

# Thyroid Nodules Evaluation with Sonography

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**Abstract:** *Thyroid nodules are common findings in clinical practice and occur in more than 50% of adult population; nevertheless, only 7% of thyroid nodules are malignant. The aim of this study were to assess the value of ultrasound [US] in the detection of nodules, to characterize the thyroid nodules patterns by ultrasound and to differentiate between benign and malignant nodules. A total of 120 patients [31 women, 89 men] with nodules ages ranged [16 – 60] years were included in the study consecutive patients had undergone thyroid US at Sudir hospital, Riyadh, KAS, evaluated the following characteristics on US images: nodule size, presence of spongiform appearance, shape, margin, echo texture, echogenicity, and presence of calcification. The total ultrasound score was obtained by summing up each ultrasound findings for nodules. US revealed that size of thyroid nodules [from 40–60 mm] 17%, above 60 mm 83%, the appearance in diagnosis of thyroid gland nodules such as thyroid cyst 31 patients, Hyperplasia & multi nodular goiter 29 patient, de Quervain 3 patients, Hashimoto's thyroiditis 34 patients, Thyroid lymphoma 2 patients, Adenoma 18 patients, Carcinoma [malignant] 3 patients, [70%] of nodules are solid, whereas the remaining [30%] exhibit various amounts. The ultrasound diagnosis, detects and gets main signs about the types of thyroid nodules, thus the study advices to do differential diagnosis by taking (FNA) biopsy, Shape, margin, echogenicity, and presence of calcification are helpful criteria for the discrimination of thyroid nodules.*

**Keywords:** Thyroid nodules. Ultrasonography, echogenicity, Adenoma, Biopsy

## 1. Introduction

Thyroid nodules are common and occur in up to 50% of the adult population; however, less than 7% of thyroid nodules are malignant. US is the most sensitive method for diagnosing intra thyroid lesions. It can depict 2-mm cystic lesions and 3-mm solid intra thyroid lesions. The challenge is differentiating a few malignant nodules from common benign nodules. Despite US's ability to clearly identify nodules, no single US criterion is reliable in differentiating benign ones from malignant thyroid nodules. Even so, many US features may aid in predicting the benign or malignant nature of a given nodule.[1, - 6] Most cystic lesions are benign masses that contain internal debris with a solid component that is hyper echoic relative to the adjacent thyroid tissue. Typically, benign nodules are well defined (96% benign). Lesions demonstrating eggshell calcification and a thin echo lucent halo around the entire lesion are most often benign. Some authors have found that the halo sign is present in 21-33% of thyroid cancers. Typically, malignant nodules are mostly solid and hypo echoic, with irregular margins and, at times, fine punctate calcification in the nodule, particularly in papillary carcinomas. Thyroid cancer has a hypo echoic texture, as compared with that of a normal thyroid gland, because a malignancy contains many cells that lack colloid. Carcinoma is hypo echoic in 68-100% of patients; however, a hypo echoic nodule is more likely to be benign than malignant, because benign nodules are highly prevalent in the general population. Recent research has revealed a correlation between osteopontin messenger RNA expression and the formation of micro calcification seen on US in papillary thyroid carcinomas.[7] Considerable overlap may exist between benign nodules and malignant nodules.

Some malignant nodules can have a cystic component. Cystic degeneration is reported in 4-33% of thyroid cancers. A retrospective review of 624 patients examined the usefulness of surgeon-performed US to predict benign thyroid nodules. About 10% of patients were found to have benign nodules (classified as 1-4 cm, isoechoic, with regular borders, a cystic component, and no micro calcifications) through this procedure, leading the authors to conclude that patients without clinical risk factors and significant features of benignity can forego further fine needle aspiration and thyroid lobectomy and can be monitored through follow-up US examinations.[8] Solid sub centimeter nodules that are taller than wide, are hypo echoic or markedly hypo echoic, and have coarse micro calcifications and macro calcifications are associated with a risk of malignancy, indicating the need for further assessment.[9] Ultrasonography (US) is an excellent imaging technique for identifying thyroid nodules, which are very common in clinical practice. The incidence of thyroid nodules detected by US ranges from 10% to 67% [10-13]. Currently, different guidelines have been used for increasing the diagnostic accuracy of US [14-17].

