Intraoperative color detection of lymph nodes metastases in thyroid cancer

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ABSTRACT

The subject of a research was the group of patients with morphologically confirmed diagnosis of a thyroid cancer. We carried out an analysis of follow-up process for 11 patients (9 – with a papillary thyroid cancer, 2 – with a medullary thyroid cancer). All patients underwent surgical treatment according to the standard for this category of patients – a total thyroidectomy with bilateral radical and/or selective lymphatic dissection. 1% blue dye glucose solution was injected into the thyroid tissue surrounding the tumor with an insulin syringe at the periphery of the square into 4 points at a volume of 0.2 ml in each point. The median exposition of the dye distribution (15 minutes) was chosen empirically.

Papillary thyroid carcinoma metastases to lymph nodes have also been morphologically confirmed in 7 patients. In medullar thyroid carcinoma, massive, seen intraoperatively lesion of levels II – IV lymph nodes has been confirmed morphologically as well. But in medullar cancer, no one lymph node among those visualized ad oculus has been stained with blue dye. In 7 from 9 patients with papillary thyroid carcinoma, the ultrasound scanning did not reveal neck lymph nodes metastases while color detection method showed a false-positive only result in 2 patients.

The lymph node staining with blue dye allows detecting regional lymph nodes containing metastases of papillary thyroid carcinoma.

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1. Introduction

Therefore, the preoperative or intraoperative visual detection of lymph nodes containing tumor tissue seems to be very expedient when making a decision about the extent of the lymph node dissection.

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Radical surgery in cancer patients consists of complete tumor removal as well as appropriate node dissection.

In 1977, Cabanas RM et al., first, proposed the sentinel lymph node concept (Alex 1993). In 1992, Morton D. et al. using the indirect lymphoscintigraphy with Te 99 proved this concept to be true taking skin melanoma as an example. Simultaneously with using the radioisotope tracer Te 99 for the detection of sentinel lymph nodes in melanoma, the aqueous solution of blue dye was proposed. The dye has proved to be highly effective in detecting a sentinel lymph node, this finding being unexpected. The technique included blue dye peri-tumoral injections from several points. A lymph node positive for the tumor tissue presence was determined ad oculus (Balch 2000). Conducted international randomized studies aimed at the identification of regional lymph nodes using blue dye and radioisotope tracer in melanoma have shown these techniques to be highly effective (Cabanans 1977; Cox et al. 1999).

Aim of study: to determine a feasible use of blue dye for intraoperative visualization of differentiated thyroid carcinoma (DTC) metastases spreading into regional lymph nodes.

2. Materials and methods

11 patients with DTC, 8 women and 3 men aged 47,8±2,1 years were enrolled in the study group. The intrathyroid tumor did not exceed the limits of the capsule, its median morphological size being 16,9±2,5 mm, corresponding to pT1/T2 descriptor according to the TNM/pTNM Classification of Thyroid Cancer.

All patients suspected for having the cancer underwent ultrasound (US) scanning of the neck for assessing tumor size and enlarged neck lymph nodes.

Cytologically, the diagnosis was confirmed in 100% of cases using fine-needle aspiration biopsy, papillary carcinoma was revealed in 9 patients, medullar cancer in 2 patients.

Intraoperative contrast study of neck lymph nodes
1% blue dye glucose solution (Neopharma GmbH & Co. KG) was injected into the thyroid tissue surrounding the tumor with an insulin syringe at the periphery of the square into 4 points at a volume of 0,2 ml in each point. Due to the excellent vascularization and perfusion capacity of the thyroid tissue, the median exposition of the dye distribution (15 minutes) was chosen empirically. (Fig. 1, 2).

The total resection of the thyroid gland was performed for securing the non-recurrence and making the conditions for the radioiodine therapy. The lymph node dissection was performed with treatment and prophylaxis (prevention) aims and was determined as radical, modified radical and selective. Topographically, regional neck metastases were defined depending on the level of lymph drainage (I – submandibular and submental lymph nodes; II – upper jugular lymph nodes; III - middle jugular lymph nodes; IV - inferior jugular lymph nodes; V - lymph nodes of the posterior triangle of the neck; VI - pre-, paratracheal, perithyroid and cricothyroid lymph nodes).
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Fig. 1. Injecting the blue dye into the thyroid tissue surrounding the tumor

Fig. 2. Metastatic node on the jugular vein is contrasted 15 minutes later

Fig. 3. Stained lymph node in lymphatic tissue

Fig. 4. Metastasis of the same node seen microscopically
3. Results

The thyroid carcinoma has been morphologically confirmed in 100% of patients. Papillary thyroid carcinoma metastases to lymph nodes have also been morphologically confirmed in 7 patients. In medullar thyroid carcinoma, massive, seen intraoperatively lesion of levels II – IV lymph nodes has been confirmed morphologically as well. But in medullar cancer, no one lymph node among those visualized ad oculus has been stained with blue dye. In 7 from 9 patients with papillary thyroid carcinoma, the ultra sound scanning did not reveal neck lymph nodes metastases while color detection method showed a false-positive only result in 2 patients: level III of lymph drainage (1 lymph node false-positive), level IV (1 lymph node false-positive), and level VI (2 lymph nodes false-positive) (Table 1).

Table 1. Comparison characteristic of lymph nodules by US scanning and intraoperative color detection

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<th>Levels of lymph drainage</th>
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<td>Intraoperative color detection with blue dye</td>
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<td>5LN+</td>
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<td>*2LN+</td>
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<td>*LN+ lymph nodes positive</td>
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<td>**LN± lymph nodes false-positive</td>
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4. Discussion

In breast cancer, the combined use of radioisotope and color detection allowed identifying involved lymph nodes in 95% of cases and performing an adequate lymph node dissection [5].

The results of the first contrast lymph nodes studies in colorectal cancer have shown only a 70% informativity of color detection technique, and the combined use of blue dye and radioisotopes did not allow increasing the accuracy when determining the metastatic involvement of mesentery and retroperitoneal lymph nodes (Joosten 1999; Merrie et al. 2001).

Identifying sentinel lymph nodes allowed decreasing the extent of ilioinguinal lymph node dissection in 60-80% of patients with vulva and cervical cancer, thus contributing to a decreased postoperative complications rate (Morton 1992).

Performing a D2 or D3 lymph node dissection is still the matter of a controversy, the lymph nodes mapping
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being of a prognostic value when choosing an optimal surgical strategy for gastric cancer (Terada 1998).

In our study, we have demonstrated the feasibility of this method for treating the patients with thyroid cancer and determining the volume of lateral neck dissection.

5. Conclusions

The lymph node staining with blue dye allows detecting regional lymph nodes containing metastases of papillary thyroid carcinoma. This method can help to choose appropriate volume of node dissection at early-stage thyroid carcinoma. Sentinel lymph node containing metastasis indicates the necessity of lateral neck node dissection in all patients.

The sentinel lymph node staining allows differentiating early or advanced medullary and papillary thyroid carcinomas.

References