

# Modifications of Thyroid Cancer Surgical Diagnosis and Treatment: 33 Years of Experience at Saint-Petersburg Center of Endocrine Surgery and Oncology

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## Abstract

Objective identification of recurrences and application of radioactive iodine for the treatment of cancers of the thyroid have now been available in Russia over the last 10 years. This has improved results of the treatment of thyroid cancers. Central neck dissection has also been crucial in the treatment of cancer of the thyroid.

**Keywords:** Thyroid cancer, medullary cancer, chromothyrolymphography, papillary cancer, follicular cancer.

## INTRODUCTION

More than 100 years ago G Crile published his paper “Excision of cancer of the head and neck with special reference to the plan of dissection based on one hundred thirty-two operations”<sup>1</sup> in “JAMA”. Later this operation was named in his memory and popularized by H Martin,<sup>2,3</sup> who often performed routine excision of metastases of cancer to lateral cervical lymph nodes together with surrounding tissues. Besides a cosmetic defect after a broad excision of cervical muscles, another essential disadvantage of this operation is a functional impairment of the upper limb due to traumatic paralysis of spinal accessory nerve (SAN). W Mullally<sup>4</sup> called this complication a “shoulder syndrome”. Despite high effectiveness of the operation judged by a better survival rate of patients with head and neck tumors with metastases to regional lymph nodes, such a situation could not be considered satisfactory. During the last 30 years several modifications of Crile’s operation had been introduced. Their common requirement was preservation of jugular vein (JV), SAN and sternocleidomastoid muscles (SCMM), yet providing the oncological radicalism of the original Crile’s technique.

Titles and essences of neck lymphadenectomy in cases of thyroid cancer (TC) during different periods of history

can be presented as follows: Crile’s operation, thyroid version of Crile’s operation and radical neck dissection—are synonyms (2nd-6th groups of cervical lymph nodes are removed without preservation of SAN, JV and SCMM); modified neck dissection, central and lateral lymphadenectomy, performed simultaneously—are synonyms (2nd-6th groups of cervical lymph nodes are removed with preservation of SAN, JV and SCMM). Another possible operation in TC cases is mediastinal lymphadenectomy.

Dynamics and results of surgical tactics and techniques of thyroidectomy and neck dissections in TC patients are presented after analysis of 33 years of experience in our department.

## MATERIALS AND METHODS

Between 1979 and 2006, in Saint-Petersburg Center of Endocrine Surgery and Oncology, 21066 patients had been operated. Among them—2606 (12.4%) TC patients. The number of operated patients has been constantly increasing (from 138 to 1204 per year), as well as the number of TC patients (from 11 to 233 a year). However, the proportion of oncological patients had been growing faster (from 6.7% in 1973-77 to 26.4% in 2001-06).

The morphological studies of 1892 operated patients has shown prevalence of papillary thyroid carcinoma (58.0%) in the North-West region of Russia, where Saint-Petersburg is allocated. Follicular carcinomas were recognized in 28.3%, medullary—in 5.0%, and anaplastic—in 9.0%. In average, regional metastases of papillary carcinoma were met in 32.2%, follicular—in 25.3%, and medullary—in 68.3%.

Due to considerable changes in diagnosis, techniques and tactics of surgical treatment of differentiated TC during that 33 years period we have divided all patients into 4 groups operated during 4 periods of our work:

- 1st period (1973-1981), 1st group—3259 patients
- 2nd period (1982-1991), 2nd group—4625 patients
- 3rd period (1992-2000), 3rd group—7905 patients
- 4th period (2001-2006), 4th group—5215 patients

## RESULTS AND DISCUSSION

During the analyzed periods, the ratio of histological forms of TC had been changing, mostly due to papillary and follicular carcinomas. This could be explained by iodine prophylaxis of goiter and changes in the international morphological classification, in which papillary-follicular form of TC is referred as papillary cancer now (Khmelnitzky OK, 1987).<sup>5</sup> The ratio of medullar and anaplastic carcinomas has remained constant for over 30 years.

