The Journal of Laryngology and Otology
June 1998, Vol. **112,** pp. 556–560

Microsurgical technique in thyroid surgery – a 10-year experience

TORFINNUR RUBEK NIELSEN*, ULRIK KOKS ANDREASSEN†, CHRISTOPHER LEIGH BROWN†, VIGGO HULTHIN BALLE*, JENS THOMSEN*

Abstract

Objective To report the results of thyroid surgery in a University department of ENT – head and neck surgery, and to evaluate the benefits of the use of the surgical microscope in thyroid surgery.

Design A retrospective evaluation of the records of all patients who underwent thyroid surgery in the 10-year period 1987–1996.

Methods In addition to standard surgical principles the Zeiss multi-discipline universal surgical microscope with a 250 mm ocular lens was used in all cases. Total thyroidectomy was performed in all malignant cases, while unilateral lobectomy plus isthmus resection was the standard procedure in benign cases.

Patients There were 573 patients, aged 11–87 years, 444 females and 129 males. Four hundred and fifty-one had benign lesions, 122 malignant. Four hundred and eighty-nine had primary surgery, 84 underwent completion surgery or surgery for recurrent disease.

Results Primary thyroid gland surgery in benign/malignant disease resulted in permanent recurrent laryngeal nerve palsy in 0.6 per cent/3.5 per cent of the patients respectively, when calculated as nerves at risk (NAR). In benign recurrent or malignant completion surgery this complication rate was 4.5 per cent/ 2.9 per cent respectively.

Conclusion Thyroid surgery in our University ENT – Head and Neck Department with the use of the surgical microscope provides pleasing results, especially considering the diversity of surgeons, due to the departments' teaching responsibilities.

Key words: Thyroid gland; Laryngeal nerves; Surgery, operative

Introduction

In Denmark, with a population of five million inhabitants, thyroid surgery is performed in more than sixty different departments.

Thyroid surgery is allocated to appropriate departments according to guidelines published in a report in 1991 by the Danish Surgical Society (Blichert-Toft, 1991). These guidelines were negotiated between the Danish Society of Surgery and the Danish Otolaryngological Society. All cases suspected of malignancy should be treated in the five university ENT departments in co-operation with their respective departments of oncology. Benign cases which are expected to be particularly difficult (recurrent disease, very large goitres in children etc), should be treated in the five university ENT departments or in the two surgical departments specializing in endocrinological surgery.

The ENT – Head and Neck Surgery Department of Gentofte University Hospital, trains ENT surgeons in thyroid surgery. The department deals with malignant and/or complicated thyroid diseases. It has a close collaboration with the endocrinology and oncology medical departments. After discharge from this department the patients with benign disease are reviewed by the endocrinology unit whilst malignant cases are reviewed by the oncology unit.

Since 1987 the surgical microscope has been used as part of the standard procedure in thyroid surgery. The aim of this study was to evaluate if this addition to thyroid surgery could reduce the number of complications, especially permanent recurrent laryngeal nerve (RLN) injury.

Patients and methods

Through a computer search, all thyroid gland operations performed in this department between January 1987 and December 1996 were identified. Data obtained from the patients' records concerning clinical history, operative procedures, histopatho-

From the Department of ENT, Head and Neck Surgery, Gentofte University Hospital*, Hellerup, Denmark and the Division of ENT Surgery, Monash Medical Centre†, Melbourne, Victoria, Australia.
Accepted for publication: 21 April 1998.

logical reports and post-operative course were recorded and arranged in a database, Paradox Win 5.0. Five hundred and seventy-three patients aged 11 to 87 (median 46) were identified of whom 444 were women and 129 were men.

Indications for operations included the following: cold nodules, cosmetically disturbing goitres, goitres with compression symptoms, recurrent goitre, uncontrollable thyrotoxicosis where medical treatment failed, suspected malignancy and completion surgery where the primary surgery was performed elsewhere and had revealed malignancy. Most, but not all patients, were seen by an endocrinologist pre-operatively.

