



Radioguided thyroidectomy for follicular tumors: Multicentric experience



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H I G H L I G H T S

- The diagnosis of thyroid nodular diseases requires an integrated approach.
- In case of “Follicular Lesions” findings the non-invasive technique is unable to distinguish carcinoma from follicular adenoma, then indicating the necessity of surgery to obtain a correct diagnosis.

A R T I C L E I N F O

Article history:

Received 31 December 2016

Received in revised form

29 March 2017

Accepted 29 March 2017

Keywords:

Thyroid cancer

Thyroid follicular neoplasm

99m Tc-MIBI scintigraphy

MIBI uptake

Radioguided surgery

Thyroidectomy

A B S T R A C T

Background: The diagnosis of thyroid nodular diseases requires an integrated approach that has been widely established over the past years. This strategy includes: ultrasonography (US) with; implemented Color-Power-Doppler, conventional scintigraphy also with positive indicators, specific pathological studies targeted by immunohistochemically-assays, and the fine needle; aspiration biopsy (FNAB), which, usually, in case of “Follicular Lesions” (10–20%) findings is; unable to distinguish carcinoma from follicular adenoma, then indicating the necessity of surgery to; obtain a correct diagnosis. The aim of this study was to evaluate the role of the scintigraphy with; positive indicators, both preoperatively in diagnostic approach of the thyroid nodules and; intraoperatively as a guide to the extension of the surgical excision.

Methods: On 4482 Thyroidectomy performed, we selected 360 cases of follicular neoplasms (192; females and 168 males). In the preoperative phase, these patients underwent 99 m Tc-sestaMIBI; scintigraphy with both early (10 min) and late (2 h) image acquisition, which were later; compared to the ones obtained by image subtraction of means 99 m Tc-pertechnetate. Following the; sestamibi administration before intervention, we selected the most up-taking nodularity with the; assistance of a specific surgical probe (Neoprobe), quantifying uptake with relation to the surgical pathology, for an amount of 324 total thyroidectomies and 36 hemi thyroidectomies.

Results: In all cases of multinodular goiter the benign nodules showed an intraoperative low sestamibi uptake whereas follicular carcinomas showed both a high preoperative uptake and, as a; percentage, the highest values of intraoperative uptake; on the other hand, follicular adenomas had; both pre-and intraoperative mean values of uptake. On the contrary, papillary carcinomas only; showed a mild uptake.

Abbreviations: US, ultrasonography; FNAB, fine needle aspiration biopsy; LBC, liquid-based-cytology.

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<http://dx.doi.org/10.1016/j.ijssu.2017.03.081>

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Conclusions: Preoperative sestamibi scintigraphy confirmed its importance in improving the information obtained through different diagnostic investigations. Also intraoperatively, it pointed out high-risk nodules more accurately. Therefore, radio (Sestamibi) guided surgery could have an interesting rule in the thyroid follicular lesion treatment.

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1. Introduction

Nowadays, the characterization of the surgical pathology of the thyroid, both in benign (85–90% of cases) and malignant (10–15% of cases) diseases, employs traditional biochemical tests together with standardized ultrasound and scintigraphy examinations, which can give their assistance in obtaining a better cytology by guided needle aspiration, according to well established diagnostic and therapeutic criteria. On the other hand, the therapeutic setting of thyroid nodules defined by cytology as “follicular proliferation” or “follicular neoplasm”, that represent between 10 and 20% of needle aspirations, still requires a diagnostic aimed surgery [1–3]. Even if liquid-based-cytology LBC-processed biopsies are a valid alternative to conventional cytology [4], the possibility of applying additional techniques to enhance the efficacy of the cytological diagnosis of thyroid nodules still cannot definitively solve the problem. In fact, in such situations, surgical strategy is influenced by the lack of suitable cytological criteria to distinguish follicular carcinomas from adenomas, requiring surgery to fully assess pathology. Here we report our experience in managing follicular neoplasms utilizing, in addition to the traditional surveys, both scintigraphy tracers and radio guided surgery.