Starting from the first period (1973-81) we have used organ-saving operations in cases of papillary, follicular and sporadic medullar carcinoma of T1, T2 and even T3 stages without distant metastases. Complete removal of the tumor-containing lobe was the indispensable condition. Initially, completeness of thyroidectomy was controlled by iodine or technetium radionuclide incorporation test. From the 80's,

thyroid resections were expanded with biopsies of cervical and upper mediastinal lymph nodes according to the results of indirect chromolymphography (Romanchishen AF, 1989<sup>6</sup>) for the purpose of early, preclinical diagnosis of regional metastases (Fig. 1). In cases of pre- or intra-operational detection of macrometastases, Crile's operation has been performed, or when opportunity offered, modified neck dissection with preservation of JV and SAN (Rakov AI, Vagner RI, 1969<sup>7</sup>). In cases of tumor expansion to other cervical organs (T4), metastases to contralateral cervical or mediastinal lymph nodes (N1b), combined and expanded operations were performed through cervical or trans-sternal approach. To the second half of 1980's it had become obvious that prolonged extensive operations should be divided into 2 stages (cervical and mediastinal, cervical on one side and cervical on the other side), since it is easier for patients of different ages to undergo it.

After 1982 (period 2) new possibilities for cancer diagnosis appeared: regular use of sonography and cytology of the thyroid. Since that time, during every operation concerning TC not only revision of areas of regional tumor expansion (3rd, 4th, 6th groups of lymphatic nodes\*) had been performed, but also biopsy of lymph nodes for the purpose of preclinical microscopic diagnosis of metastases.

Before 1988 regional metastases, were found in 27.9% of operated patients, but as soon as above-mentioned techniques have been introduced, regional expansion has been met more often: 34.5%—from 1989 to 1997, 40.1%—from 1998 to 2006. The difference between groups of patients on this factor was statistically significant. During that time we have used the following surgical tactics. If regional metastases were not revealed before or during operation, but were diagnosed with histological study only, we have offered patients to undergo the 2nd stage – modified

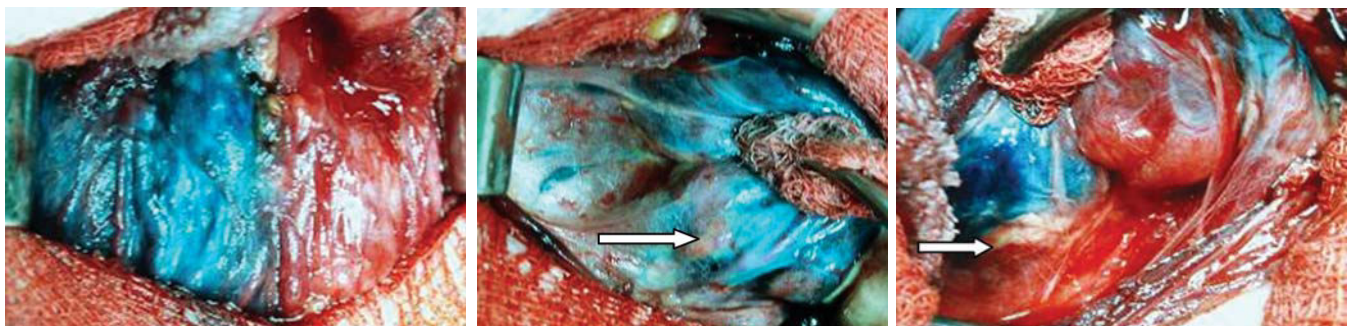


Fig. 1: Indirect chromothyrolymphography by methylene blue (colorless structure—parathyroid gland)

