission of hospital managers was taken before the beginning ,verbally consent and direct questionnaire from participant .

Chapter four

The Results

Chapter four

The Results:

Table (4.1) frequency distribution of age

Age	Frequency	Percent	Valid Percent	Cumulative Percent
18-22year	24	47.1	47.1	47.1
23-27year	20	39.2	39.2	86.3
28-30year	7	13.7	13.7	100.0
Total	51	100.0	100.0	

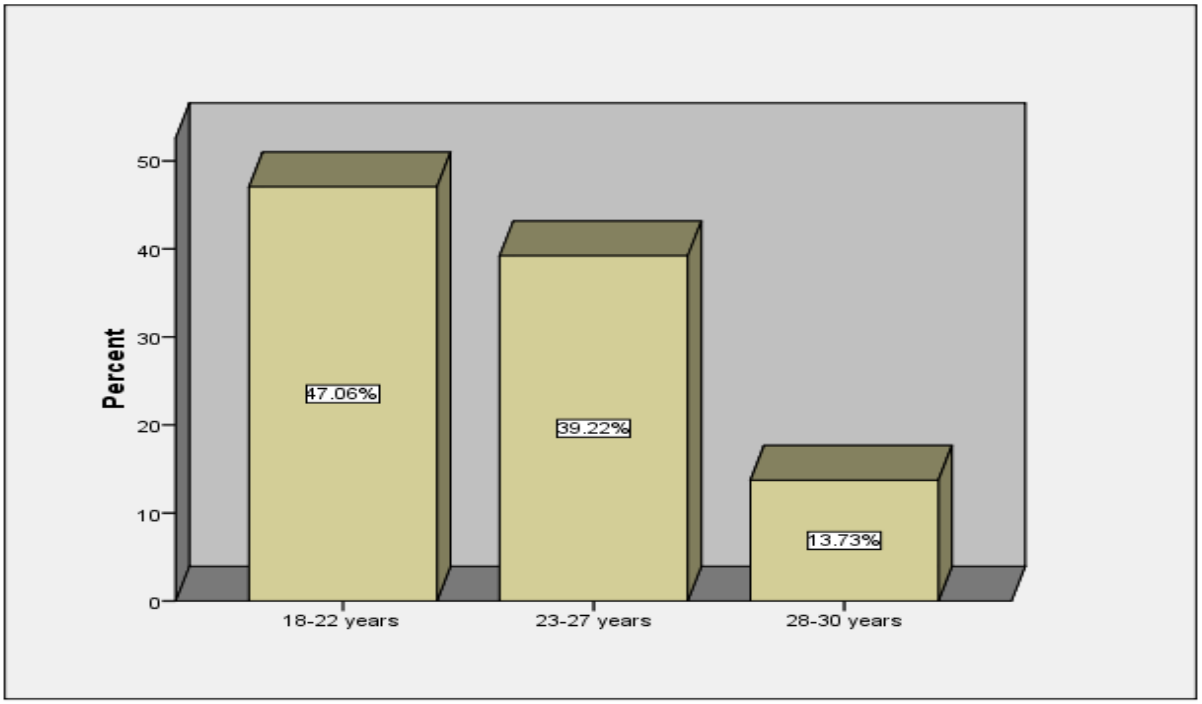


Figure (4.1) frequency distribution of age

Table (4.2) frequency distribution of gender

Gender	Frequency	Percent	Valid Percent	Cumulative Percent
Male	11	21.6	21.6	21.6
Female	40	78.4	78.4	100.0
Total	51	100.0	100.0	

