Introduction
The Thyroid gland is located in the anteroinferior part of the neck (infrahyoid compartment) in a space outlined by muscles, trachea, esophagus, carotid arteries and jugular veins. The Thyroid gland is made up of two lobes located along either side of trachea and connected across the midline by the isthmus, a thin structure draping over the anterior tracheal wall at the level of junction of the middle and lower thirds of the thyroid gland. 10% to 40% of normal patients have a small thyroid (pyramidal) lobe arising superiorly from the isthmus and lying in front of the thyroid cartilage[1].

Thyroid gland is involved by various pathological entities including benign and malignant lesions that represent some of the most heterogeneous abnormalities in the head and neck [2].

Thyroid diseases can present clinically with one or more nodules. Various nodular diseases are:

**Hyperplasia and Goiter:**

Approximately 80% of nodular thyroid diseases are due to hyperplasia of the gland, and it occurs in up to 5% of any population [3]. When hyperplasia leads to an overall increase in size or volume of the gland, the term “Goiter” is used.
Adenomas:

They represent about 5% - 10% of all nodular diseases of the thyroid and are more common in females [4].

Carcinomas:

Primary thyroid malignancies are mainly of epithelial origin and are derived from the follicular or parafollicular cells. Morphologically, 75%-85% of thyroid malignancies are of the papillary type. Follicular and medullary carcinomas constitute 10%-20% and 5% respectively. Other carcinomas include lymphoma and anaplastic carcinoma [5].

Such nodules represent common and controversial clinical problems. Although nodular thyroid disease is relatively common, thyroid cancer is rare and accounts for less than 1% of all malignant neoplasm. The most common reason for operating on a patient with a thyroid nodule is the risk of malignancy, which is present in only 10% - 20% of patients. Clinical examination often fails to differentiate between benign and malignant lesions. Fine needle aspiration cytology of a nodule enables the correct preoperative diagnosis to be made in at least 75% of the total cases and in over 90% of the nodules that are malignant. Follow-up of patients with benign pathology suggests that fine needle aspiration cytology has a false-negative rate of 0.7% for malignancy. However, it fails to provide a satisfactory specimen in about 15% of cases and is difficult to perform if the nodule is small. Moreover; fine
needle aspiration samples only one area of the thyroid [6].

So the clinical challenge is to distinguish the few clinically significant malignant nodules from the many benign ones and, thus, to identify those patients for whom surgical excision is genuinely indicated.

Main objective in imaging of thyroid is to identify lesions likely to be malignant. Once the diagnosis of malignant disease is confirmed by pathological examination, imaging is further useful to see the extent of tumor or metastasis. The initial methods of evaluation are clinical history, physical examination and laboratory values. Although palpation is the clinically relevant method of examination of thyroid gland, it is notoriously insensitive. It has long been recognized that palpation, even with the thyroid gland actually in the hands of the examiner, does not always reliably indicate the presence or absence of nodules. Clinical examination often fails to distinguish benign from malignant lesions [7,8].

To assist the clinician faced with diagnostic dilemma, thyroid imaging has a well-defined role. Thyroid can be imaged with multiple modalities including nuclear medicine, high-resolution sonography, computed tomography and magnetic resonance imaging [2].

For many years, Radionuclide studies have been the most commonly used imaging technique in the evaluation of nodular abnormalities of the thyroid gland. Imaging with I-123 has limited spatial resolution, requires two or more sittings, and is subject to the effects of diet and medications.
Scintigraphy also has the disadvantage of exposing the thyroid and surrounding neck tissues to radiation. Technetium scanning is used for anatomic thyroid evaluation but has not been found to be sensitive for detection of nodules smaller than 5mm. Three dimensional distortions of image with pinhole scanning and decreased sensitivity in the region of mediastinum are other difficulties encountered with the use of this technique. Despite its leading role, scintigraphy has proved to be unsatisfactory in assessing the exact nature even with the introduction of labeled test agents [9,10].