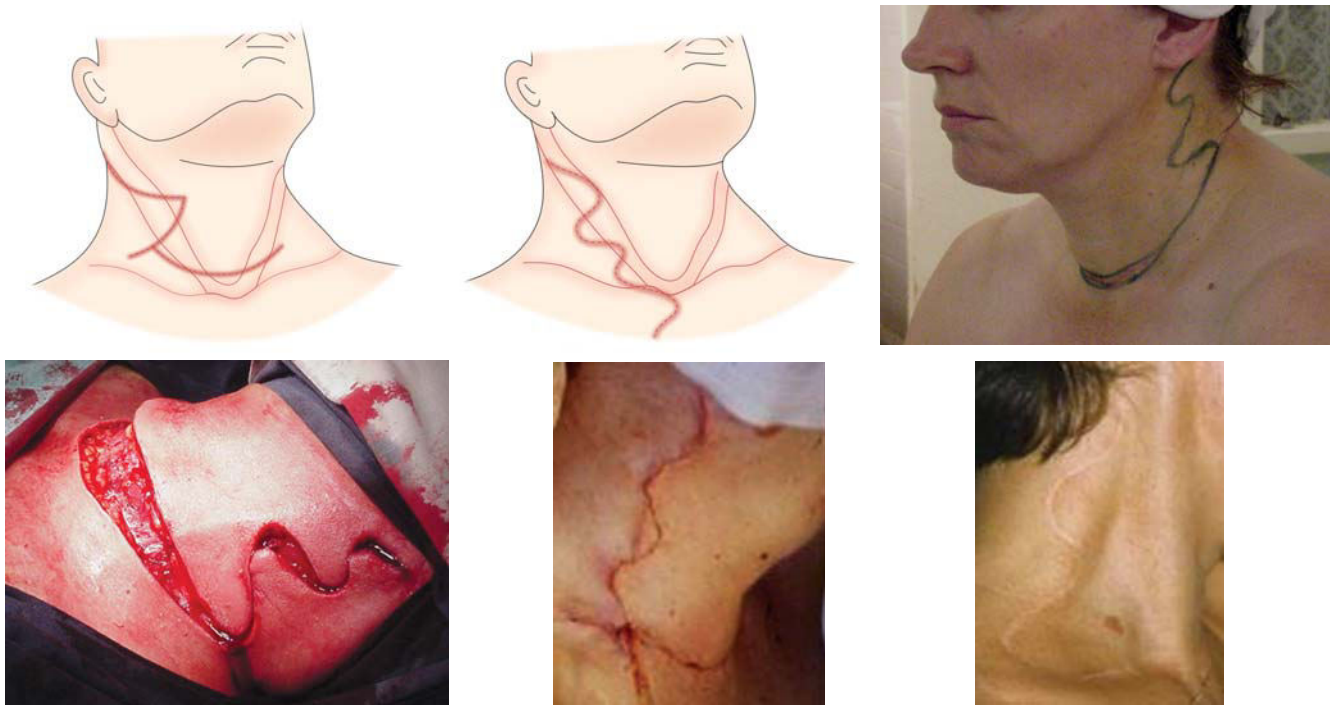


Fig. 2: Cosmetic results: Transversolongitudinal (Z-figurative) approach for lateral neck dissection (Author's certificate no: 1647951)

neck dissection \*\* (central and lateral lymphadenectomy—name of the operation after 1998)—in 1 to 3 months after initial operation. The necessity of the 2nd stage was dictated by finding of foci of malignant growth in regional lymph nodes, which was the case in 60.8 to 80.0% cases after secondary operations. In addition, the study of katamnesis of patients, that have not undergone lymphadenectomy under some reason, has shown that micrometastases have developed into clinically manifesting ones in  $4.1 \pm 0.5$  years. In the same way surgical treatment was divided in 2 stages, if thyroidectomy combined with modified neck dissection appeared to be too much of a burden for the patient.

Rationality of such an approach can be discussable, but it seems important for us that similar tactics was recommended later by C McHenry et al, 1991,<sup>8</sup> W King, A Li, 1994,<sup>9</sup> A Khafif, JE Medina, 2003.<sup>10,11</sup>

Comparison of immediate and follow-up results of surgical treatment of 76 patients in stage 1 (average age  $48.7 + 1$  year) and 97 patients—in stage 2 (average age  $63.9 + 0.9$  year), has shown the advantages of chosen tactics. In the 1st group 4 patients died in the early postoperative period. The causes of death were heart attack, pulmonary and brain embolism, and a cardiovascular collapse. In the 2nd group there were no lethal outcomes, though, patients

in this group were significantly older. Follow-up results of treatment in both groups did not differ.

A so-called “zigzag” incision (Fig. 2) on the lateral surface of neck along rear rim of SCMM was introduced in 1986 and since 1989 is regularly applied for neck dissection. The use of this incision in 177 patients has shown obvious esthetic superiority of postoperative scar, which is very important for women, who have made 85.2% of patients, undergone lateral neck dissection.

\*According to classification by RH Spiro, EW Strong, JP Shah, 1994.<sup>12</sup>

\*\*According to classification by KT Robbins, JE Medina, GT Wolfe, et al 1991.<sup>13</sup>

For the same purpose—to acquire better functional and esthetic results, we have changed another surgical grip. Before 1989 during neck dissections SCMM was usually cut off the collar-bone and sternum, later continuity of this muscle was kept intact. During modified neck dissections surgeons started to allocate elements of neurovascular cervical fascicle, spine accessory, hypoglossal, diaphragm and laryngeal nerves more carefully and anatomically.

The number of classical Crile's operations performed has decreased from 14 (in 1973-88) to 5 (in 1989-97). Crile's operation was applied only in cases, when deserted TC had spread to jugular veins or SCMM.