The aim of this study were to assess the value of ultrasound (US) in the detection of nodules, to characterize the thyroid nodules patterns by ultrasound and to differentiate between benign and malignant nodules.

### 1.1 Material and methods

#### 1.1.1 Patients

This study was based on patient data collected from Sudir hospital it is far from Riyadh city about (150) kilometres on northern of KAS.. A total of 120 consecutive patients with

both palpable and nonpalpable nodules (31) females and (89) males, which ages ranged (16 -- 60) years old who had undergone thyroid US was considered for the study.

**1.1.2 US Examination Technique**

All US examinations were performed with The ultrasound machine using on this study to scan thyroid gland for all patients is: Siemens Adara Sonoline ultrasound machine and more information about it, transducer linear array 7 MHz – linear convex array 3,5MHz available color Doppler in this machine 12 inch monochrome display monitor Part No :5927749- LE700 Rating :12V-+3%----3,5A Serial No : 58745423Model No :Mc12 H6J3- Mfg Date : 2002.

Aloka SSD – 500 ultrasound machine and the information about it, transducer linear array 7 MHz – linear convex array 3.5 MHz Model No: 21M12107. Measured by planimetric ultrasound, with the patient resting in supine position, in addition to assessing the echogenicity pattern of thyroid gland, the measurements were made to calculate two lobes and isthmus, on the anteroposterior and transverse. The patient is typically examined in supine position, with neck extended, small panda placed under the shoulders to provide pater exposure of the neck, particularly in the patient with short stock habits. Must should wear comfortable and loose-fitting clothing for your ultrasound exam, or you will need to remove all clothing and jewelry in the area to be examined thyroid gland, it is best to ask the patient to wear gown during the procedure. Also must a clear gel is applied to the area of the body being studied to help the transducer to secure contact with the body and eliminate air pockets between the transducer and skin. The sonographer (ultrasound technologist) or radiologist then presses the transducer firmly against the skin and sweeps it back and front over the area of interest.

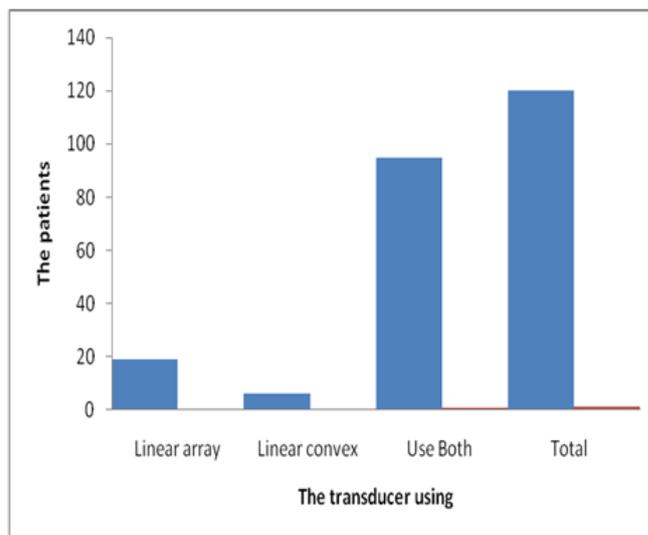
The thyroid gland must be examined thoroughly in both transverse and longitudinal plane. Aiming of the lower poles can be enhanced by asking the patient to swallow, which momentarily raises the thyroid gland and isthmus in the neck. The examination should also be extended laterally to include the region of the carotid artery and jugular chain lymph nodes, and superiorly to visualized submandibular adenopathy , and inferiorly to define any pathology superoclavicular lymph nodes.

