Endocrinology & Metabolic Syndrome
ISSN: 2161-1017

Schillaci et al., Endocrinol Metab Synd 2012, 1:4
DOI: 10.4172/2161-1017.1000108

Case Report Open Access

Frequency of Discrepancy between Scintigraphy Reports and TSH Dosage

Schillaci O[1], Modoni S[2], Tavolozza M[1], Travascio L[1], Lacanfora A[1], Di Biagio D[1]*, Palombo E[1] and Simonetti G[1]

[1]Department of Diagnostic Imaging and Interventional Radiology, Molecular Imaging and Radiotherapy, University of Rome "Tor Vergata", Rome, Italy
[2]Nuclear Medicine, University Hospital Ospedali Riuniti, Foggia, Italy

Abstract

Objective: The purpose of the study was to analyze the discrepancy observed between scintigraphic reports and hormonal dosages.

Methods: Eighty-four consecutive patients undergone thyroid scan with ^{99m}Tc were included in this study. 6/84 pts also underwent a ^{131}I scan to compare discordant TSH value and thyroid scan result.

Results: Discrepancy in our series due to the absence of focal areas of thyroid hyperfunction was found in 15/84 patients with subclinical hyperthyroidism, defined by standard free fractions (FT3 and FT4) and TSH inhibited or anyway substandard (18% of all cases, 48% of patients with low TSH). In 11/84 patients (13% of all cases, 21% of patients with normal TSH value) a "hot" nodule was found without hormonal values suggestive of a frank or subclinical hyperthyroidism.

Conclusion: In cases with TSH below the normal range as there is often in front of the non-detection of nodules functionally independent. Further studies are needed to identify the coexistence of factors other than those already known, that play a role in regulating TSH. On the other hand the unexpected feedback of "hot" nodules with hormonal tests perfectly normal suggest a low intake of iodine in the diet; infact a low intake of iodine cannot produce enough thyroid hormone so high as to trigger the pituitary feed-back, even in areas of functional autonomy.

Keywords: Thyroid gland; Thyroid nodule; Thyrotropin; Radionuclide imaging; ^{99m}Tc-Pertechnetate

Introduction

Currently the main indication for a thyroid scan is given by frank or subclinical hyperthyroidism aiming to verify the presence of glandular hyperfunction which may either be diffuse or focal (autonomous nodule). Though, in clinical practice low TSH values may not relate to a functionally autonomous thyroid nodule, while scintigraphically "hot nodules" may be found in patients with a normal thyroid hormonal profile. In the latter cases, given the well documented literature of "hot" nodules in scintigraphy with radiopertechnetate but "cold" in scintigraphy with radioiodine, scans performed both with ^{99m}Tc and ^{131}I were compared. In our nuclear medicine unit we wanted to quantify these mismatches, comparing scintigraphic results to hormonal dosages and ultrasound thyroid examination.

Material and Methods

Eighty-four consecutive patients undergone thyroid scan with ^{99m}Tc were included in this study. Six/84 patients also underwent a^{131}I scan to compare discordant TSH value and thyroid scan result.

The images were acquired 20-40 minutes after IV administration of 3 mCi (111 MBq) of ^{99m}Tc-pertechnetate by GE Discovery ST gamma camera, equipped with low energy high resolution collimators (about 500 k counts planar acquisitions, matrix 128×128, zoom 2). Scans with ^{131}I were performed 24 hours after administration of 50 μCi (1.8 MBq) of ^{131}I by a single-head gamma camera GE Millennium MG equipped with "general purpose" collimators for high energy (about 50 k counts planar acquisitions, matrix 128×28, zoom 2).

Scintigraphic scans were evaluated keeping into account thyroid hormone serum values from several laboratories (TSH, FT3, FT4) and the report of thyroid ultrasound examination (Figures 2a and 2b) performed previously, respectively within 6 months and 1 year from the scintigraphy.