Four hundred and eighty-nine patients (85.3 per cent) were admitted for primary surgery and 84 were admitted for recurrent or completion surgery.

Patients referred for primary surgery had a fine-needle aspiration (FNA) examination and a technetium scan before operation. Ultrasonographic examination has been included in the latter part of the study period.

All patients were pre- and post-operatively examined by indirect laryngoscopy with a mirror. In cases where the patient could not tolerate this procedure a fibre-optic laryngoscope was used.

A pre-operative assessment of the likely degree of difficulty of surgery was made in order to assign the appropriate cases to the appropriate surgeon.

During the period, 11 different surgeons operated according to uniform guidelines and operating techniques.

Surgical technique

The Kochers' collar incision was used in all cases. After capsular dissection the gland was rotated medially and the surgical microscope was introduced when the RLN was to be identified, normally when the position of the inferior thyroid artery had been established.

We used the Zeiss OPMI or the Zeiss multi-discipline universal surgical microscope with a 250 mm ocular lens. The microscope was used to identify and then follow the RLN until it entered the larynx. The RLN was normally found close to the inferior thyroid artery. Both inferior thyroid arteries were routinely ligated in bilateral disease. The superior laryngeal nerve (SLN) was not routinely identified but the superior vessels were selectively ligated close to the capsule. Frozen sections were routinely obtained. In cases of malignancy a total thyroidectomy was performed. The parathyroid glands were spared where possible.

In all malignant cases the carotid sheath was explored and lymph nodes were sent for frozen sections. A modified neck dissection (preservation of the accessory nerve) was performed when the disease had metastasized to the lymph nodes in the neck.

Extent of thyroid resection

In malignant cases total thyroidectomy was performed. In benign cases an ipsilateral total lobectomy as well as removal of the isthmus was the minimum amount of resection undertaken.

Results

Four hundred and eighty-nine patients had a primary thyroidectomy of whom 411 had benign and 78 had malignant disease. Forty-four patients with established malignancy had completion surgery and 40 with benign disease had a recurrent operation.

Four hundred and twenty-seven patients were operated with suspected malignancy and of these carcinoma was found in 78 (18.3 per cent).

Technetium scan revealed a cold nodule in 90 per cent in the benign group and 95 per cent in the malignant group. The ultrasonographic diagnosis was solid tumour in 69.8 per cent, cystic tumour in 24.4 per cent, enlarged gland in 4.1 per cent and normal gland in 1.8 per cent.

Of those patients undergoing primary surgery and having proven benign histology FNA reported malignancy in 1.4 per cent (false positive), possible malignancy in 10.8 per cent, benign disease in 77.6 per cent and inadequate material in 10.2 per cent of cases. In histologically proven malignant primary surgery FNA showed malignancy in 38 per cent, suspicion of malignancy in 24 per cent, benign disease in 28 per cent (false negative) and inadequate material in four per cent of cases.

When calculating the incidence of RLN palsy the 17 patients with pre-operative vocal fold palsy and the seven patients who had the RLN resected because of tumour involvement were excluded. Exposed nerves at risk (NAR) totalled 683.

The operations performed are shown in Table I.

Three patients in the benign group had a tracheotomy after surgery; one as an emergency procedure in the ward due to bleeding and associated compression, another due to permanent tracheal malformation after removal of a large goitre and the last due to pre-operative bilateral vocal fold palsy of unknown origin.

The tracheotomies in the malignant group were performed as either palliative procedures to relieve the already debilitated patients or in advanced cases with bilateral vocal fold palsy.

Infection was not a problem except in one patient who had an abscess evacuated from the operation

TABLE I

TYPES OF THYROID OPERATIONS PERFORMED IN 573 PATIENTS, 1987–1996

	Benign (n)	*Malignant* (n)
Unilateral resection	*19*	*0*
Bilateral resection	9	0
Unilateral lobectomy	365	0
Total thyroidectomy	21	78
Subtotal thyroidectomy	37	1
Total thyroidectomy + neck dissection	0	43

https://doi.org/10.1017/S0022215100141076 Published online by Cambridge University Press

TABLE II
POST-OPERATIVE COMPLICATIONS IN 573 PATIENTS AFTER THYROID SURGERY

	All patients	Benign	Malignant
Bleeding	17	11	6
Tracheostomy	9	3	6
Temporary RLN palsy	18	12	6
Permanent RLN palsy	11	5	6
Permanent Ca treatment	18	6	12

cavity. Other complications are listed in Tables II and III. The mean stay at the hospital was 6.9 days, median five days with a range from two to 76 days.

