

# Halo Sign - A Helping Hand to Predict A Thyroid Nodule Possibly Benign

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## ABSTRACT

**Introduction:** Thyroid disease are very common and around 4%-8% of the adult population have a palpable thyroid nodule. Prevalence of Ultrasound detectable thyroid nodules is 19-60%. Thyroid cancer is rare and account less than 1% of all malignant neoplasm. Challenge is to distinguish the few clinically significant malignant nodules from many benign one. Clinically occult nodules can be detected by sonography. High prevalence of thyroid nodule in general population call for clear strategy of management. We had done this study with objectives to study the pattern of ultrasound finding especially the Halo sign in confirmed thyroid nodular swelling and to determine the nature of thyroid swelling using sonography.

**Material and Methods:** A total of 71 patients with neck swelling were included in the study after permission from institutional review board. They are evaluated with ultrasound and the following characteristics on US images noted special focus was kept on presence or absence of halo and its type - thin or thick; complete or incomplete, also other usg features like nodule size, shape, margin, echogenicity, and presence of calcification noted. Ultrasound diagnosis is correlated with FNAC result and significance of Halo sign and its type was studied.

**Results:** Out of the 71 patients, 58 were having benign thyroid nodular lesion confirmed on FNAC or biopsy and 13 turned out to be follicular thyroid carcinoma on biopsy. Most of benign thyroid lesion showed complete thin halo around them.

**Conclusion:** Ultrasonography is repeatable noninvasive imaging modality for investigating thyroid gland. Our experience demonstrates significantly improve specificity for high resolution ultrasound for diagnosis and characterization of benign thyroid lesions. Thin complete halo around thyroid nodule can be taken as strong sign of benignity.

**Keywords:** Halo Sign, USG thyroid lesions, Thin and Thick Halo, Complete halo

## INTRODUCTION

The thyroid gland is unique among endocrine gland in that it is the only one endocrine gland amenable to direct physical examination because of its superficial location. Thyroid lesion is the most common among the entire endocrine gland lesion in India.<sup>1</sup> Thyroid nodules are common and occur in up to 19-60% of the adult population; however, less than 1% of thyroid nodules are malignant. Ultrasonography [US] is the most sensitive method for diagnosing intra thyroid lesions. The challenge is differentiating a few malignant nodules from common benign nodules. Despite the ability of ultrasonography 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.<sup>2-6</sup> Typically, Lesions demonstrating a thin echo lucent halo around the entire lesion are most often benign.

Before the advent of high resolution ultrasound capability, radionuclide scintigraphy was the chief means to evaluate the thyroid gland both functionally and morphologically. Along with being much safer and nonionizing, ultrasound is also a much cheaper alternative. C.T. and M.R.I. are also used in the evaluation of thyroid lesion/masses but not as sensitive as ultrasound in detection of intrathyroid lesions and more used for mediastinal extension of thyroid lesion.<sup>3</sup> Nearly 50% of patients with a clinically solitary thyroid nodule have avoided surgery by thyroid scanning.<sup>4</sup>

As Thyroid surgeries are complicated by many post-operative complications. So there has been an effort to limit unnecessary surgery in asymptomatic patients with benign lesions.<sup>5,6</sup> Hence this study was done with aim to study the pattern of ultrasound finding especially the Halo sign in confirmed thyroid nodular swelling and to determine the nature of thyroid swelling using sonography.

## MATERIAL AND METHODS

Data for study was collected from all patients (71 patients) of clinically suspected thyroid lesion, referred to the department of Radio diagnosis, Govt. Medical College and Sir Takhatsinghji General Hospital, Bhavnagar. Study was done for a period of 15 months (November 2014 to February 2016) after getting approval from institutional review board.

Patients referred for thyroid ultrasound scan and having nodular lesion were included in the study. Informed consent taken in all patients. We exclude patient having diffuse thyroid lesions. Present study included a total number of 71 cases. Ultrasonography and FNAC was performed following a history and physical examination. Ultrasound and FNAC results were compared.

In our study we use 7.5 to 12 MHz short focus transducer. The patient is examined in the supine position with the neck hyper extended to identify the inferior margin of gland, which may extend to the clavicle in some patients. A pillow is placed under the shoulder to provide better exposure of the neck, particularly in patient with a short, stocky habitus. The thyroid gland is

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scanned in both longitudinal and transverse planes.