Patients previously under levothyroxine or anti-thyroid (propylthiouracil or methimazole) therapy, within respectively 60 and 3 days from the scintigraphy, were also excluded from the present study. Only patients with a single nodule >15 mm, in example scintigraphic spatial lower limit, evaluated by US of the neck, were included.

Statistical Analysis

The significance of the association between two variables in a contingency table performing two-tail P value calculus obtained from X^2, or through Fisher's exact test in a 2×2 table when sample sizes were

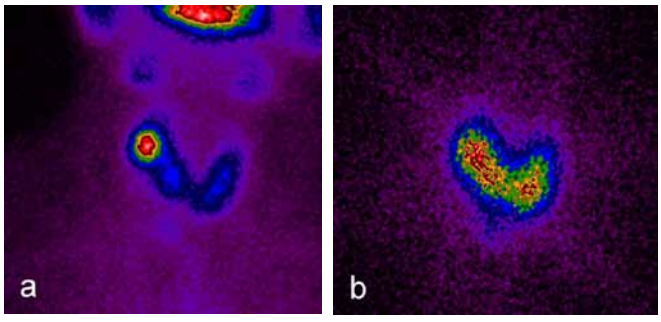

Figure 1: Appearance of a "hot" nodule in the upper right lobe with a low concentration in the remaining parenchyma at ^{99m}Tc-scintigraphy (a) and (b) only a weakly increased uptake of iodine-131 by the same nodule at ^{131}I-scintigraphy; in this case the TSH was 2.46 with FT3 and FT4 in normal range.

***Corresponding author:** Daniele Di Biagio, Department of Diagnostic Imaging and Interventional Radiology, Molecular Imaging and Radiotherapy, University of Rome "Tor Vergata", Rome, Italy, E-mail: danieledibiagio@gmail.com

Received October 02, 2012; **Accepted** October 26, 2012; **Published** October 28, 2012

Citation: Schillaci O, Modoni S, Tavolozza M, Travascio L, Lacanfora A, et al. (2012) Frequency of Discrepancy between Scintigraphy Reports and TSH Dosage. Endocrinol Metab Syndr 1:108. doi:10.4172/2161-1017.1000108

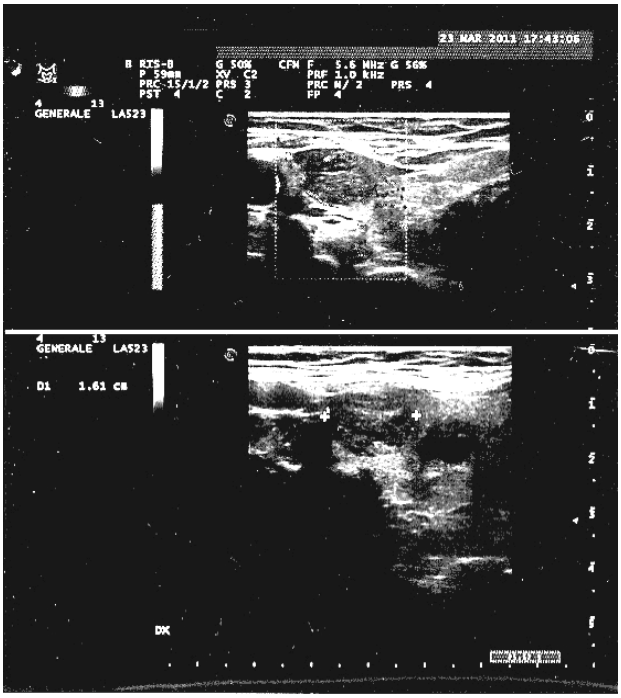

Figure 2: Ultrasound images of the thyroid in Figure 1: a) axial view; b) sagittal view. The hot nodule seen in figures 1a and 1b was evaluated with ultrasound: there was an intranodular increased vascularity at the Doppler assessment.

small, was studied. A hypothesis was considered valid when P value ≤ 0.05. All the data were processed using R Development Core Team.

