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Principles of surgery for thyroid carcinoma

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ABSTRACT

Surgery is the initial therapy in thyroid carcinoma. The basic principles of surgical oncology in malignant epithelial tumors have their full improvement in thyroid carcinoma (TC). The surgery is performed on organ of tumor origin and regional lymphatic basins. The aim of surgery in thyroid carcinoma is to eradicate all tumor foci, cure the most number of patients, reduce recurrence and mortality rate, and provide good quality of life. There is no doubt between oncologists that the surgery for thyroid carcinoma has no alternative. The extent of surgery is matter of actual controversies. Surgery is the initial treatment for all differentiated, papillary and follicular, as well as medullary and even anaplastic thyroid carcinoma. It should be performed by well-trained surgeons. The surgery of thyroid gland is the surgery of laryngeal recurrent nerve and parathyroid glands. The extent of primary surgery should be dictated by stage of disease and prognostic factors. The quality of surgery and incidence of complications depends on surgeon's skill and experience. That is why the surgeon is factor of prognosis in treatment of patients with TC.

SURGERY FOR DIFFERENTIATED THYROID CARCINOMA

Surgery is the initial therapy in thyroid carcinoma. The basic principles of surgical oncology in malignant epithelial tumors have their full improvement in thyroid carcinoma (TC). The surgery is performed on organ of tumor origin and regional lymphatic basins. The aim of surgery in thyroid carcinoma is to eradicate all tumor foci, cure the most number of patients, reduce recurrence and mortality rate, and provide good quality of life. There is no doubt between oncologists that the surgery for thyroid carcinoma has no alternative. The extent of surgery is matter of actual controversies (1-15).

Postoperative radioiodine ablation is proposed for patients with high risk for recurrence. External radiotherapy is indicated in older patients (over 45 years at diagnosis) with residual tumor without radioiodine uptake.

The extent of primary surgery should be dictated by stage of disease and prognostic factors. The quality of surgery and incidence of complications depends on surgeon's skill and experience. That is why the surgeon is factor of prognosis in treatment of patients with TC (16).

Surgery is the initial treatment for all differentiated, papillary and follicular, thyroid carcinoma. It should be performed by well-trained surgeons.

Pre-operative diagnosis and evaluation

Clinical examination is the keystone in diagnosis of TC. Ultrasound of the neck is the next step and it is very informative. Fine needle aspiration biopsy of thyroid nodule or neck lymph node for cytology examination is inevitable part of pre-operative diagnostic.

Indirect laryngoscopy and ORL examination gives the information of vocal cord status in cases of laryngeal nerve infiltration with local tumor growth.

Chest X ray, bone scan, ultrasound of abdominal organs, blood tests, hormonal thyroid status, serum thyroglobulin and calcitonin levels, as well as scintigraphy, computed tomography (CT) or magnetic resonance imaging (MRI) of mediastinum if indicated enables detection of initial distant metastases.

Before the operation the patient should be informed about surgical procedure and eventual complications (laryngeal recurrent nerve injury, hypocalcaemia) and examined by anesthesiologist.

Surgery of thyroid gland

Surgery for TC, as in all malignant epithelial tumors, includes surgery of organ of tumor origin and surgery of regional lymph nodes, i.e. thyroid gland and neck lymph nodes as well as mediastinal lymph nodes if indicated.

The extent of operation is planned according to tumor stage and other prognostic factors including experienced thyroid surgeon. Tumor stage is obtained by frozen-section histopathology examination of thyroid gland, neck lymph nodes, surrounding soft tissue and eventually parathyroid glands in cases of infiltration.

The complete operation should be performed in the same act in goal to avoid reoperation and to reduce percent of complications, i.e. laryngeal nerves and parathyroid glands injury (16).

The extent of primary operation is debated. The best results are achieved with total or "near" total thyroidectomy and appropriate dissections of neck and mediastinal lymph nodes.

Choice of operation

Nodectomy or partial lobectomy is not suggested because of high percent of recurrences (3, 7, 12). Total lobectomy is the minimal surgical procedure for thyroid nodule. It is followed with minimal complications, but unfortunately laryngeal nerve injuries are registered. "Near" total thyroidectomy includes removal of affected lobe, isthmus and almost the entire opposite lobe except small amount of thyroid tissue (1 g) in Berry's ligament. With total thyroidectomy the whole thyroid gland, including pyramidal lobe, is removed. The surgery of thyroid gland is the surgery of laryngeal recurrent nerve and parathyroid

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glands. The parathyroid glands should be preserved on venous-arterial stalks (17,18). If the gland is operatively removed it could be implanted in sternocleidomastoid muscle (acc Wells) (19). Intra-operative mapping of parathyroid glands with methylene blue stain is helpful in some cases (20).