Discussion

Since Kocher began performing thyroidectomies from 1878 there has been an increased awareness of the RLN and a decline in the incidence of permanent RLN palsy after thyroidectomy. The current incidence is now reported to be 1.6 per cent (Eisele, 1996). When comparing the incidence of RLN palsy in different series, it is important to observe the method of establishing the diagnosis. In a recent article post-operative laryngoscopy after thyroidectomy was advocated only in patients with stridor or voice change and not performed routinely (Ready and Barnes, 1994). We do not agree with this statement. All patients undergoing thyroidectomy should be seen before and after operation by an ENT surgeon. Alternative ways of establishing the function of the vocal fold does not seem optional. RLN palsy can cause a considerable degree of morbidity to the patient. The majority of the patients referred for thyroid surgery will, as shown in this study, be subsequently found to have a benign lesion in the thyroid gland. It is therefore important to reduce the incidence of permanent RLN palsy after surgery and/or reduce the number of patients undergoing surgery.

The latter has partly been achieved by improved pre-operative evaluation, especially FNA cytology, which in many centres has reduced the number of operations (Al-Sayer *et al.*, 1985; Rojeski and Gharib, 1985). In our study, however, the FNA cytology results were less convincing in their ability to separate benign from malignant disease. Ultrasound-guided FNA may in the future improve the sensitivity of the FNA test. It is well known that FNA cannot separate benign follicular adenoma tissue from differentiated follicular carcinoma. When FNA indicates a malignant or possibly malignant diagnosis such patients are given preference when scheduling patients for surgery. The large number of false negative FNA responses underline the need for using thorough clinical judgement in evaluating the indications for surgery.

TABLE III
PERMANENT UNILATERAL RLN PALSY FOR 573 PATIENTS AFTER THYROID SURGERY, CORRELATED TO NAR. PRE-OPERATIVE RLN PALSY (N = 17) AND RLN RESECTION (N = 7) WERE OMITTED

	Palsy	Nerves at risk (NAR) %
All patients, NAR = 683	11	1.6
Benign, NAR = 501	5	1
Malignant, NAR = 182	6	3.3
Primary operation		
Benign, NAR = 457	3	6.5
Malignant, NAR = 114	4	3.5
Benign, recurrent operation		
NAR = 44	2	4.5
Malignant, recurrent operation		
NAR = 68	2	2.9

The technetium scan could not be used to distinguish between malignant and benign disease.

In Denmark today the technique of thyroid operation employed usually involves visualization of the RLN, which is in accordance with most current thyroidectomy studies. When exposing the RLN one has to be aware of the varying anatomy of the recurrent nerve which normally divides before entering the larynx (Steinberg *et al.*, 1986).

Furthermore one must remember that the RLN is not always recurrent. This is estimated to be 1 in 200 on the right side (Henry *et al.*, 1988).

Concerning the degree of exposure there is more controversy. Many centres 'recognize the direction' of the nerve (Delbridge *et al.*, 1992) whereas in contrast we expose the nerve in its full length from the inferior thyroid artery to its entrance into the larynx. We are able to do this because we use the surgical microscope. Furthermore this allows us to remove all the thyroid tissue, especially in the area of the ligament of Berry, where we have often found residual thyroid tissue in recurrent operations or completion surgery. The patients' awareness of the seriousness of permanent RLN palsy is demonstrated by recent data from USA (Kirsch, 1997) which shows that thyroid surgery is the most common cause of malpractice litigation in endocrine and head and neck surgery. In Denmark a recent review of 10 complaints pertaining to thyroid surgery from 1985–1995 revealed that eight complained of damage to the RLN and about the lack of information prior to their operation regarding the risk of damage to the RLN (Quist *et al.*, 1997).