1.1. Objectives

To evaluate the possible role of scintigraphy with positive indicators in thyroid nodular disease, both in preoperative diagnosis and in leading intraoperative surgical excision.

2. Materials and methods

From January 2006 to December 2013, we collected 4482 patients surgically treated for thyroid disease. Of these, 360 reported follicular neoplasms, to which we applied the following diagnostic flowchart [Table 1]:

In this flowchart we suggest using scintigraphy with sestamibi in the diagnostic pathway, with a procedural protocol described hereinafter.

2.1. Scintigraphy procedure

In patients previously undergone scintigraphy with pertechnetate, scintigraphy Whole-body scan images are acquired in supine position, both in front and at the back, and focused on the cervicothoracic region, at 10' and 120' (early and late acquisitions) after the intravenous administration of 555 MBq of 99 m Tc-MIBI. A wide field gamma camera is used, provided with a low energy parallel-hole collimator, interfaced by a dedicated workstation.

Sestamibi images are evaluated for each patient and directly compared to those with pertechnetate. In each patient, the number and the location of the nodules were also established on the basis of the clinical examination and of the ultrasound findings, besides Eco-Color-Doppler.

2.2. Findings

The 99 m Tc-MIBI scintigraphy shows a radiopharmaceutical uptake of both single nodules and in the context of multinodular goiters, colloid and neoplastic, benign or malignant; however, the latter acquisition (two hours after administrating the tracer) shows how the different tracer washout by both of the labeled drugs allows to better define the two morbid conditions. Also, over several experiments we noticed that colloid nodules had a late washout, whereas solid nodules, either benign (follicular adenoma) or malignant (carcinoma) [5–7], had an early washout.

According to our diagnostic algorithm, we enrolled our patients, 192 F and 168 M, mean age 44.5 years, suffering from thyroid nodular disease, and “follicular neoplasm” carriers at the FNAB. Of these patients, 156 patients had a single nodule, “cold” on scintigraphy with 99mTc-pertechnetate and Eco-Color-Doppler intranodular vascularization (Pattern III sec. Lagalla), while the remaining 204 patients had a multinodular disease, although FNAB was carried out on the most suspicious nodules according to the findings on ultrasonography and scintigraphy. All patients underwent a preoperative 99 m Tc-MIBI scintigraphy (iv administration of 555MBq 99 m Tc-MIBI), and early (10 min) and late (2 h) images were acquired; sestaMIBI images were obtained for each patient and directly compared to those obtained by 99mTc-pertechnetate. Then, immediately before surgery, following the iv administration of a tracer dose (37mBq) of sestamibi, we used a probe for radio guided surgery (Neoprobe) in order to perform a more rigorous selection of the most uptaking nodules. This probe is composed of a stylus-like detector and of a digital console showing the tracer uptake as percentage [Fig. 1].

The intraoperative pathological examination was not performed, because of the limitations above mentioned. Once removed, and always using the same radio guided probe, the excised sample was immediately examined by a pathologist, who accurately examined it by practicing serial slices of the most uptaking lesions [Fig. 2].

We undertook 324 total thyroidectomies and 36 hemi thyroidectomies, in patients with one single node and a macroscopically intact contralateral lobe [Table 2].

3. Results

By means of preoperative scintigraphy, we distinguished:

- 120 low up-take nodules (of which only 6 as single nodes) with an uptake until 12 Gy;
- 144 medium up-take nodules with an uptake until 24 Gy;
- 96 high up-take nodules (including 72 as single nodes) with an uptake over 24 Gy.

Intraoperative survey confirmed, as percentage, the preoperative findings, and the high uptake in the reported 96 nodules; particularly, in one case, the high concentration of the tracer was related to the presence of a small nodule (<1 cm diameter), not revealed at preoperative examinations, and placed behind a bigger

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