Evaluation of preoperative Technetium99m (99mTc) Pertechnetate Scintigraphy in patients with thyroid Mass

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Citation

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Abstract

Introduction: Preoperative thyroid scintigraphy has traditionally been regarded as the gold standard for the investigation of the solitary thyroid nodule. It determines the activity of the lesion in relation to the adjacent structures.Objective: The aim of this study was to evaluate the accuracy of preoperative thyroid scintigraphy, in terms of sensitivity and specificity, in detecting malignant lesion.Materials and methods: This was a retrospective observational study, conducted at Hospital Universiti Sains Malaysia. We identified the patients who were operated between 2000 and 2005. Patients with thyroid mass, who had thyroid scintigraphy as part of the preoperative assessment, were recruited in this study.Results: 33 patients were recruited. The sensitivity of thyroid scan in our study population was 81.8 % and the specificity was 22.7 %.Conclusion: The specificity of thyroid scintigraphy was low and this technique should not be done as a routine test in every patient with thyroid nodule.

INTRODUCTION

Imaging using isotopes has been described as one of the earliest investigational tools to detect malignant behavior of the thyroid lesions. The principle is to evaluate the functional aspect of thyroid gland. The activity of the gland is described by the terms hot and cold nodules. Cold nodule reflects the non-concentrating part of the gland while the hot nodule is the truly functioning nodule.

Technetium^{99m} (^{99m}Tc) Pertechnetate is currently used as the alternative to radioactive Iodine^{123}, although the latter is the most suitable agent. The use of I^{123} has been limited because it is a cyclotron generated product, it is more expensive and it is not readily available as the ^{99m}Tc Pertechnetate.[1]

Besides that, ^{99m}Tc is used because it is trapped by the gland in similar manner to the I^{123}. It also has a shorter half life. It is readily available at a cheaper cost with lower radiation dose to the exposed patients.

Traditionally, thyroid scintigraphy has been regarded as the gold standard investigation for the thyroid mass. However, it has a poor sensitivity and specificity in picking up malignant lesion. A hot nodule is said unlikely to be malignant but malignancy can not ruled out. The prevalence of thyroid cancer in hot nodules is low, as it is estimated to be between 0 and 4% in adults.[2]

On the other hand, only 20 % of the cold lesions are malignant. The false positive result is unavoidable, especially if the malignant nodule, which should be cold, is labeled as hot, which can be due to its vascularity or overlapping by normal functioning thyroid tissue.

OBJECTIVE

The aim of this study is to evaluate the accuracy of preoperative thyroid scintigraphy performed in Hospital Universiti Sains Malaysia in terms of its sensitivity and specificity in detecting malignant lesion.

MATERIALS & METHODS

This was a retrospective observational study.

All patients who underwent thyroid scintigraphy as part of the pre-operative investigations were recruited. All of them underwent thyroid surgery between 2000 and 2005 at Hospital Universiti Sains Malaysia.

The radiological conclusions made from the thyroid scans (hot or cold) will be compared with the final histopathological diagnosis of the removed specimens. The histopathological interpretation was taken as the gold standard.

RESULTS

Thirty three patients were identified and thirty of them were

females. The peak incidence was seen in 41-60 year old patients (Table 1). Majority of the patients were Malay (Table II). This figure reflects the majority of the population in Kelantan state in Malaysia.

Figure 1

Table I: Age of the patients requiring thyroid scan

Age	Number of patients	Percentage
<20	3	9.1
21-30	7	21.2
31-40	6	18.2
41-50	7	21.2
51-60	7	21.2
>60	3	9.1

Figure 2

Table II: Racial distribution of the patients reflecting the population of the state

Race	Number of patients	Percentage
Malay	28	84.85
Chinese	4	12.12
Siamese	1	0.03

Figure 3

Table III: Histopathology results as compared to the thyroid scan findings

HPE result & Thyroid scan findings	Malignant	Benign	Total
Cold nodule	9	17	26
Hot nodule	2	5	7
Total	11	22	33

It was shown that 26 out of 33 scintigraphy scans revealed cold nodules. Only 9 of them were consistent with the pathology reports which were malignant. The positive predictive value was 34.6 %

The sensitivity of thyroid scan in our study population was 81.8 % but the specificity was only 22.7 %. The negative predictive value was 71.4 %.

The accuracy of thyroid scintigraphy in our set up was 42.4 %

DISCUSSION

Thyroid scintigraphy has traditionally been regarded as the gold standard investigation for a patient presented with solitary thyroid nodule. Its use started before the era of computed tomography scan or magnetic resonance imaging.

However, it is poorly sensitive and specific in the diagnosis of thyroid cancer. In Hospital Universiti Sains Malaysia, some of the surgeons still investigate with this modality. Our study showed the sensitivity and specificity of thyroid scintigraphy is 81.8% and 22.7% respectively. This is consistent with other studies, where the sensitivity and the specificity were reported to be 95.8% and 21.1% respectively.[3] Although the sensitivity is acceptably high, the specificity index is more useful in these cases because the aim of the investigation is to predict the malignant status. A good sensitivity is required for screening but specificity is crucial in the diagnosis.

The outcome of the thyroid scintigraphy with low rate of specificity has rarely changed the management of the patient with thyroid swelling.

However, thyroid scintigraphy is still a useful investigational tool, especially in the follow-up cases of thyroid malignancy post operatively. This is done to evaluate the status or presence of any thyroid tissue remnants. Other than that, Puylaert J B et al has concluded from his study that scintigraphy is the examination of choice for screening for radiation-induced thyroid malignancies.[4]

CONCLUSION

The specificity of thyroid scintigraphy is low and this technique should not be done as a routine test in every patient with thyroid nodule. However, it is helpful as an adjunct investigation as well as in monitoring of residual thyroid tissue post opertaively.

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