Lesion of thyroid gland are divided with nodular thyroid lesion and diffuse thyroid lesion with nodular lesion are studied under size, shape, echogenicity, margin, halo, intralesional vascularity, presence of calcification. Presence or absence of halo, thickness of halo and completeness of halo were noted in all patients. In addition, surrounding structure were studied if any pathology, especially lymphadenopathy.

After the history, physical examination, Ultrasound scanning, thyroid hormonal assay a diagnosis is made. The diagnosis made on ultrasonography was compared with that of histopathological diagnosis.

**STATISTICAL ANALYSIS**

SPSS version 21 was used to infer results. Results are based on descriptive statistics

**RESULTS**

71 patients who came in department for ultrasonography of neck were evaluated with high resolution ultrasound for thyroid lesion in this study. Out of 71 patients 58 patients had benign nodular thyroid lesion and 13 patients have a malignant thyroid lesion on Biopsy.

Using complete halo as a predictor for benign thyroid nodule, Statistical Calculations for above table-2 shows high positive predictive value (90.91%) for benign thyroid lesion. This study also reveals good specificity of halo sign 84.62. However Sensitivity is low and is 34.48% and negative predictive value is very low and is 22.45%.

**DISCUSSION**

Thyroid nodules are extremely common. High resolution sonography is commonly used to evaluate the thyroid gland. Virtually any thyroid disease can manifest itself as one or more nodules. Thyroid surgeries are complicated by post-operative thyroid hormone imbalance, hypoparathyroidism, recurrent laryngeal nerve injury, bleeding or infection; thus, there has been an effort to limit unnecessary surgery in asymptomatic patients with benign lesions.<sup>5,6</sup> Surgery for benign lesions should ideally be limited to patients with compressive symptoms, Graves's disease presenting with a nodule, hyperthyroidism, hyperparathyroidism, enlarging nodule. Because of the real problem of morbidity and at times mortality and cosmetic

reasons, surgical excision of a solitary nodule should be preserved for all those thyroid neoplasm whose ultrasound picture are suspicious of malignancy and cytology reveal malignant cells.<sup>8,9</sup>

According to several reports, for differentiation of benign versus malignant thyroid nodules, sonography has sensitivity rates ranging from 63% to 94 %, specificity from 61% to 95 % and overall accuracy from 80% to 94%.<sup>7-10</sup>

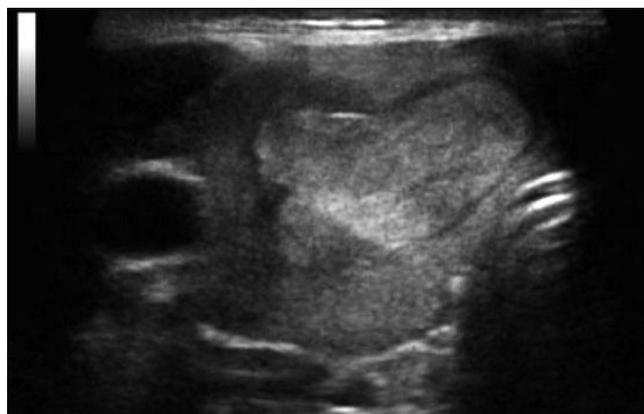


Figure-1: Completesthin halo around a bening thyroid nodule



Figure-2: Incompelete halo sign in biopsy proven follicular carcinoma thyroid

Thyroid lesions with prevalence of halo (71 Total - 100 % )	Halo sign	Number of patients	Percentage%
Benign thyroid lesions (58 total - 81.69 % )	Complete thin halo	20	34.49
	Incomplete halo	9	15.51
	No Halo	29	50
	Total	58	100
Neoplastic thyroid lesions (13 total - 18.30 % )	Complete halo	2	15.38
	Incomplete halo	6	46.15
	No halo	5	38.46
	Total	13	100

**Table-1: Nodlarthyroid lesions types with prevalence of halo**

Type of Halo	Benign Thyroid Lesions	Malignant Thyroid Lesions	Total
Complete Halo	20 (True Positive )	2 (False Positive)	24
No Halo or Incomplete Halo	38 (False Negative)	11 (True Negative)	11

**Table-2: Calculations of complete halo sign's as a predictor for Benign Thyroid lesions**

There are many sonography features to predict possible benign or malignant nature of a nodule. Sonolucent Halo is one the features, Halo in benign thyroid lesion is thin and complete because rapid but controlled growth of thyroid cell leads to compression of adjacent parenchyma and which appear as hypo echoic rim around the lesion called as sonolucent halo.

Less frequently malignant thyroid lesion may have uncontrolled and spontaneous cell growth with loss of cellular cohesion can lead to incomplete halo around the lesion.