**1.1.3 Data collection**

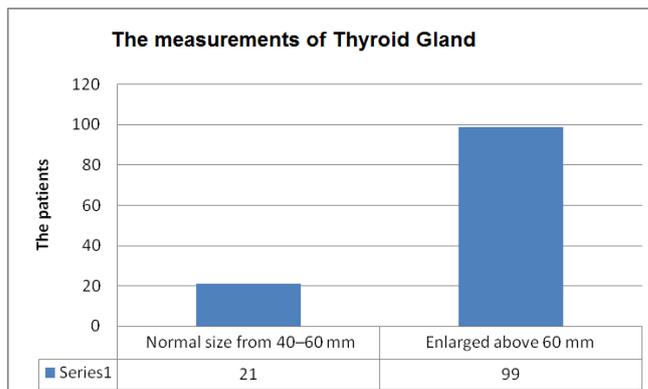
Data collected includes age, gender, and ultrasound finding such as thyroiditis, thyroid cystic or solid or mix, calcification, size and echogenicity. Also clinical details as swelling of neck and weight loose. Further, probe choice, color Doppler, position, measurement, shape and contents. The data collection used during this study is the visiting patients, file sheet of the patient, and pervious their medical reports. We a records the patients who received to the Hutat Sudir Hospital, this is study performed in above center during two years from January 2007 to December 2008. Statistically computer analysis, using graph and percent programmed.

**2. Results**

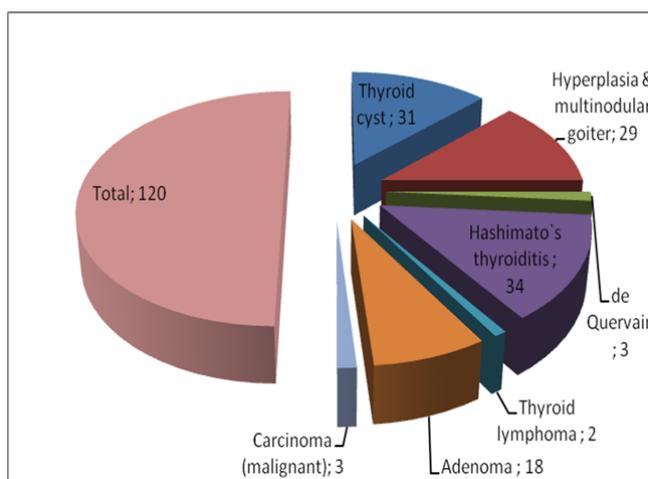
**2-1US Characteristics of All Nodules:**



**Figure 1:** shows the best using both transducers to diagnosis thyroid gland nodules



**Figure 2:** Appear the distribution of the measurements of thyroid gland nodules patients



**Figure 3:** Shows the Sonographic appearance in relation to final diagnostic of thyroid nodules patients

**3. Discussion**

The echogenicity of thyroid gland on this study appear abnormal change as hyper echoic or isoechoic this is high probability benign nodules, the hypo echoic sign give

intermediate probability malignant nodules.. However, hypoechoic nodules are benign A hyper echoic nodule is more likely to be benign. The isoechoic nodule (visible because of peripheral sonolucent rim that separate it from normal parenchyma) has intermediate risk of malignant [18]. in this study normal internal texture contents of the thyroid gland has high echogenicity than the near organs, and abnormal included purely cystic, cystic with thin septa and mixed solid with cystic, A nodule that has a significant cystic component is usually a benign cystic nodule (adenomatous), that undergone degeneration or hemorrhage and percent clinically with a rapidly growth. Often tender neck mass [19] In this study, the halo in the thyroid gland mass divided in two features, thin halo mostly is benign disease, and thick incomplete halo is intermediate probability malignant nodules. A peripheral sonolucet halo the complete or incomplete surround a thyroid nodule maybe percent in (60%) to (80%) of benign nodules and (15%) of malignant nodules Color or power Doppler imaging have demonstrated that the thin, complete peripheral halo, which is strongly suggestive of benign nodules represents blood vessels coursing around the peripheral of the lesion [20]. This study clear margin in thyroid gland deal to two section well define contour this high probability benign disease, the and poorly define contour this intermediate probability cancer, .Benign thyroid nodule tends to have sharp well-define margin, whereas malignant lesions tend to have irregular or poorly define margins.