In all we had 29 patients with RLN palsy and of these 11 were permanent. All the transient RLN palsies recovered within three months. A similar ratio of transient/permanent palsies have been found by others (Wagner and Seiler, 1994).

Another challenge in thyroid surgery is preventing hypocalcaemia (Ready and Barnes, 1994) and superior laryngeal nerve (SLN) palsy (Kark *et al.*, 1984; Lenquist *et al.*, 1987). We use the capsular dissection which preserves the vascular supply to the parathyroid glands and thereby reduces the risk of hypocalcaemia (Delbridge *et al.*, 1992). In a large series of primary total thyroidectomies (Khadra *et al.*, 1992) only 0.6 per cent developed permanent hypocalcaemia compared to 3.1 per cent in our study. This difference may be explained by the large number of patients undergoing completion and recurrent surgery in our material.

Damage to the SLN has received some interest in the literature (Kark *et al.*, 1984; Lenquist *et al.*, 1987) but no large study with 'voice-print' (videostroboscopy) has been performed to determine the exact consequences and incidence of SLN damage after thyroidectomy. To reduce the incidence of injury to the SLN we meticulously dissect the upper pole individually ligating the vessels of the vascular pedicle (Delbridge *et al.*, 1992). If possible we visualize the superior laryngeal nerve, however, we have no reliable information about how often the SLN was identified, and we were unable to evaluate the incidence of SLN damage in our study.

Before making a decision regarding surgery an assessment of the patient's voice requirement is recommended as it is well known that damage to the SLN can be devastating to professional voice-users (Kark *et al.*, 1984).

Different devices have been advocated in order to reduce the incidence of complications after thyroidectomy, especially RLN injury. One well-established device are the magnifying glasses which generally give an excellent view.

A second option is to use a device that is based on real-time electromyography. The principle involves electromyographic monitoring of the intrinsic laryngeal muscle via a special commercially available endotracheal tube (NIM-2 EMG endotracheal tube) (Eisele, 1996; Kirsch, 1997). This is a sensitive device which seems very promising but still has to be evaluated further. It has so far not been commercially available in Denmark.

Another option involves the use of a laryngeal mask and observation of vocal fold movements with a fibre-bronchoscope whilst stimulating the RLN (Hobbiger *et al.*, 1996). The latter method does not require any specific instruments and can be performed at any ENT department equipped with basic instruments. A fourth option is to use the surgical microscope (Canino *et al.*, 1992; Andreassen *et al.*, 1997), as in our study. The training of otologists involves the use of the surgical microscope for ear surgery, and it is therefore easy for otologists to include this modality in performing surgery for thyroid tumours.

The operation time was prolonged by five to 10 minutes with the use of the surgical microscope, but ensured the surgeon in training a more confident handling of the recurrent nerve. Our incidence of RLN palsy after primary surgery is in accordance with the best achievable results. These results would probably have been even better if the operations had been performed only by experienced surgeons. However, another study found that thyroid surgery can be safely done by surgeons in training provided they are closely supervised (Shindo *et al.*, 1995).

In recurrent surgery it was difficult, even with the microscope, to distinguish between the RLN and scar-tissue. This is reflected in the high incidence of RLN palsy in recurrent surgery, a finding also found by others (Wagner and Seiler, 1994). This stresses the point that the primary surgery must be radical (Reeve, 1992). This would eliminate the need for ipsilateral re-operation with the increased risk of complications should completion or recurrent surgery prove necessary.

The additional use of an NIM-2 EMG endotracheal tube might be an option in the future in these high risk patients. Denmark does not have a policy of compulsory written informed consent and 10 years ago informing the patient of the risk of permanent RLN injury was not considered necessary (Quist *et al.*, 1997). Today lack of information regarding potential complications in thyroid surgery will result in a 'disapproval remark' from the Patients Complaints Board (Quist *et al.*, 1997).