Most thyroid malignancies are hypoechoic. Most of malignant nodules are ill-defined with irregular margins with thick irregular mostly incomplete or absent hypo echoic halo.

We studied 71 patients with thyroid nodular lesions out of which 58 patient had benign thyroid lesion and out of 58 patient 20 (34.5%) were containing thin complete halo around them. 29 patients (50% ) didn't show halo around the nodule while 9 patients (15.5%) showed incomplete halo. Statistical analysis revealed high positive predictive value and specificity of Complete halo for benign thyroid nodular lesion. So it can be postulated that thin complete halo around the thyroid nodule can predict possible benign nature of the nodule.

A peripheral sonolucent halo that completely surrounds or incompletely surrounds a thyroid nodule is presented in 50 % of benign thyroid lesion and 20 patients(34.5%) have thin complete halo. Color and power Doppler imaging have demonstrated thin complete peripheral halo strongly suggestive of benign nodules which represents blood vessels coursing around the periphery of the lesion (the basket pattern).

6 patients out of 11 patients (54.5%) who turned out to have follicular neoplasm demonstrate incomplete halo around them. While 5 patients (45.5%) didn't show halo around the nodule. 2 thyroid nodules showed complete halo which turned out to be malignant nodule on biopsy. 20 patients having benign thyroid lesions containing thin complete halo (figure-1) with most of lesion are of colloid goiter which can be managed nonsurgically and with iodinated salt and thus risky surgery can be avoided. This constitute 34% of our study and thus by identifying this characteristic halo and so benignity we can avoid surgical risk in these patients.

One study described the non specificity of halo sign in 1970 when ultrasound machine were of less resolution as compared to present time high resolution machine. Today high resolution sonography has highest spatial resolution of 0.7mm which is highest among all imaging modality. This can pick up very thin halo around the lesion which is not demonstrated in previous study.

With 20 patients out of 58 patients having benign nodular thyroid lesion had complete thin halo (Figure-1) and 6 patients out of 11 neoplastic thyroid lesion contains incomplete halo (Figure-2) as well only 2 of the neoplastic thyroid lesions patient had complete thin halo. Thus it can be postulated that thin complete halo around thyroid nodule can be taken as strong sign of benignity.

## CONCLUSION

From this study it can be postulated that thin complete halo around thyroid nodule can be considered as a very specific sign of benignity. USG of thyroid nodule showing thin complete halo are most likely to have benign thyroid lesions with most of

lesion are of colloid goiter which can be managed non surgically and with iodinated salt. Thus by identifying this characteristic complete halo as a strong predictor of benignity, surgical risk and its complication can be avoided.

## REFERENCES

1. Bartolotta TV, Midiri M, Runza G, et al. incidentally discovered thyroid nodules: incidence, and grayscale and color Doppler pattern in an adult population screened by real-time compound spatial Sonography, *Radiol Med (Torino)*. 2006;111:989-98.
2. Tsantis S, Dimitropoulos N, Cavouras D, Nikiforidis G. Morphological and wavelet features towards sonographic thyroid nodules evaluation. *Comput Med Imaging Graph*, 2008;
3. Ahuja AT, Metreweli C. Ultrasound of thyroid nodules, *Ultrasound Q*. 2000;16:111-22.
4. Gooding GA. Sonography of the thyroid and parathyroid. *Radiol Clin North Am*. 1993;31:967-89.
5. Simeone JF, Daniels GH, Mueller PR. High-resolution real-time Sonography of the thyroid, *Radiology*. 1982;145:431-5.
6. Kim DW, Park JS, In HS, Choo HJ, Ryu JH, Jung SJ. Ultrasound-Based Diagnostic Classification for Solid and Partially Cystic Thyroid Nodules. *AJNR Am J Neuroradiol*. 2012;
7. Hoang JK, Lee WK, Lee M, Johnson D, Farrell S. US Features of thyroid malignancy: pearls and pitfalls. *Radiographics*. 2007;27:847-60.
8. Braden A et al. Thyroid Gland US screening in a random population, *Radiology*. 1993;181:683.
9. Mettler FA et al: Thyroid nodules in the population living around Chernobyl, *JAMA*. 1992;268:616-620.
10. Lalit Singh, Abhishek Jain, Anurag Agrawal, Rajeev Tandon, Hemant Kumar. A study of prevalence of thyroid disorders in chronic obstructive pulmonary disease patients at a tertiary care center in U.P. *International Journal of Contemporary Medical Research*. 2016;3:1239-1242.

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