Journal of Clinical and Nursing Research, 2023, Volume 7, Issue 1
http://ojs.bbwpublisher.com/index.php/JCNR
ISSN Online: 2208-3693
ISSN Print: 2208-3685

Diagnostic Value and Misdiagnosis Analysis of Conventional Ultrasonography Combined with Contrast-Enhanced Ultrasonography in Thyroid Nodules

Meiqing He*, Xixi Zhang, Hui Li, Tian Wang

Ultrasonic Diagnosis Center of Shaanxi Provincial People's Hospital, Xi'an 710068, Shaanxi Province, China

***Corresponding author:** Meiqing He, hmq359340106@sina.com

Abstract: *Objective:* To explore the diagnostic value of conventional ultrasonography combined with contrast-enhanced ultrasonography in thyroid nodules. *Methods:* From June 2021 to July 2022, 163 patients with thyroid nodules enrolled in our hospital were selected as research subjects. After pathological diagnosis, 24 cases were malignant thyroid nodules, and 139 cases were benign thyroid nodules. The diagnosis rate of malignant and benign thyroid nodules was observed and analyzed, with 95% CI. *Results:* Among them, the malignant and benign detection rates of routine ultrasound were 88.63% and 75.00%, respectively, and the malignant and benign detection rates of contrast-enhanced ultrasound were 81.82% and 81.25%, respectively. The malignant and benign detection rates of conventional ultrasound combined with contrast-enhanced ultrasound were 93.18% and 87.50%, respectively, and the 95% CI was greater than 0.7. *Conclusion:* Conventional ultrasound combined with contrast-enhanced ultrasound can help improve the diagnostic accuracy of benign and malignant thyroid nodules and reduce the misdiagnosis rate.

Keywords: Conventional ultrasound; Contrast-enhanced ultrasound; Thyroid nodules; Diagnostic value

Online publication: January 16, 2023

1. Introduction

Thyroid nodules are a common disease, accounting for about 70% of all thyroid diseases, of which benign nodules are more common. Most benign nodules can subside naturally, and it is difficult to differentiate between benign and malignant modules; most malignant nodules can undergo malignant transformation. Most of the current literature reports on the diagnosis of thyroid nodules are limited to routine ultrasonography. Studies have shown that contrast-enhanced ultrasound can effectively identify symptomatic or asymptomatic thyroid nodules, play an important role in differentiating between benign and malignant, and help follow-up observation [1]. Most thyroid nodules ranging from 10 to 100 mm in diameter are single, and a few of them can be multiple [2]. Most nodules are associated with thyroid follicular hyperplasia and thyroid cancer, but some nodules are associated with follicular hyperplasia and nodular goiter [3]. A small number of nodules may have calcification, most of which are calcified foci with hypoechoic nodules [4]. There is no apparent relationship between nodule size and growth rate [5]. The smallest nodule diameter that can be identified by contrast-enhanced ultrasound is 0-1 mm. If the nodules cannot be identified as benign or malignant by conventional ultrasonography, ultrasonography and biopsy

can be used to further confirm the diagnosis [6]. Contrast-enhanced ultrasound can clearly display changes in microvessel density and blood flow signal status in nodules, and can evaluate the degree of tumor cell infiltration and condition of surrounding tissue, judge the nature of nodules, and guide the selection of treatment methods.

2. Materials and methods

2.1. General information

From June 2021 to July 2022, 163 patients with thyroid nodules in our hospital were selected as research subjects. After pathological diagnosis, 24 of them were malignant thyroid nodules, and 139 of them were benign thyroid nodules. There were statistical differences in the general data graphs of the patients in the two groups, and the entry standard was that they met the symptoms of thyroid nodules and had no other comprehensive metabolic diseases and mental illnesses. The exclusion criteria were those with incomplete clinical data and patients with other major diseases.