Advantages of total and "near" total thyroidectomy

- The complications are extremely rare when they are performed by experienced surgeon (16).
- Postoperative TSH suppression is indicated in all patients with differentiated thyroid carcinoma (DTC), so less radical operations are not justified (13).
- Histological studies of the opposite lobe have shown the high incidence (30%-82%) of bilateral multifocality in papillary thyroid carcinoma (PTC) (3). After lobectomy, local recurrence rate is 5%-24%. De Groot have shown significantly higher survival rate after "near" total thyroidectomy versus lobectomy or subtotal thyroidectomy in patients with papillary thyroid carcinoma greater than 1 cm in diameter (21).
- Total or "near" total thyroidectomy facilitate follow-up and detection of distant metastases in differentiated thyroid carcinoma. After total thyroidectomy serum thyroglobulin levels are excellent marker of disease recurrence. In cases of thyroid remnant, J131 scan is not the most efficient in early detection of local or distant recurrence. Also, ablative radioiodine treatment is more efficient after radical surgery.

Mazzaferrri refers a significant reduction (up to 50%) of recurrence after total or "near" total thyroidectomy in stage 3 and 4 tumors in PTC, comparing with less radical surgery (22). The incidence of recurrence in the first two years after initial surgery is four times higher in patients with PTC treated with lobectomy compared to "near" total or total thyroidectomy (26% vs. 6%) (23). The same group has found that cancer specific mortality is two times higher with less radical surgery (24). Also, overall survival is significantly improved with "near" total or total thyroidectomy in high risk PTC and non-Hurthle-cell FTC (25).

According to novel studies, the extent of surgery in FTC is not as important as in PTC. However, total thyroidectomy in FTC enables more confident follow-up and facilitate diagnosis and treatment of distant metastases. In cases of solitary papillary micro carcinoma lobectomy could provide excellent long-term outcome. Nevertheless, in cases of multifocal micro carcinoma, total thyroidectomy is the surgery of choice (26).

In conclusion, the advantages of total and "near" total thyroidectomy are: lower recurrence rate, better survival, increased sensitivity of thyroglobulin as tumor marker, decreased indications for radio-iodine ablation, low complications rate when performed by experienced surgeon. L-thyroxin suppression is indicated in all patients with DTC even if less radical surgery is performed.

SURGERY OF LYMPH NODES

Choice of operation

Thyroid carcinoma metastasizes in central (pre- and paratracheal) and lateral (jugulo-carotid, supraclavicular) neck lymph nodes. The incidence of lymph node metastases in PTC is 30% - 80%, up to 95% in children, while in FTC is very low (20%) (2). In medullary thyroid carcinoma (MTC) lymph node metastases were found in 70% - 100%. Very often, lymph node metastases were found in both central and lateral region. Involvement of spinal, submental, submaxillar and retropharyngeal lymph nodes is rare.

Lymph node metastases (LNM) are most common on the side of primary tumor. Also, metastatic spreading depends on tumor localization. Most often, lymph node metastases are found in pre-, paratracheal (central) region of the neck and upper anterior mediastinum, and jugulo-carotid (lateral) region. The incidence of LNM depends on histology type, tumor stage and extent of dissection, as well as precise path histology examination of obtained specimens. Staging and therapeutic dissections are suggested instead of visual staging. Dissection of central and biopsy of supraclavicular and lower third of jugular chain of neck lymph nodes is the integral part of thyroid cancer surgery,

together with total thyroidectomy. This operation is called total extended thyroidectomy. Only surgically removed and histology examined lymph nodes, if they are not metastatic, could be staged as pN0.

Lymph node metastases are associated with high risk of loco-regional recurrence and distant metastases. Gross lymph node metastases in the neck, as well as bilateral and mediastinal metastases significantly decrease survival rate in patients with DTC. (22,28,29)

Lymph node metastases in lower third of jugulo-carotid chain have high predictive value (80%) of LNM in upper two thirds. In that case modified radical neck dissection (MRND) is indicated in the same act 31. Preservation of internal jugular vein, sternocleidomastoid muscle and accessory nerve is mandatory. Dissection is performed through oblique skin incision or through prolonged horizontal incision for thyroidectomy. Dissection of upper anterior mediastinum till aortal arc is performed through the same incision (30,31). Sternotomy is indicated in massive mediastinal lymph nodes and it is performed under the tracheal bifurcation.

In FTC, dissection is performed in the same manner in cases of lymph node metastases on frozen-section examination (26,29).