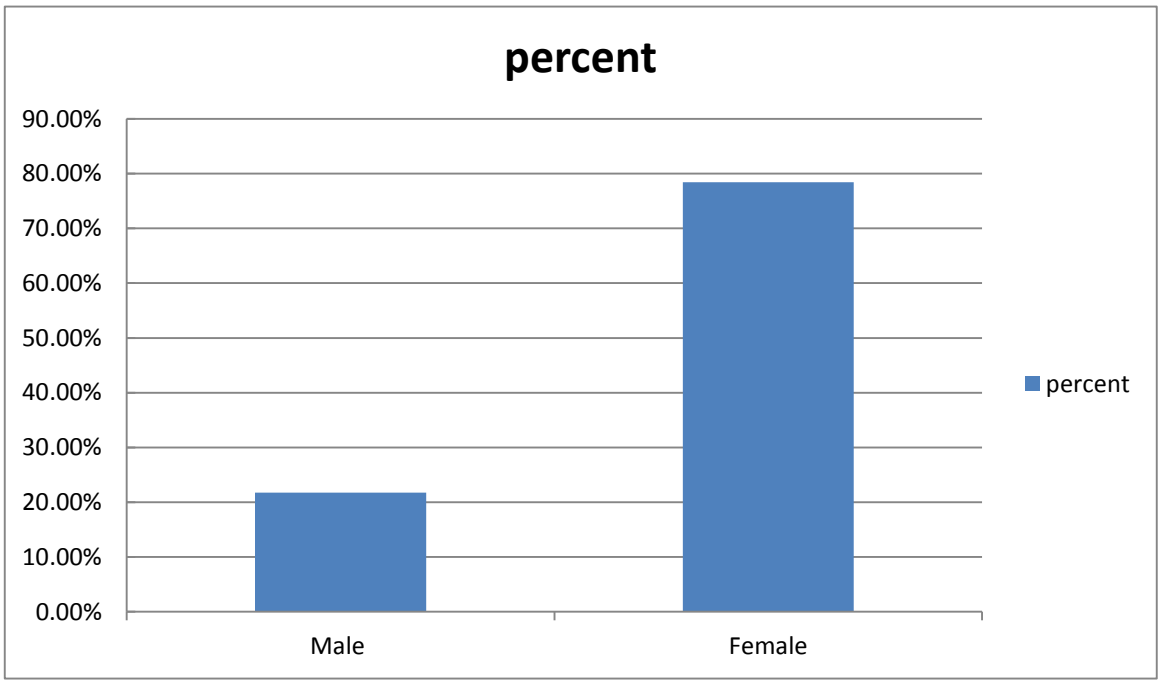


Figure (4.2) frequency distribution of gender

Table (4.3) descriptive statistic (age and thickness) minimum, maximum, mean± Std. Deviation

Variables	N	Minimum	Maximum	Mean	Std. Deviation
Age	51	19.0	30.00	23.2	2.96
Length of right lobe	51	2.20	4.10	3.18	0.32
Width	51	0.90	2.10	1.33	0.28
Depth	51	0.70	3.20	1.38	0.35
Volume of right lobe	51	10.5	64.3	30.7	10.5
Length left lobe	51	2.40	4.30	3.30	0.29
Width left	51	1.00	1.90	1.31	0.21
Depth left	51	0.90	1.90	1.45	0.25
Volume left	51	14.7	52.2	33.4	9.92
thickness	51	2.40	5.30	3.40	0.60
Valid N (listwise)	51				

Table (4.4) Compare mean thyroid volume and isthmus thickness in different age group

Age		Isthmus thickness	Right volume	Left volume	
18-22 years	Mean	3.33	29.3	29.3	p> 0.01
	Std. Deviation	0.68	11.9	9.57	
23-27 years	Mean	3.44	32.8	37.2	
	Std. Deviation	0.53	10.0	8.17	
28-30 years	Mean	3.54	29.6	36.3	
	Std. Deviation	0.54	5.28	11.5	
Total	Mean	3.40	30.7	33.4	
	Std. Deviation	0.60	10.5	9.92	