For any given nodule, the appearance of outer margin can not merely on to predict the histological feature because exception to these general trends has been identified. This study appear the calcification as eggshell calcification and coarse calcification are mostly benign nodules, when seen micro calcification this is deal malignant disease. Calcification was detected in (10-15%) of thyroid nodules but the location and pattern of the calcification has more predictive value in distinguishing benign from malignant lesion. Peripheral or eggshell-likely, calcification is perhaps the most reliable feature of benign nodule, but unfortunately, it accure in only a small percentage of benign nodules. Scattered echogenic foci of calcification with or without acoustic shadows are more common. When calcification is large and a course, the nodule is more likely to be benign. When the calcification are fine and punctuate, however, malignant are more likely Based personal experience and literature data, of the various Sonographic feature, micro calcifications shows the highest accuracy (76%) specificity (93%) and position predictive value (70%) for malignant as single sign, however, sensitivity detection of malignant [21]. Doppler play important role on ultrasound diagnosis, in this study the peripheral flow pattern mostly was benign nodules, internal flow pattern perhaps malignant nodules. As result Doppler examination may provide useful diagnostic information in thyroid gland nodules .With currently available high sensitive Doppler instruments, the rich vascularity of the gland can be seen and is most pronounced at superior and inferior poles [22].

The age distribution of this study, ranged from (16 – 60) years, (26 – 40) years 69 patients), (41 – 60) years 27

patients and age group above 60 year are 11 females patients. Papillary cancer is prevalent in young patients [23]. Diffuse enlargement of the thyroid in a young middle-aged woman [24]. Principally, women older than 50 years are more affected [25].The gender distribution of study, 83 patients male and female 37 patients, male more visit department than female, because the tradition and the habit of KSA not allow to visit department when male radiologist, except emergency cases, all critical condition patients shown mostly females. Females are affected more than males. Use both transducer, linear array and convex array, in this study appear linear array are use in 9 patients, gives excellent Sonographic result of thyroid gland, the linear convex array use in 9 patients and gives result patter than nothing, when use both probes this good way of Sonographic diagnosis to thyroid gland. High frequency transducers (7.5 -15) provide both deep ultrasound penetration up to 5cm – and high – definition image, with a good resolution.

Thyroid is one of the most vascular organs of the body [22]. The study record when the thyroid gland size change this is sign of thyroid disease, must give proper care and need follow up the patients, to show the enlargement increase or decrease size. thyroid volume measurements is useful for goiter size determination in order to assess the need surgical procedures to prompt calculation of the dose of the need in treating thyrotoxicosis, when AP diameter is more than 1cm in child and more than 2cm in adults that is thyroid gland may be considered enlarged.

In this study thyroid cyst was shown in 31 patients, as degeneration cells and accounted 26% from all patients of thyroid nodules. Thyroid cysts represent 15 – 25 % of all thyroid nodules. True thyroid cysts lines with in the epithelium are rare. Most thyroid cysts are macro nodules which undergo degeneration with accumulation of serous fluid, colloid substance, or blood. Clear hypoplasia and multi nodular goiter in 29 patients, Sonographic seen diffuse enlargement size and volume in thyroid gland, the common name is goiter and account for 24% from all patients of thyroid gland nodules .The thyroid gland enlargement is known as goiter. The reason or its etiology includes iodine deficiency (endemic), disorder of hormone genesis (hereditary families), and poor utilization of iodine as a result of medication, whereas hyperplasia leads to an overall increase in size or volume of the gland.

This is followed by involution of the thyroid gland which results in dilated follicles filled with colloid; this condition is referred to as diffuse colloid or simple goiter. Sometime this sequence of hyperplasia and involution occurs in cycles this does not affect the gland uniform, on other process some acini (follicles) may rupture from continued distention and be replace with focal scarring. In this case, areas hyperplasia, involution and scarring all may co-exist in the same gland producing the multiple colloid adenomatous goiters.

Generally diffuse and multi nodular goiter produces normal amounts of hormone. Usually the patient presents with an enlarged gland and pressure symptoms related to the trachea and esophagus. Multi nodular goiter (MNG) can grow to

enormous size [26].