Advantages of central neck dissection

- It enables precise staging of the disease, as in all epithelial malignancies. Intraoperative detection of LNM also enables immediate therapeutic dissections in the same act.
- It facilitates postoperative follow-up and improves ablation with J131
- It is the therapy of choice in thyroid cancer that does not uptake J131
- Reoperation in paratracheal region carries a high risk of laryngeal nerve and parathyroid glands injury (9).

Reoperations

Reoperation carries higher risk for complications than primary operation even in cases of locally advanced thyroid cancer.

Indications:

- in cases of cancer or LNM found on definitive histology after false negative result on frozen-section
- In cases of incomplete primary operation with rest tumor or thyroid tissue, or presence of LNM in the neck or mediastinum.

Surgical complications

Transit or permanent hypoparathyroidism and laryngeal nerve paralysis are the most common and the most serious complications in thyroid cancer surgery. The incidence of complications depends on surgeon's skills. The incidence of laryngeal nerve paralysis is under 5% and permanent hypoparathyroidism is under 2% (22).

Surgeon as a prognostic factor

It is necessary to emphasize that thyroid cancer surgery should perform only a surgeon well trained in that field of surgery. The first evidence was Theodore Kocher who declined the thyroid surgery complication mortality rate from 40% to 1%, after 5000 operation performed (16).

The novel studies have shown that incidence of postoperative complications could be lesser than 0.5% when performed by experienced surgeons. Furthermore, some studies have found that completeness and quality of primary operation improves the long-term disease free survival and quality of life (16, 32).

Surgery for medullary thyroid carcinoma MTC

Primary treatment of MTC is surgical and includes removal of all neoplastic foci in the neck. Total thyroidectomy is indicated both in sporadic and hereditary MTC because C-cells have diffuse and bilateral distribution in thyroid tissue. The incidence of LNM in MTC is very high, up to 90% in tumors less than 1 cm in diameter. Clark advocates bilateral MRND in all MTC with tumor

greater than 2cm in diameter (33).

Surgery for MTC, either preventive or curative, includes total thyroidectomy, bilateral central dissection and lateral lymph node dissection (MRND) according to frozen-section findings of lower two thirds of jugulo-carotid chain (29). However, surgery for MTC also includes visualization (methylene blue staining) and exploration of all four parathyroid glands. In cases of adenoma or hyperplasia the affected glands should be removed and histology examined. All MTC patients should be pre-operatively screened for pheochromocytoma (34).