Not only accumulation of experience and increasing number of lymphadenectomies (from 117 to 579), but also further rationalization of surgical tactics and operational techniques with appliance of new technologies became apparent for the next periods (1992-2006 years). Thus, the necessity of performing central (pre- and paratracheal) lymphadenectomy on the tumor side in the 1st stage in all patients with TC in order to simplify the 2nd stage had been realized. We have started to allocate the inferior laryngeal nerve (recurrent or nonrecurrent) along its whole length—from subclavial area to the entry point in the larynx, at every operation. Since 2000 we have an opportunity of electrophysiological monitoring of inferior laryngeal and other cervical nerves. It is very important during secondary operations and during restoration of injured RLN. Additional anatomical and clinical studies allowed us to interrogate surgical anatomy of this area and also developed a safe operational technique of laryngeal and spinal accessory nerves dissection, practically excluding their damage. The number of central lymphadenectomies, that earlier had been performed only during modified neck dissections, has grown up to 579, that has made 78.9% of all operations on primary TC.

Lately (2001-2005 years) central lymphadenectomy was performed in 317 (82.3%) of 385 operated patients, and was combined with biopsy of 3rd and 4th lymphatic node groups. This has allowed us to increase timely diagnosis of TC metastases up to 40.1%. In summary, nowadays algorithm of regional metastases diagnosis and choice of surgical treatment is shown on Figure 3. The crucial points of surgical treatment of differentiated TC patients are justification and utility of prophylactic 6th group of neck lymphatic node dissection. Current recommendations range from selective dissection for high-risk patients to unilateral dissection to routine bilateral dissection (Sadowski B, et al, 2009). Possible increasing of postoperative specific complications calls as disadvantage of central neck dissection (CND). During 1973-2007 we operated on 2887 TC patients. CND was performed in 1145 of those patients. In 155 (13.6%) cases it was curative, and in 757 (66.1%)—prophylactic. Postoperative morbidity was assessed after 2182 operations. 183 TC interventions were underwent before (1980-1997) and 1999 after (1998-2009) regular CND implementation. Constant carry out of CND under RLN and parathyroid visual control significantly decreased total postoperative complications rate (from 5.2 to 1.0%).

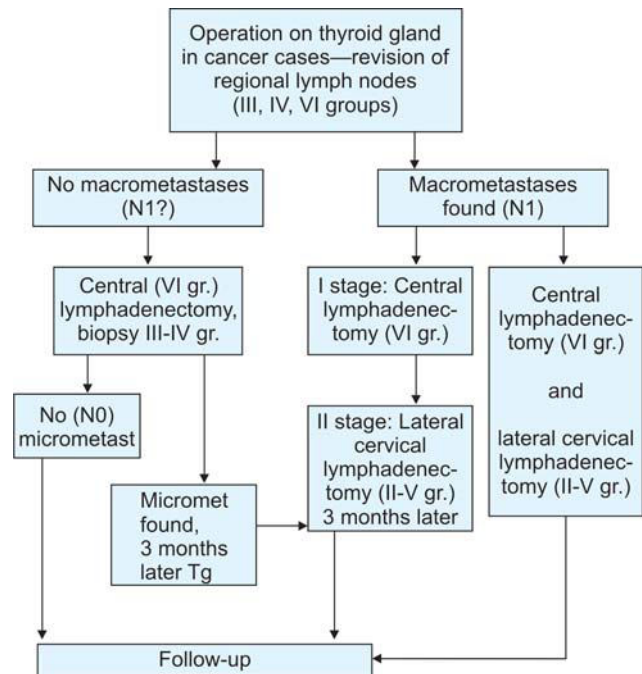


Fig. 3: Regional metastasis diagnosis and lymphadenectomy volume selection algorithm in TC patients

The retrospective analysis of operation's volume in TC patients has shown that the 1990 was notable for our center. Since then the amount of thyroidectomies has grown steadily. In 2000 thyroid has been removed completely 2 times more often, than during the period between 1973 and 1988 (53% against 26%). This change was obvious in papillary cancer patients, specifically with T3 and T4 tumors especially. What has happened? Does not a reasonable organ-saving tactics of surgical treatment of TC patients justify itself? Has the quantity of cancer relapses increased significantly? Has the aggression of TC grown? We did not observe anything of that kind. The tumors at stage T1 have been diagnosed in 19.9%, T2—in 30.7%, T3—in 30.9% and T4—in 18.5% of cases during the first period of our work, in 32.4%, 25.9%, 18.2% and 23.6% during last period, accordingly. What has changed?