Results

Among the 84 patients studied (21 Males, 63 Females), 31/84 showed a TSH below normal, 52/84 had TSH within normal limits and 1/84 had TSH higher than higher limit. The hormone values considered, even though made in different laboratories, were performed 10-90 days before the scintigraphy (median 60 days, interquartile range 28-98 days).

There were no significant differences in the percentage of males and females among the entire population (25% male, 75% female) and groupings for normal TSH (25% male, 75% females) and lower than normal (26% male, 74% females) and within the same subgroups.

Among patients with low TSH, 8/31 had also free fractions (both FT3 and FT4 or one of the two) that exceeded the normal limits.

The highest number of discordance between scintigraphic results and hormonal levels was found in cases with TSH below lower limit (15/31, 48.4%), as the scan did not show focal hyperfunction in these patients has not been revealed the presence of focal hyperfunction as might be expected; only a subset (8 patients) in which the low TSH was associated with the presence of free fractions higher than normal, there was not any discordance.

T-test was used to evaluate whether the two groups of patients with TSH below normal belonged to different populations: the test was significant ($p<0.01$); excluding the 8 patients who also had FT3 and / or FT4 above the normal, the difference was not significant ($p=0.355$).

In the group with normal TSH, eleven patients (11/52, 21%) showed the unexpected finding of "hot" nodule. None of these patients had TSH values lower normal limits, eventually suggesting an area of functional autonomy: the lowest value of TSH in this group was 0.64 g/dl (reference interval 0.27-4.20). Six of these had a thyroid nodule with more evident increased uptake and subsequently have also performed a scintigraphy with ^{131}I for comparison; in one case a significantly different biodistribution was found between radiopertechnetate and radioiodine therefore further evaluation by fine needle aspiration cytology was scheduled, which then showed a picture of benign nodular hyperplasia.

Finally, the total number of discordancies was observed in 26 out of 84 patients (31%), of which 18% (15 patients) is due to non-detection of "hot" nodules and 13% (11 patients) to unexpected discovery of this same type of formations.

Discussion

Data presented in this study and previously demonstrated [1-3] support the use of thyroid scintigraphy to determine the functional status of thyroid tissue. This was true especially in cases with TSH below the normal range, when no focal autonomous tissue was found (48.4%, almost one out of two). When taking into account only those patients with normal FT3 and FT4, the percentage of expected discordance is even higher (65%); in these cases the average of TSH between patients with or without hot nodules was not significant ($p=0.355$).

The presence of chronic thyroiditis at the beginning or expanding pool of iodide cannot fully explain this phenomenon; further studies are needed to identify the coexistence of factors other than those already known, that play a role in regulating TSH.

It is interesting to consider the percentage of cases (13% of all cases, 21% of patients with TSH in normal range) where the opposite applies, i.e. unexpected "hot" nodule with hormonal values perfectly normal.

In 6 patients with a thyroid nodule "hot" bulky and visible at ^{99m}Tc scan (Figure 1b), it has set the specific diagnostic doubt that it could be cold at iodine-131 scan, as it is well described [4-13] the dissociation between uptake of the radiopharmaceutical (present in the scans with radiopertechnetate) and organification, an exclusive iodine feature, present in some nodules then found to be well-differentiated thyroid cancer (papillary or follicular carcinoma). Only in one case there was a substantially different scintigraphic appearance of a thyroid nodule (Figures 1a and 1b), that appeared to be "hot" and associated with a low concentration in the remaining parenchyma examination at ^{99m}Tc scan and only a weakly increased uptake than the rest of the gland with ^{131}I. The subsequent evaluation by fine needle aspiration cytology, while showing intranodular increased vascularity at the Doppler assessment, did not detect cellular atypia suspicious for malignancy (TIR2 by "consensus" cytological SIAPEC 2007).