REFERENCES

1. Gagel RFR, Goepfert H, Callender DL. Changing concepts in the pathogenesis and management of thyroid carcinoma. *CA-Cancer J Clin* 1996;46:261-83.
2. Grebe SKG, Hay ID. Thyroid cancer nodal metastases: biologic significance and therapeutic considerations. *Surg Oncol Clin North Am* 1996;5:43-63.
3. Grebe SKG, Hay ID. Follicular cell-derived thyroid carcinomas. In: Arnold A, editor. *Endocrine neoplasms*. Boston: Kluwer; 1997. p. 91-140.
4. Hay ID, Feld S, Garcia M and the Thyroid Cancer Task Force. AACE clinical practice guidelines for the management of thyroid carcinoma. *Endo Pract* 1997;3:60-71.
5. Maxon HR, Smith HS. Radioiodine-131 in the diagnosis and treatment of metastatic well differentiated thyroid cancer. *Endocrinol Metab Clin North Am* 1990;19:685-718.
6. Mazzaferri EL. Treating high thyroglobulin with radioiodine. A magic bullet or a shot in the dark? *J Clin Endocrinol Metab* 1995;80:1485-7.
7. Mazzaferri EL. Carcinoma of follicular epithelium: radioiodine and other treatment outcomes. In: Braverman LE, Utiger RD, editors. *The thyroid: a fundamental and clinical text*. 7th ed. Philadelphia: Lippincott-Raven; 1996. p. 922-45.
8. Schlumberger M. Papillary and follicular thyroid carcinoma. *N Engl J Med* 1998;338:297-306.
9. Schlumberger M, Baudin E. Serum thyroglobulin determination in the follow-up of patients with differentiated thyroid carcinoma. *Eur J Endocrinol* 1998;138:249-52.
10. Schlumberger M, Mancusi F, Baudin E, Pacini F. 131I therapy for elevated thyroglobulin levels. *Thyroid* 1997;7:273-6.
11. Singer PA, Cooper DS, Daniels GH, Ladenson PW, Greenspan FS, Levy EG et al. Treatment guidelines for patients with thyroid nodules and well-differentiated thyroid cancer. *Arch Intern Med* 1996;156:2165-72.
12. Siperstein AE, Clark OH. Carcinoma of the follicular epithelium: surgical therapy. In: Braverman LE, Utiger RD, editors. *The thyroid: a fundamental and clinical text*. 7th ed. Philadelphia: Lippincott-Raven; 1996. p. 916-22.
13. Solomon BL, Wartofsky L, Burman KD. Current trends in the management of well differentiated papillary thyroid carcinoma. *J Clin Endocrinol Metab* 1996;81:333-9.
14. Utiger RD. Follow-up of patients with thyroid carcinoma. *N Engl J Med* 1997;337:928-30.
15. Wartofsky L, Sherman SI, Gopal J, Schlumberger M, Hay ID. Therapeutic controversy. The use of radioactive iodine in patients with papillary and follicular thyroid cancer. *J Clin Endocrinol Metab* 1998;83:419-23.
16. Pasiaka JL. The Surgeon as a prognostic factor in endocrine surgical diseases, Surgical techniques and outcomes. *Surg Oncol Clin North Am* 2000;9:13-20.
17. Džodić R. Prevencija hipoparatiroidizma kod totalne tiroidektomije (disertacija). Beograd: Medicinski fakultet Univerziteta u Beogradu; 1993.
18. Attie JN, Khafif RA. Preservation of parathyroid glands during total thyroidectomy. *Am J Surg* 1975;130:399-404.
19. Wels AS, Ross JA, Dale KJ, Gray SR. Transplantation of the parathyroid Glands: Current status. *Surg Clin North Am* 1979;59:176-8.
20. Wheeler MH, Wade JSH. Intraoperative identification of parathyroid glands: appraisal of methylene blue staining. *Am J Surg* 1982;143:713-6.
21. De Groot LJ, Kaplan EL, McCormick M, Straus FH. Natural history, treatment and course of papillary thyroid carcinoma. *J Clin Endocrinol Metab* 1990;71:414-24.
22. Mazzaferri EL, Jhiang SM. Long term impact of initial surgical and medical therapy on papillary and follicular thyroid cancer. *Am J Med* 1994;97:418-28.
23. McConahey WM, Hay ID, Woolner IB, Van Heerden JA, Taylor WF. Papillary thyroid cancer treated at the Mayo Clinic. 1946 through 1970: initial manifestations, pathologic findings, therapy and outcome. *Mayo Clin Proc* 1986;61:978-96.
24. Hay ID, Grant SC, Taylor WF, McConhey WM. Ipsilateral lobectomy versus bilateral lobar resection in papillary thyroid carcinoma: a retrospective analysis of surgical outcome using a novel prognostic scoring system. *Surgery* 1987;102:1088-905.
25. Taylor T, Specker B, Robbins J, Sperling M, Ho M, Ain K et al. Outcome after treatment of high risk papillary and non-Hurthle-cell follicular thyroid carcinoma. *Ann Intern Med* 1998;129:622-7.
26. Baudin E, Travagli JP, Ropers J, Mancusi F, Bruno-Bossio G, Caillou B et al. Microcarcinoma of the thyroid gland: The Gustave Roussy Institute experience. *Cancer* 1998;83:553-9.
27. Džodić R, Inić M, Marković I, Tasić S, Vlajić M. Dijagnostika i lečenje malignih tumora tiroidne žlezde. In: Drugi naučni skup o štitastoj žlezdi. Zlatibor, 2000. Beograd: SANU; 2001. p. 161-71.
28. Roy-Camille R, Lewger FA, Merland JJ, Saillant G, Savoie JC, Riche MC. Perspectives actuelles dans le traitement des métastases osseuses des cancers thyroïdiens. *Chirurgie (Paris)* 1980;106:32-6.
29. Tubiana M, Schlumberger M, Rougier Ph, Laplanche A, Benhamou E, Gardet P et al. Long-term results and prognostic factors in patients with differentiated thyroid carcinoma. *Cancer* 1985;55:794-804.
30. Noguchi S, Murakami N. The value of lymph-node dissection in patients with differentiated thyroid cancer. *Surg Clin North Am* 1987;67:251-61.
31. Lacour J et al. Surgical treatment of differentiated thyroid cancer at the Institut Gustave-Roussy. *Annales de Radiologie* 1977;20:767-70.
32. Hay ID, McConahey WM, Goellner JR. Managing patients with papillary thyroid carcinoma: insights gained from the Mayo Clinic's experience of treating 2,512 consecutive patients during 1940 through 2000. *Trans Am Clin Climatol Assoc* 2002;113:241-60.
33. Clark O. Predictors of thyroid tumor aggressiveness. *West J Med* 1996;165(3):131-8.
34. Schlumberger M, Pacini F. Differentiated thyroid carcinomas. Prognostic factors. In: *Thyroid tumors*. Paris: Nucleon; 1999. p. 85-105.