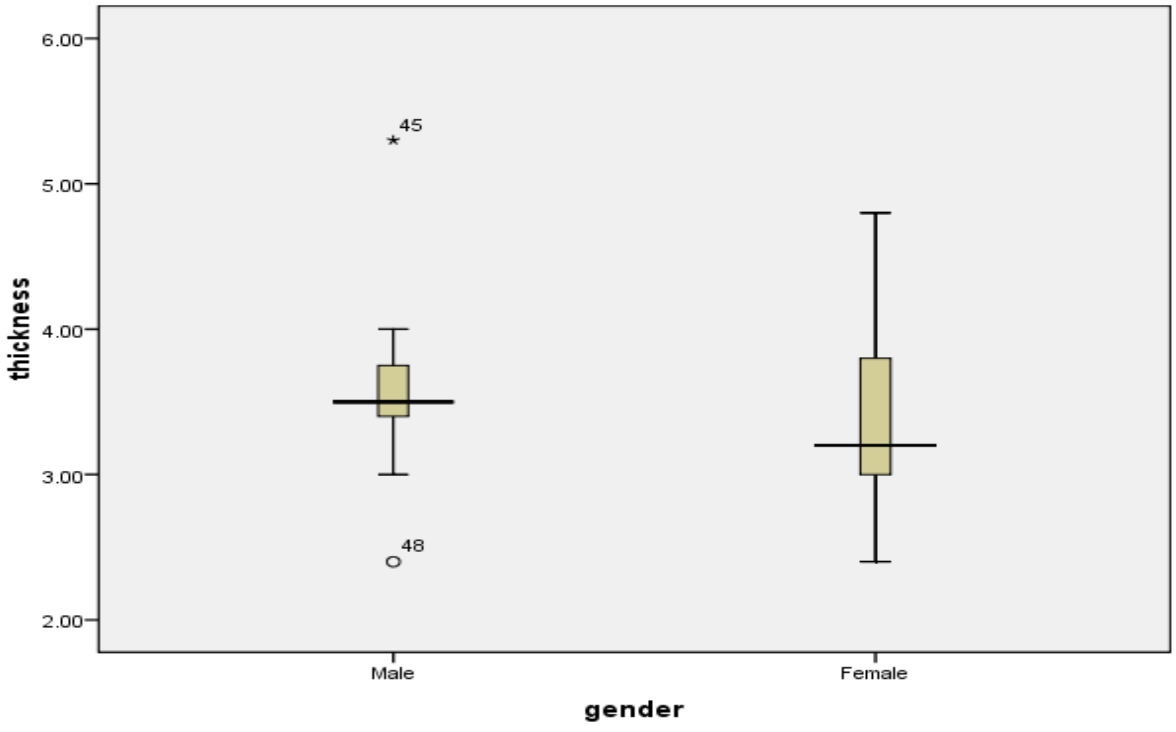


Figure (4.3) plot box shows mean isthmus thickness in different gender

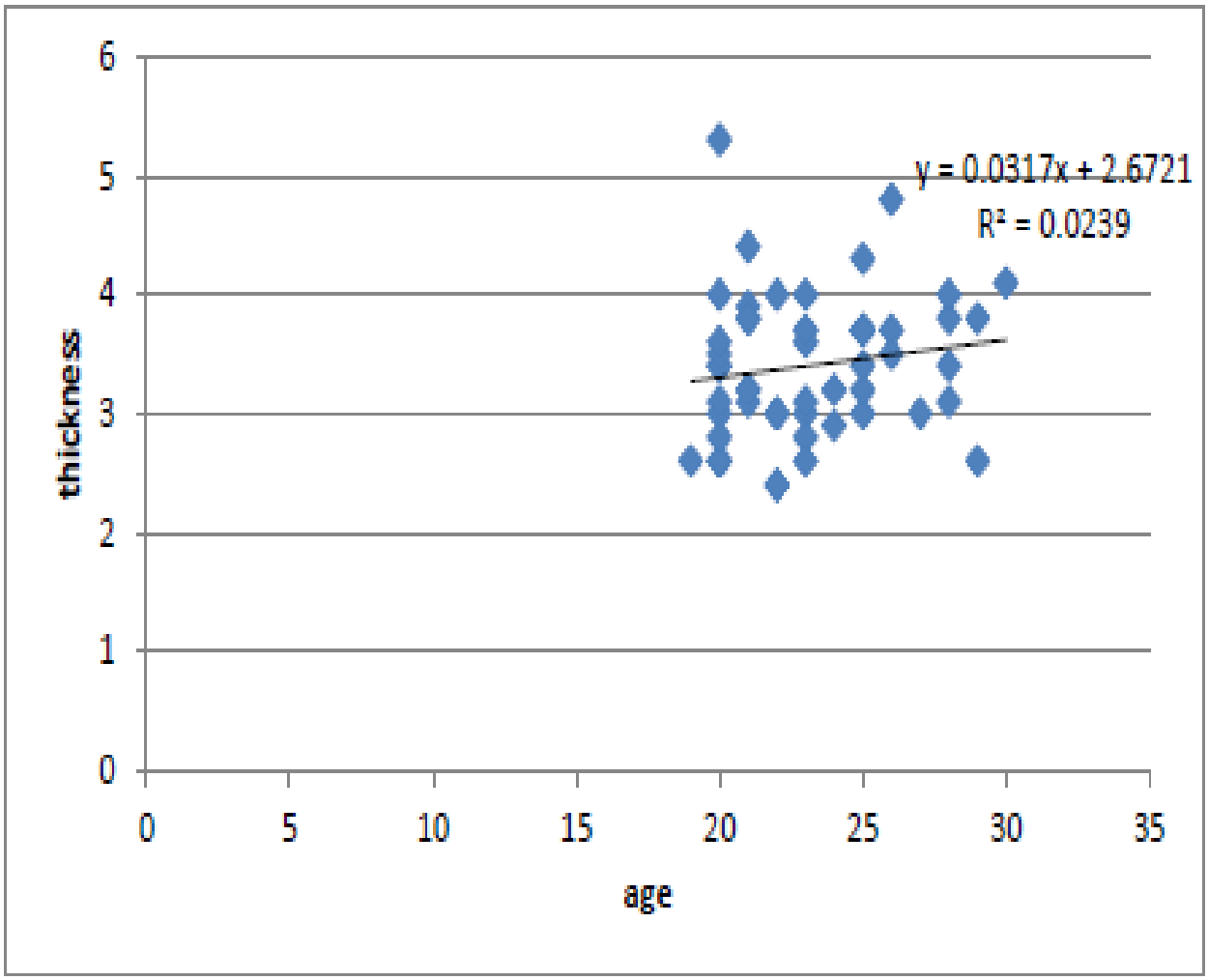


Figure (4.4) scatter plot shows relationship between age and isthmus

Thickness in hall sample

Table (4.5) correlation between the isthmus thickness and total Volume

		thickness	Total volume
thickness	Pearson Correlation	1	.299*
	Sig. (2-tailed)		.033
	N	51	51
*. Correlation is significant at the 0.05 level (2-tailed).			

Chapter five
Discussion, Conclusion, Recommendations

Chapter five

Discussion,Conclusions and Recommendation

5.1Discussion

This isdescriptive study aim to Evaluate thenormalthyroidisthmus thickness inSudanese adults by using ultrasonography,I take 51 person (40 female and 11male)which having normal thyroid.

Table (4-1) and table(4-2)showed the frequency distribution of age , the frequency of age is (51) and valid percent of it is 100 ,also explained by figure .

Table (4-2) showed frequency distribution of gender , (male and female) the frequency distribution of male (11) and valid percent is (21.6) ,the female frequency is (40) and valid percent (78.4) also explained by figure .

Table (4-3) showed descriptive statisticofvariablesincludeage, isthmus thickness, the(length,width, depth and volume)of right and left lobe separately.it was found to be the mean volume of right lobe (30),the mean of isthmus thickness is(3.4) andmeanvolume of left lobeis(33).the measurements related to normal value which was mentioned in literature review(Diagnostic ultrasound ,4th edition 2011)

Table (4-4) to comparing between thyroid volume of right and left lobe and isthmus thickness in different age . show the total mean of isthmus thickness, right volume and left volume is (3.40 ,30.7 , 33.4) and stander deviation (0.606 , 10.5 , 9.92) respectively , takethe(P. value > 0.01 *) .

There is significant difference between the isthmus thickness by increasing of ageand there is difference between the right and left lobe according to

age.Thisagree with Ismatet al 2010 reported that the isthmus thickness increasing with age and the right lobe of thyroid is bigger than the left lobe.

Figure (4-3)plot box shows mean isthmus thickness in both genders.

Figure (4-4) scatter plot shows linear relationship between age and isthmus thickness in hall sample(51).