2.2. Method

2.2.1. Contrast-enhanced ultrasound

64 rows of three-dimensional probes produced by Siemens SW (Sensible Healthcare) in Germany were used to perform contrast-enhanced ultrasound examination in units of 1 cm. Under the guidance of B-ultrasound, iodine contrast agent is used to perform cervical lymph node puncture to obtain cervical lymph nodes and puncture needles. The specimens were observed by hematoxylin and eosin (HE) staining, and the results were confirmed and recorded by 2 physicians with rich clinical experience to reduce misdiagnosis. (1) Preparation before contrast examination: in the case of no abnormalities in the subject, an appropriate amount of contrast agent (concentration: 0.1%) was injected intravenously, and then injected slowly through the catheter. (2) During the contrast-enhanced ultrasound examination, the patient was placed in a trendelenburg position. (3) The tip of the catheter was inserted into the two side walls of the thyroid gland in the neck. When the contrast agent cannot enter the thyroid gland completely, it was repeatedly injected 1 or 2 times to achieve full infiltration and a small amount of air bubbles to overflow. (4) It is necessary to perform ultrasonography within 10–20 seconds after slowly injecting contrast medium into the thyroid cavity. (5) If the nodule is large (diameter greater than 1 cm), the puncture site can be washed with 5 mL of normal saline for 3 to 4 times before puncture. For contrast image acquisition, normal thyroid and nodules underwent conventional ultrasonography and ultrasonography after contrast medium injection. The image was then scanned through a catheter into the skin of the patient's neck. Contrast-enhanced ultrasonography can be used to enhance the contrast effect and improve the diagnostic accuracy in the part and range where nodules are easily formed on the thyroid. At the same time, it can perform multi-point and multi-faceted scanning inspections, conduct all-round three-dimensional observation of lesions, analyze and diagnose, differential diagnosis, and dynamic observation. (6) During the examination, the patient should avoid emotional agitation, fatigue and other situations that cause the diffusion or absorption of the contrast medium to decrease. At the same time, blood clots and other allergic reactions may occur after the contrast medium is injected; if the examination cannot be stopped immediately or other discomforts occur, it should be treated in time and the contrast-enhanced ultrasound examination should be stopped; it is necessary to avoid repeated punctures and multiple injections of contrast agents, and to properly disinfect and keep the puncture site warm. If an allergic reaction occurs, timely treatment and symptomatic supportive treatment should be given. If a severe systemic allergic reaction occurs, the angiography should be stopped immediately, and corresponding treatment measures should be taken; appropriate treatment and observation should be carried out for patients with allergic reactions.

2.2.2. Ultrasound diagnostic method

Color Doppler flow imaging (CDFI) technology and Doppler perfusion imaging technology were used to diagnose thyroid nodules (including papillary, cystic-solid nodules, and other types of thyroid nodules).

2.3. Observation indicators

Diagnosis rate of malignant and benign thyroid nodules, including 95% CI.

2.4. Statistical methods

Statistical software SPSS22.0 was used for data analysis, measurement data were expressed as mean ± standard deviation ($\bar{x} \pm s$), and *t* test was used to compare data between groups and within groups; χ^2 test was used to compare count data, and n (%) was used to express; $P < 0.05$ means the difference is statistically significant.

3. Results

Through pathological diagnosis, there were 24 cases in the malignant group and 139 cases in the benign group. The detection rates of malignancy and benign by conventional ultrasound were 88.63% and 75.00%, respectively, and the detection rates of malignant and benign by contrast-enhanced ultrasound were 81.82% and 81.25%, respectively. The malignant and benign detection rates of conventional ultrasound combined with contrast-enhanced ultrasound were 93.18% and 87.50%, respectively, and the 95% CI was greater than 0.7, as shown in **Table 1**.

Table 1. Diagnostic performance of CT and serum tumor markers

Pathological results		Malignant (n = 24)	Benign (n = 139)	Accuracy	95% CI
Routine ultrasound	Vicious	19	20	79.17.%	0.862
	Benign	5	119	85.61%	0.791
Contrast-enhanced	Vicious	21	19	87.50%	0.811
ultrasound	Benign	3	120	86.33%	0.795
Conventional	Vicious	23	13	95.83%	0.901
ultrasound combined	Benign	1	126	90.65%	0.842
with contrast-enhanced ultrasonography					

4. Discussion

Some thyroid nodules have a relatively high detection rate. Most cystic nodules result from cystic degeneration of neoplastic or nonneoplastic nodules, such as nodular cystic changes in the thyroid; cystic nodules with epithelial tissue are relatively rare. Previous research results have shown that the incidence of malignant partially cystic thyroid nodules is 4.6% to 17.8%, and there is a certain possibility of malignant transformation. At this stage, the surgical operation rate of partially cystic thyroid nodules is 19% to 34%. Early accurate diagnosis is very important for the selection of clinical treatment and the prognosis of patients.

Due to different diagnostic methods, the misdiagnosis of thyroid nodules and benign nodules can occur in different ways. Therefore, various factors, such as age, gender, and pathological type, should be considered comprehensively. For example, there was a case where the patient did not undergo imaging examinations, thus the diagnosis could not be confirmed, and benign nodules were mistakenly confused

with malignant nodules. Depending on the level of technical mastery, the images obtained may be distorted, resulting in misdiagnosis. Therefore, during ultrasonography, it is necessary to fully understand the patient's knowledge reserve and mastery of imaging examination knowledge, and comprehensively consider various factors to avoid misdiagnosis [7-10].