Because of its higher average soft tissue attenuation, caused by the physiologically high iodine content of the gland, thyroid gland is well seen on computed tomography. Computed tomography has the advantage of allowing evaluation of retrotracheal and retrosternal extension of thyroid. It also helps in detection of aberrant thyroid in the neck or chest; and invasion or spread of tumor to adjacent structures in the neck. However, streak artifacts from shoulder girdle, need for contrast administration and exposure to radiation are undesirable features [11,12]. Thyroid adenomas and carcinomas are seen as soft tissue masses within the gland. Because calcification and cyst formation is seen in both types of lesions, computed tomography cannot reliably distinguish benign from malignant thyroid masses unless metastasis, bone or cartilage destruction or neurological involvement is identified in the latter [13].

Magnetic resonance imaging is one of the latest techniques with variable attributes for identifying diseases of the neck. The completely non-invasive
nature of MRI is a useful advantage. Excellent contrast of lesions with normal thyroid and adjoining structures, large field of view obtained and multiplanar imaging are useful in assessing thyroid masses. MRI is useful in the assessment of retrosternal and retrotracheal goiter, local invasion of thyroid masses and identification of recurrences of thyroid carcinoma [12,14]. The role of magnetic resonance imaging in thyroid is thus probably similar to that of computed tomography. Both techniques are helpful for defining the extent of large tumors but magnetic resonance imaging has some advantages over computed tomography in the assessment of invasive carcinomas of the thyroid [15,16].

MR imaging cannot distinguish benign from malignant tumors or determine functional status of the thyroid gland. It is probably less specific than sonography for establishing cystic nature of a nodule [17].

Because of the superficial location of thyroid gland, high-resolution real-time sonography can demonstrate its normal anatomy and pathological conditions with remarkable clarity. This technique is widely available, easy and rapid to perform, results are readily interpreted and is considered to be a safe and useful tool. It has been regarded as valuable in differentiating between solid and cystic lesions & single and multiple lesions. However, its capacity for distinguishing benign from malignant nodules has not been well evaluated [18].
The gray scale sonographic features suggestive of a benign nature of thyroid nodule are as follows [9,19].

- Hyperechoic echotexture (with a malignancy of less than 1%).
- Hypoechoic echotexture with distal enhancement and possible lateral acoustic shadows.
- Totally anechoic echotexture with internal floating material or interspersed echoes.
- Eggshell like calcification surrounding the whole nodule.

Hyperplastic nodules and follicular adenomas are either solid or predominantly solid [20].

Main sonographic characteristics suggestive of a malignant nature are as follows [9,19,20].

- Hypoechoic echotexture without distal enhancement.
- Incomplete and irregularly thickened (more than 2mm) peripheral halo.
- Irregular or poorly defined margins.
- Microcalcification, which is seen mainly in papillary and medullary cancers.
- Invasion of anatomical structures around the thyroid gland. Main signs of invasion detectable with ultrasonography are the infiltration of strap muscles, the encasement of the great vessels and the encasement of the recurrent laryngeal nerve.
Involvement of cervical lymph nodes, which is seen in 15% - 20% of thyroid cancers (mainly papillary and medullary carcinoma). Sonographic features characteristic of metastatic involvement from thyroid cancer are the microcalcification and the complete cystic node degeneration.

The thyroid gland is one of the most vascular organs of the body. As a result, Color Doppler examination may provide useful diagnostic information in thyroid diseases. The Color Doppler feature that may be useful in differentiating benign from malignant is the distribution of vessels. With current technology, no thyroid nodule appears totally avascular on Color Doppler. The two main categories of vessel distribution are nodules with peripheral vascularity and nodules with internal vascularity (with or without a peripheral component) [21].

Color Doppler sonography has added a new dimension to diagnostic sonography. Sometimes isoechoic thyroid nodules, which are not detected by high-resolution ultrasound, may be delineated by the use of Color Doppler. Absence of increased vascularity seems to be an important parameter for the exclusion of autonomous adenoma and thyroid carcinoma [22,23].

The present study aims at evaluating the role of Color Doppler sonography in the assessment of nodular thyroid disease.