It can therefore be assumed that the nodules that turned out to be "hot" with technetium-99m, even when not associated with increased production of thyroid hormones, are considered as areas of focal hyperplasia of benign type; sometimes they also have a hypervascular pattern at the Doppler evaluation, therefore suggesting a low dietary iodine intake [14]. Infact a thyroid receiving a low intake of iodine cannot produce enough thyroid hormone to trigger the pituitary feed-back, even in areas of functional autonomy. All these findings indicate the importance of performing a thyroid scan in iodine deficiency areas as a first-line investigation.

Acknowledgements

This work was supported by grant from "Università di Roma Tor Vergata", Italy.

References

1. Meller J, Becker W (2002) The continuing importance of thyroid scintigraphy in the era of high-resolution ultrasound. Eur J Nucl Med Mol Imaging 29: S425-S438.
2. Sarkar SD (2006) Benign thyroid disease: what is the role of nuclear medicine? Semin Nucl Med 36: 185-193.
3. Hurtado-López LM, Monroy-Lozano BE, Martínez-Duncker C (2008) TSH alone is not sufficient to exclude all patients with a functioning thyroid nodule from undergoing testing to exclude thyroid cancer. Eur J Nucl Med Mol Imaging 35: 1173-1178.
4. Thrall JH, Burman KD, Wartofsky L, Corcoran RJ, Johnson MC, et al. (1978) Discordant imaging of a thyroid nodule with 131I and 99mTc: concordance of 131I and fluorescent scans. Radiology 128: 705-706.
5. Thrall JH, Burman KD, Gillin MT, Corcoran RJ, Johnson MC, et al. (1977) Solitary autonomous thyroid nodules: comparison of fluorescent and pertechnetate imaging. J Nucl Med 18: 1064-1068.
6. Oyamada H, Tabei T (1977) Scintigraphic evaluation of cold thyroid nodules. Tohoku J Exp Med 123: 315-321.
7. Hirabayashi S, Koga Y, Kitachara T, Hishida T, Kiga M (1975) Inconsistent images of thyroid nodule scintigrams made with iodine and pertechnetate: case report. J Nucl Med 16: 918.
8. Turner JW, Spencer RP (1976) Thyroid carcinoma presenting as a pertechnetate "hot" nodule, but without 131I uptake: case report. J Nucl Med 17: 22-23.
9. O'Connor MK, Cullen MJ, Malone JF (1977) A kinetic study of [131I] iodide and [99mTc] pertechnetate in thyroid carcinoma to explain a scan discrepancy: case report. J Nucl Med 18: 796-798.
10. dell'Erba L, Gerundini P, Caputo M, Bagnasco M (2003) Association of hyperfunctioning thyroid adenoma with thyroid cancer presenting as "trapping only" nodule at 99mTcO4- scintigraphy. J Endocrinol Invest 26: 1124-1127.
11. Steinberg M, Cavalieri RR, Choy SH (1970) Uptake of technetium 99-pertechnetate in a primary thyroid carcinoma: need for caution in evaluating nodules. J Clin Endocrinol Metab 31: 81-84.
12. Shiroozu A, Inoue K, Nakashima T, Okamura K, Yoshinari M, et al. (1981) Defective iodide transport and normal organification of iodide in cold nodules of the thyroid. Clin Endocrinol (Oxf) 15: 411-416.
13. Demeester-Mirkine N, Van Sande J, Dor P, Heimann R, Cochaux P, et al. (1984) Iodide organification defect in a cold thyroid nodule: absence of iodide effect on cyclic AMP accumulation. Clin Endocrinol (Oxf) 20: 473-479.
14. Becker D, Bair HJ, Becker W, Günter E, Lohner W, et al. (1997) Thyroid autonomy with color-coded image-directed Doppler sonography: internal hypervascularization for the recognition of autonomous adenomas. J Clin Ultrasound 25: 63-69.