Contrast-enhanced ultrasound diagnosis of thyroid nodules is a newly developed technology in recent years. It uses blood vessels as a contrast agent, and directly enters the systemic circulation through the blood vessels, so as to achieve a contrast effect similar to that of thyroid nodules, making it easier to distinguish between benign and malignant nodules. Research results have shown that the sensitivity and specificity of conventional contrast-enhanced ultrasonography in the diagnosis of thyroid nodules are 86.0% and 92.3%, respectively. Besides, there is no significant difference between the diagnostic specificity of conventional contrast-enhanced ultrasonography for thyroid nodules and benign and malignant nodules ($P > 0.05$). However, there was a significant difference between the diagnostic specificity of thyroid cancer and benign and malignant nodules ($P < 0.05$), which indicated that the diagnosis of nodules by conventional contrast-enhanced ultrasound was more accurate, but its sensitivity and specificity were low and lack of specificity, so it is necessary to further improve the sensitivity and specificity of conventional contrast-enhanced ultrasound in the diagnosis of thyroid nodules.

Contrast-enhanced ultrasonography uses the diffusion properties of contrast agents in tissues to detect tumor tissues. There are two diffusion characteristics of ultrasound contrast agents. (1) Diffusion: ultrasound contrast agents diffuse into the blood through the interstitial space, forming a large diffuse concentration distribution in the tissue. (2) Monocentricity: A lesion often occurs in multiple centers at the same time. The same lesion often has many central lesions, which are fused or close to each other. Contrast-enhanced ultrasonography is a new clinical method, which has the advantages of high diagnostic accuracy, repeatable operation, no need for biopsy, and less damage to normal tissues. The contrast agent passes through the vessel wall into the arterial vessel, where it performs targeted blood thinning in the peripheral vein. When blood flows from the arteries to the veins, a high-oxygen blood flow is formed; when blood vessel walls produce a low-oxygen blood flow, a high-oxygen blood flow is formed; when both occur simultaneously, a low-oxygen blood flow is formed. Due to the difference in the high and low flow exchange process, the high blood flow velocity is much higher than the normal blood flow. The results of contrast-enhanced ultrasonography are hemodynamic changes observed in a hyperoxic state. The results of ultrasonography can show whether abnormal hemodynamic changes occur in the lesion area and whether the lesion is malignant; at the same time, it can detect whether abnormal hemodynamic changes occur in the patient's disease process, such as atherosclerosis, plaque rupture, and so on. Contrast-enhanced ultrasonography can be used to detect early thyroid nodules, thyroid cancer and other benign diseases and precancerous lesions. It can accurately determine the benign and malignant thyroid tumors and provide a more reliable basis for the diagnosis of malignant tumors. Among them, contrast-enhanced ultrasound is to place liquid containing contrast agent outside the body for inspection. This technology allows simultaneous injection of multiple drugs into the same tissue to form a multi-modal and multi-parameter imaging method, which can provide 3D images and dynamic display functions of multiple organs and regions [11-13].

Thyroid nodules were found by conventional ultrasonography, and the nodules were further analyzed by contrast-enhanced ultrasonography. Conventional ultrasound is mainly applicable to the diagnosis and follow-up observation of thyroid nodules and tumors. Ultrasonographic examination is only suitable for a small number of thyroid nodules with definite properties and cannot clearly determine whether the nodules are malignant (including precancerous lesions, papillary carcinoma, and many more), while contrast-enhanced ultrasonography can be used to distinguish benign and malignant nodules. Contrast-enhanced ultrasound can provide diagnostic reference for patients with symptomatic or asymptomatic goiter nodules. Conventional ultrasound is difficult to differentiate benign and malignant symptomatic nodules, while

contrast-enhanced ultrasonography has a higher diagnostic accuracy for asymptomatic or symptomatic nodules. In the follow-up observation of clinical cases, the presence or absence of nodules (especially malignant nodules) found through routine ultrasound + sonographic examination can be used as one of the important basis for determining the follow-up observation parameters [14 -17].

5. Conclusion

In conclusion, conventional ultrasound combined with contrast-enhanced ultrasound can help improve the diagnostic accuracy of benign and malignant thyroid nodules and reduce the misdiagnosis rate.

Disclosure statement

The authors declare no conflict of interest.