As the age increase the isthmus thickness was also increased.(This find agree with Barrere et al from France2009 reported that : there is positively correlated with age).it increased by 0.039mm starting from 2.7mm in any five years.

Table (4.5) correlation between isthmus thickness and total volume show significant correlation at (0.05 level (2-taild) .(This agree withHegedus et al 2011 reported that there is positively correlation between the isthmus thickness and thyroid volume).

5.2 Conclusion

- This is study done to measure the isthmus thickness in Sudanese adults and compare it with age and volume of thyroid .The study taked 51 volunteers without any complaining or physical examination finding regarding the thyroid disease were included in the study.in which 11male and 40 female, The range of age between 18-30years.The result show that isthmus thickness is increase with age .it increase by 0.03 mm starting from 2.7 mm in any five years .there is significant correlation between isthmus thickness and total volume at the 0.05 level .The study recommended to making the examination of the thyroid ultrasound to be as a routine approach for early detecting any abnormality.and increasing the number of sample also taking another parameter like body surface area and body mass index

5.3Recommendation:

- Making the examination of the thyroid ultrasound to be as a routine approach for early detecting any abnormality.
- The measurement were done by one sinologist taking one reading ,for standardization resultsthe researcher recommended done anotherresearch by two sonographer with two readings and compare between them .or one sonographer take two or more measurement and gives the means between them for proper result.and increasing the number of samples.
- This is just high line study ,More research should be performance take large sample and other parameters like :body surface area (BSA) ,body mass index (BMI) , height and weight .
- Comparingbetween gender (male and female)taking equal number sample for them .
- More research should be performance take the relation ship between thyroid isthmus and smokers or oral contraceptive drug.
- further study about the use of ultrasound comparing to nuclear medicine.

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Appendices

6.2Appendexes

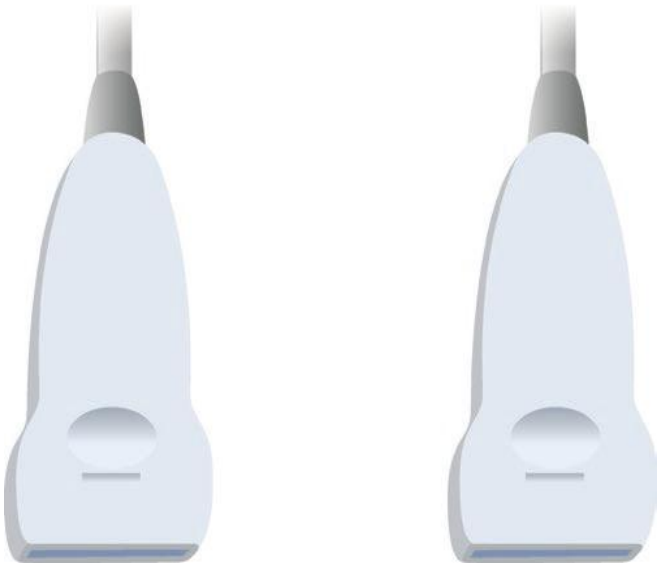
Appendex(1)Data collection sheet

Number	**Age**	**gender**	**Isthmus thickness**	**RT lobe**			LT **lobe**		
				Depth	width	Length	depth	width	Length

Appndex (2)

Ultrasound equipment:

A- DP1100 PLUS Portable ultrasound system from MindaryMedical



B:Linear probe using for imaging thyroid by ultrasound

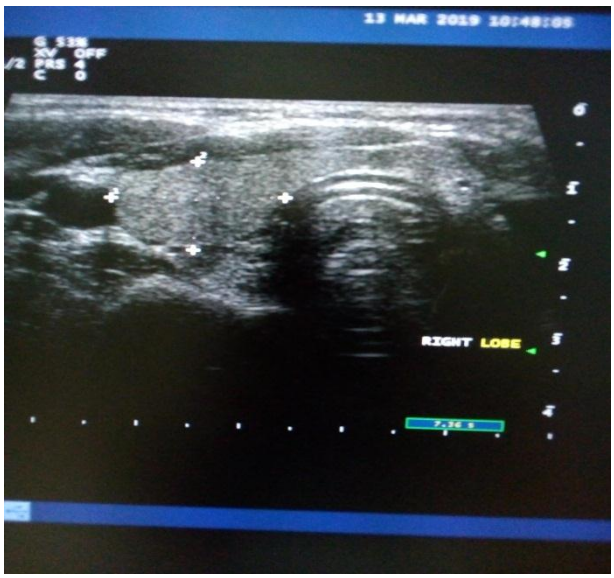
Appendix(3)