Hashimoto's thyroiditis assess in 34 patients, shown as diffuse enlarged size with more hypo echoic texture in thyroid gland, also known as goiter and account for 28,5% from all thyroid nodules patients. Most common form of thyroiditis is chronic autoimmunity lymphatic (Hashimoto's) thyroiditis. It typically occurs as a pain less, diffuse enlargement of the thyroid in a young middle-aged woman, often associated with hypothyroidism. Hashimoto's can take many course. It can go into spontaneous remission, remain stable for years or progress to several hypothyroidism.

The typical Sonographic appearance of the Hashimoto's thyroiditis is diffuse glandular enlargement with homogeneous but coarse parenchymal echo texture generally more hypo echoic than a normal thyroid. These finding is nonspecific and difficult to differentiate sonographically from multi nodular goiter. Clinical and lab data provide definitive diagnosis [24]. Acute and subacute (de Quervain) thyroiditis in 3 patients, Sonographic seen as diffuse enlarged edema with coarse hypo echoic in thyroid gland, also known goiter, the account for 2,5% from all nodules. Acute suppurative (de Quervain thyroiditis) is rare inflammation disease that is usually caused by bacterial infection. Sonography can be useful in selected cases to detect the development of frank thyroid abscess. Sub-acute granulomatous thyroiditis is spontaneously remitting normal or decrease vascularity due to diffuse edema of the thyroid. Sonography can be useful for the diagnosis [22]. Thyroid lymphoma clear in 2 patients, the Sonographic appearance multi hypo echoic areas surround thyroid gland or near it, account for 1,5% from all thyroid gland nodules patients. Thyroid lymphomas are almost always non-Hodgkin lymphomas, and they account for 4-10% of thyroid malignancies. Principally, women older than 50 years are affected, typically in association with Hashimoto thyroiditis.

Patients usually present with a rapidly growing neck mass, which may cause symptoms of obstruction, such as dyspnea and dysphagia. The prognosis depends on the stage of the disease at diagnosis. Signs of cervical invasion in the late stages are also similar to those of an undifferentiated thyroid carcinoma [25]. The thyroid adenoma in 18 patients, Sonographic has seen solitary hypo echoic with regular contour or thin halo without calcification, the account for 15% from all thyroid nodules. Adenomas are benign tumor of the thyroid follicles which commonly occur in young adults, usually adenomas is solitary, well encapsulated lesion. The remainder of the gland appears normal. Hyper function adenomas usually result in "hot lesion" or radioisotope nuclear medicine. The degeneration of adenomas represent simple cyst of thyroid, this is rare, and most thyroid cyst are complex. Both benign and malignant lesion can have cystic component. Ultrasound scan used to distinguish a cystic from solid mass is generally not of much clinical value. Hemorrhagic cystic are most often the result of acute hemorrhage within follicular adenoma.

According to pathologic analysis, this lesion appears complex (cystic and solid). Fluid level can sometimes be

seen in cystic component. Fluid in thyroid is most consistent with degeneration adenomas however malignant can't be excluded [27]. The carcinoma appear in 3 patents, the general Sonographic feature as hypo echoic, heterogeneous, irregular contour or halo, tortuous blood supply and see micro calcification, after analysis all three biopsies of cancer patients appear benign nodules there are not matching to the features of malignant, the account for 2,5% from all thyroid gland nodules patients In most patients with primary thyroid cancer, the tumors are of epithelial origin and derived from either the follicular or the para follicular cells.

Malignant thyroid of mesenchymal origin are exceedingly rare, as metastasize to the thyroid, and have low mortality rate. Although it can occur in patients of any age, papillary cancer is especially prevalent in young patients. Females are affected more than males. There is no unique Sonographic feature that allows differentiation of follicular carcinoma from adenomas, which is not surprising, giving the cytological and histologic similarities of these two tumors [23].

#### 4. Conclusion

The ultrasound diagnosis detects and gets main signs about the types of thyroid nodules, thus the study advices to do differential diagnosis by taking (FNA) biopsy for histology or surgically during thyroidectomy, to confirm that the mass is either benign or malignant. Shape, margin, echogenicity, and presence of calcification are helpful criteria for the discrimination of malignant from benign nodules; the diagnostic accuracy of US criteria is dependent on tumor size Using ultrasound, thyroid nodules can be characterized effectively. The number of the US features used in this distinction varies in respect to the nodule size.

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