1. Early diagnosis of relapses and dissemination of TC due to thyroglobulin level control can be possible after full removal of thyroid tissue only.
2. Radioiodine therapy has become more available during last 10 years in Russia.
3. Effective replacement and TSH-suppressive treatment by thyroxin instead of thyreoidin is used now.

Improvement of tactics and techniques of surgical treatment of patients with differentiated TC has resulted in

**Table 1:** Changes of complications rate after thyroid surgery in the Saint-Petersburg endocrine surgery and oncology center (1973-2006)

<i>Period of center's work</i>	<i>Absolute number of operations</i>	<i>Unilateral RLN injuries (%)</i>	<i>Bilateral RLN injuries (%)</i>	<i>Temporary hypoparathyroidism (%)</i>	<i>Total specific complication (%)</i>	<i>Postoperative bleeding (%)</i>	<i>Postoperative mortality (%)</i>
1973-1981	3259	3.10	1.20	1.00	5.30	0.61	0.50
1982-1991	4625	1.80	0.60	0.80	3.20	0.32	0.60
1992-2000	7905	0.48	0.17	0.40	1.05	0.48	0.14
2001-2006	5215	0.33	0.12	0.73	1.30	0.31	0.13
<i>Period of center's work</i>	<i>Number of operations</i>	<i>Unilateral RLN injuries (%)</i>	<i>Bilateral RLN injuries (%)</i>	<i>Temporary hypoparathyroidism (%)</i>	<i>Total specific complications (%)</i>	<i>Bleeding (%)</i>	<i>Postoperative mortal (%)</i>
1980-1997	183	3.12	1.04	1.04	5.20	1.04	0.05
1998-2009	1999	0.35	0.10	0.55	1.00	0.55	0.10
Total	2182	0.6	0.18	0.6	1.41	0.6	0.14
Complications rate <i>before</i> and <i>after</i> regular using of central neck dissection on differentiated TC patients							
<i>Period of center's work</i>	<i>Absolute number of operations</i>	<i>Unilater RLN injuries (%)</i>	<i>Bilateral RLN injuries (%)</i>	<i>Temporary hypoparathyroidism (%)</i>	<i>Total specific complications (%)</i>	<i>Bleeding (%)</i>	<i>Postoperative mortality (%)</i>
1980-1997	183	3.12	1.04	1.04	5.20	1.04	0.05
1998-2009	1999	0.35	0.10	0.55	1.00	0.55	0.10
Total	2182	0.6	0.18	0.6	1.41	0.6	0.14

a considerable drop (from 0.89% to 0.2% during 1-2 periods), and then in a complete elimination of postoperative lethality during 3rd period (Table 1). The number of unilateral recurrent laryngeal nerve (RLN) injury has been gradually decreasing from 4.4 to 1.6 and to 0.33%, and bilateral paralysis – from 2.1 to 0.5 and to 0%. Relative number of all postoperative SAN paralysis for the 30 years of work has decreased from 2.7 to 1.2 and to 0.1%.

1335 (87.2%) of 1531 patients with TC, operated since 1989, had been on our follow-up list for over 10 years. The study of follow-up results (5-10 and 10-15 years) has shown, that differentiated TC metastases to the zones of negative biopsy of macroscopically intact lymph nodes of 3rd-6th groups occurred only in 1, 5% of all cases. Repeated regional metastases after modified neck dissections (or central + lateral lymphadenectomies) occurred only in 6 (1.91%) cases. Recurrences of differentiated TC in patients of initially resectable tumor and under condition of complete removal of lobe(s), containing tumor, were met in 7 (0.63%) of all cases.

### CONCLUSIONS

1. Organ-saving operations in T1, T2 differentiated TC patients, should be considered as a radical surgical intervention.

2. Possibility of objective preclinical recognition of tumor recurrences and generalization by the thyroglobulin level measurement, application of radioiodine therapy that have become high available in Russia in recent 10 years, and also synthetic thyroid hormones, allow to perform thyroidectomy in T2, T3 papillary and follicular TC cases.
3. The operation, introduced by G Crile in 1906, has fundamentally changed the results of surgical treatment of patients with head and neck tumors including TC. Organ-saving and function-sparing modification of this operation improved quality-of-life and oncological adequacy.
4. Technique of central neck dissection performance predicts the postoperative morbidity rates. Regular using of central neck dissection under visual control of RLN and parathyroid glands is effective screening method for definition of TC extending.

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