References

[1] Wang Y, 2019, Observation on the Diagnostic Effect of High-Frequency Ultrasound, Elastography Combined with Contrast-Enhanced Ultrasound in Solid Thyroid Nodules. China Practical Medicine, 14(31): 73–75.

[2] Song S, Xu X, Zhai H, 2019, Diagnostic Value of High-Frequency Ultrasound Elastography Combined with Contrast-Enhanced Ultrasound in Benign and Malignant Thyroid Solid Nodules. Primary Medical Forum, 23(28): 4104–4105.

[3] Liu L, Zhao R, 2019, The Application Value of Conventional Ultrasonography Combined with Contrast-Enhanced Ultrasonography in the Differential Diagnosis of Benign and Malignant Thyroid Nodules. Imaging Research and Medical Application, 3(11): 93–94.

[4] Zhou C, Xu X, Shen B, et al., 2018, Research on the Diagnostic Value of Real-Time Elastography Combined with Contrast-Enhanced Ultrasonography in the Diagnosis of Benign and Malignant Thyroid TI-RADS 4 Nodules. Tumor Imaging, 27(06): 493–498.

[5] Wang Y, 2018, Diagnostic Value of Conventional Ultrasonography Combined with Contrast-Enhanced Ultrasonography in Papillary Thyroid Microcarcinoma. Henan Journal of Surgery, 24(06): 94–95.

[6] Li G, 2018, Analysis of the Diagnostic Value of Contrast-Enhanced Ultrasonography and Conventional Ultrasonography in Benign and Malignant Thyroid Nodules. Journal of Practical Medical Technology, 25(10): 1108–1110.

[7] Wang B, Xu X, Zhai H, 2018, Diagnostic Value of High-Frequency Ultrasound, Elastography Combined with Contrast-Enhanced Ultrasound in Solid Thyroid Nodules. Imaging Research and Medical Application, 2(15): 179–181.

[8] Xu S, Chen L, Bao B, et al., 2017, Value of Conventional Ultrasonography Combined with Contrast-Enhanced Ultrasonography in Differentiating Benign and Malignant Thyroid Nodules. Cancer Progress, 15(09): 1073–1075.

[9] Li J, Yang M, Zhang Y, et al. 2017, Diagnostic Value of Elastography Combined with Contrast-Enhanced Ultrasonography in Thyroid Nodules. Journal of Harbin Medical University, 51(04): 351–355.

[10] Yu X, Guo L, He H, et al., 2017, Value of TI-RADS Classification System Combined with Contrast-Enhanced Ultrasonography in the Differential Diagnosis of Benign and Malignant Thyroid Nodules. Journal of Medical Imaging, 27(06): 1056–1059 + 1072.

[11] Zhang Y, 2017, Comparative Study on the Differential Diagnosis and Pathology of Thyroid Nodules

by Conventional Ultrasound Combined with Contrast-Enhanced Ultrasound, dissertation, Zhengzhou University.

[12] Zhu J, Wen K, 2016, Diagnostic Value of High-Frequency Ultrasound, Elastography Combined with Contrast-Enhanced Ultrasonography in Solid Thyroid Nodules. Chinese Journal of Modern Medicine, 26(05): 83–86.

[13] Deng Y, He Y, Yang H, et al., 2015, The Value of Thyroid Imaging Report and Data System Grading Combined with Contrast-Enhanced Ultrasonography in the Differential Diagnosis of Benign and Malignant Thyroid Nodules. Guangxi Medicine, 37(08): 1079–1081 + 1084.

[14] Tao L, Wang T, Li X, et al., 2015, The Combined Score of Routine Ultrasound and Contrast-Enhanced Ultrasound for the Differential Diagnosis of Benign and Malignant Thyroid Nodules. Clinical Ultrasound Medicine Journal, 17(04): 227–230.

[15] Li W, Liu S, 2015, Study on the Diagnostic Value of Conventional Ultrasonography Combined with Contrast-Enhanced Ultrasonography for Thyroid Nodules. Journal of Practical Medical Imaging, 16(02): 167–169.

[16] Zhang L, Zheng C, Yong Q, et al., 2019, The Application Value of Conventional Ultrasonography Combined with Contrast-Enhanced Ultrasonography Scoring Method in Differentiating Benign and Malignant Thyroid Micronodules. Chinese Journal of Ultrasound Medicine, 35(11): 969–973.

[17] Chen C, 2019, The Value of Conventional Gray-Scale Ultrasound and Contrast-Enhanced Ultrasound in the Diagnosis of Benign and Malignant Thyroid Nodules. Contemporary Medicine, 25(36): 169–170.