The Value of Intraoperative Scintigraphy as a Routine Procedure in Thyroid Carcinoma

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Intraoperative scintigraphy (IOS) was performed with a previously developed and described technique in a prospective study of 64 patients with highly differentiated thyroid carcinoma. Residual iodine uptake after macroscopically radical thyroidectomy was registered at IOS in 43 patients. IOS permitted identification and removal of the residual tissue in 33 of these patients, leading to negative postoperative scintigraphy in 27. Of the 10 patients in whom the residual iodine uptake at IOS could not be eliminated, 3 had metastases outside the operative field (treated with postoperative radioiodine ablation) and 7 had a tiny remnant of thyroid tissue behind the entrance of the inferior laryngeal nerve.

The residual tissue detected by IOS was localized in or associated with the pyramidal lobe in 11 patients, and in 8 it was immediately behind and below the entrance of the inferior laryngeal nerve. Other locations were lymph nodes along the carotid artery or internal jugular vein, in the supravacular fossa or in the ligated inferior thyroid artery.

Conclusions from this case series were that IOS is more sensitive than regular postoperative scintigraphy for detection of residual thyroid tissue, that it significantly reduces the need for postoperative radioiodine ablation (which was avoided in more than half of the patients with residual uptake at IOS), and that it technically facilitates performance of the operation and greatly enhances the possibility of achieving complete thyroidectomy.

Although the surgical strategy in thyroid carcinoma has been controversial, the dominant therapeutic concept today is total thyroidectomy combined with removal of all lymph nodes with manifest or suspected metastatic growth. There are several reasons why total thyroidectomy should be the treatment of choice:

1. Complete removal of thyroid tissue increases the feasibility of detecting metastatic growth outside the operative field at an early, treatable stage by postoperative radioiodine scanning [1-3].

2. When all thyroid tissue has been removed, serum thyroglobulin levels can be used as a sensitive indicator for early detection of recurrence, which can then be successfully treated [4].

3. Total thyroidectomy is the only means of ensuring removal of all multicentric tumor growth, which has been reported to occur in 30-80% of highly differentiated thyroid carcinomas [5-8].

Even after macroscopically radical surgery, however, scintigrams reveal, in many cases, iodine uptake in residual thyroid tissue or metastatic lymph nodes [5, 9-13]. Radioiodine ablation is then required for completion of the thyroidectomy [1-3], which implies additional discomfort for the patient and exposure to considerable irradiation.

We previously presented a new technique for intraoperative scintigraphy, which permits detection and thence removal of residual thyroid or tumor tissue of a size as small as 2 mg. The possibility of achieving a truly complete thyroidectomy is thereby increased [14].

In the present study, we prospectively evaluated the results of intraoperative scintigraphy with that technique as standard procedure in a series of patients operated on for highly differentiated thyroid carcinoma.

Material and Methods

Sixty-four patients (42 women, 22 men) undergoing operation for highly differentiated thyroid carcinoma at Linköping University Hospital, Linköping, Sweden, from 1983 to 1986 were included in the study. They ranged in age from 15 to 77 years (median, 36.7 yr). The histologic tumor type was follicular in 28 patients, mixed papillofollicular in 20, and pure papillary carcinoma in 6. The operation, in all cases, was total thyroidectomy according to a strictly standardized procedure [15-17], including careful inspection of regional lymph nodes and removal of all nodes with manifest or suspected metastatic growth (modified neck dissection).

When the diagnosis of malignancy had been confirmed preoperatively, the thyroidectomy was done as an en bloc procedure—removing the thyroid gland and adjacent lymph nodes in a single piece [17]. When the diagnosis could not be secured preoperatively, complete hemithyroidectomy was done, and extended within 2–3 days to total thyroidectomy if histologic examination showed malignancy.
After removal of all macroscopically visible thyroid and tumor tissue, intraoperative scintigraphy was performed as described below. Residual tissue was recorded in a protocol and (when possible) removed.

About 6 (5–8) weeks after the operation, all patients underwent routine scintigraphy (37 mBq $^{131}$I). No patient received thyroxine medication before the operation or between the operation and postoperative scintigraphy. When postoperative scintigraphy showed no residual uptake, thyroxine replacement therapy (0.20–0.30 mg/day) was started.

In accordance with our routine procedure, the patients were seen at the Department of Surgery at 3, 10, and 20 weeks after the operation and then at 4 monthly intervals, for clinical examination and determination of serum thyrotropin, thyroxine, and thyroglobulin (S-TG) levels.

**Analytical Method**
S-TG was determined with a double antibody radioimmunoassay [18].

**Results**

**Intraoperative and Postoperative Scintigraphy**
No radioiodine uptake was registered at either intraoperative or postoperative scan in 21 of the 64 patients (Fig. 1). The intraoperative scintigraphy registered iodine uptake within the operative field in 43 patients, and this uptake could be located with the detector. In 33 of these 43 patients, residual thyroid or tumor tissue was removed and no further uptake could be registered during the operation. The postoperative scintiscan was negative in 27 of the 33, but was positive in the other 6, in whom radioiodine ablation was performed (Fig. 1).

The residual uptake identified intraoperatively in 7 other patients was traced to a tiny remnant of thyroid tissue immediately behind the entrance of the recurrent laryngeal nerve in the cricolyangueal cartilage. In 3 of them this uptake was confirmed in the postoperative scan, but on the basis of the intraoperative observations, postoperative radioiodine ablation was not considered necessary in these cases. In the other 4 patients, the small residual uptake could not be confirmed on the postoperative scan, which was entirely negative.

Increased background counts were registered intraoperatively in 3 patients, but there was no distinct local uptake within...