Cases

A

B

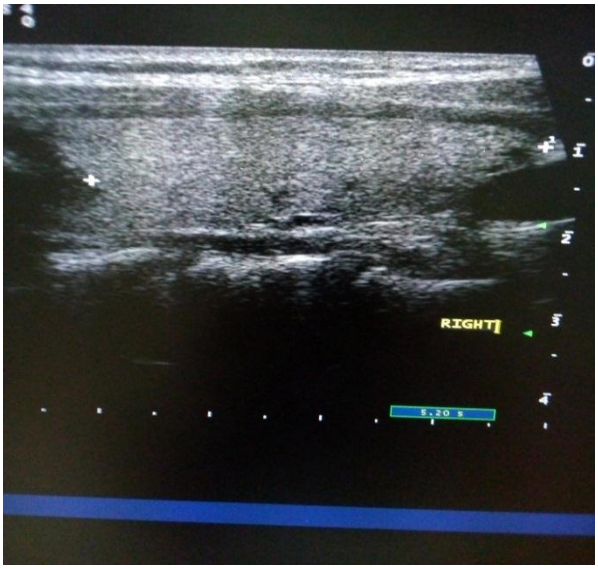
Image NO (A,B) show transverse view of thyroid (A: measuring thyroid isthmus thickness(2.8cm) in girl 23 years)ultra sound finding show normal thyroid and thyroid isthmus .



C

D

Image (C,D) same volunteer measuring depth(1.6-1.2 cm) and width(1.6-1.4) of right and left lobe respectively .



E F

Image (E,F) same volunteer measuring the length of right(3.1cm) and left lobe (3.4cm)respectively .

A B

Image NO 2 (A,B) show transverse view of thyroid (A: measuring thyroid isthmus thickness(3.7cm) in girl 25 years) ultra sound finding show normal thyroid andnormal thyroid isthmus.

C D

Image (C,D) same volunteer measuring depth (1.5-1.6 cm)and width(1.3-1.4cm) of right lobe and left lobe respectively .

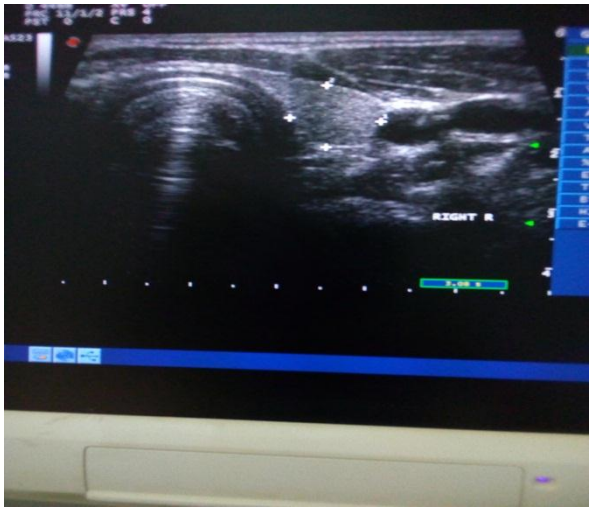
E F

Image (E,F) same volunteer measuring the length of right and left lobe (3.3 -3.4cm)respectively .

A B

Image NO3 (A,B) show transverse view of thyroid (A: measuring thyroid isthmus thickness(3.7cm) in male 25 years) ultra sound finding show normal thyroid and thyroid isthmus.

C



D

Image (C,D) same volunteer measuring depth (1.3-1.2 cm)and width(1.2-1.4 cm) of right lobe and left lobe respectively.

E

F

Image (E,F) same volunteer measuring the length of right and left lobe (3.4 -3.4cm) respectively.