In contrast, damage to the RLN is not considered to warrant a disapproval if the surgeon has attempted to identify the RLN (Quist *et al.*, 1997).

In an attempt to further improve our results in thyroid surgery we have set up a quality assurance project. Hopefully this will help us to identify the causes of complications in thyroid surgery.

Conclusion

Society's increasing expectation of low morbidity after benign thyroid surgery necessitates further exploration into safer surgical procedures.

We present our results with the use of the surgical microscope over a 10-year period. Our results have been very satisfactory and it is our impression that it is possible to achieve even better results with closer surveillance of surgeons in training. A further option may be the use of the newly developed electromyographic monitoring devices in patients where the RLN is at high risk.

Our study is in accordance with others which show that recurrent surgery has an inherently high complication rate. Minimal primary surgery should, therefore, normally be total removal of the ipsilateral lobe as well as removal of the isthmus.

The surgical microscope is easy to use by a surgeon accustomed to its use. Although it does prolong the operation by five to 10 minutes we believe its benefits justify its use.

Quality assurance projects in the future may further assist in identifying and reducing complications in thyroid surgery and a further decline in the incidence of permanent recurrent laryngeal nerve palsy should be achievable.

References

Al-Sayer, H. M., Krukowski, H. Z., Williams, V. M. M., Matheson, N. A. (1985) Fine needle aspiration cytology in isolated thyroid swellings: a prospective two year evaluation. *British Medical Journal* **290:** 1490–1492.

Andreassen, U. K., Nielsen, T. R., Balle, V. H., Thomsen, J. C. (1997) *Thyroid Surgery Using the Surgical Microscope. A 9-Year Review*. Poster, Abstract Book, Sydney, XVI World Congress of Otorhinolaryngology – Head and Neck Surgery. p 338.

Blichert-Toft, M. (1991) Forslag til thyreoideakirurgiens strukturering og visitationsforhold I Danmark. *Ugeskrift for Læger* **153:** 2136–2137.

https://doi.org/10.1017/S0022215100141076 Published online by Cambridge University Press

Canino, V., Massaglia, F., Remonda, G., Comotti, F., Baldini, D., Fornari, M., Ribero, F., Scaglia, M. (1992) La tiroidectomia totale nelle recidive di gozzo (Osservazioni anatomo-chirurgiche con l'ausilio del microscopio operatorio) *Chirurgia Italiana* **44:** 223–229.

Delbridge, L., Reeve, T. S., Khadra, M., Poole, A. G. (1992) Total thyroidectomy: The technique of capsular dissection. *Australian and New Zealand Journal of Surgery* **62:** 96–99.

Eisele, D. W. (1996) Intraoperative electrophysiologic monitoring of the recurrent laryngeal nerve. *Laryngoscope* **106:** 443–449.

Henry, J-F., Audiffret, J., Denizot, A., Plan, M. (1988) The nonrecurrent inferior laryngeal nerve: Review of 33 cases, including two on the left side. *Surgery* **104:** 977–984.

Hobbiger, H. E., Allen, J. G., Greatorex, R. G., Denny, N. M. (1996) The laryngeal mask airway for thyroid and parathyroid surgery. *Anaesthesia* **51:** 972–974.

Kark, A. E., Kissin, M. W., Auerbach, R., Meikle, M. (1984) Voice changes after thyroidectomy: role of the external laryngeal nerve. *British Medical Journal* **289:** 1412–1415.

Khadra, M., Delbridge, L., Reeve, T. S., Poole, A. G., Crummer, P. (1992) Total thyroidectomy: Its role in the management of thyroid disease. *Australian and New Zealand Journal of Surgery* **62:** 91–95.

Kirsch, J. P. (1997) *Recurrent Laryngeal Nerve EMG Monitoring in Safe Thyroid and Parathyroid Surgery*. Abstract Book, Sydney, XVI World Congress of Otorhinolaryngology Head and Neck Surgery. p 3.

Lenquist, S., Cahlin, C., Smeds, S. (1987) The superior laryngeal nerve in thyroid surgery. *Surgery* **102:** 999–1008.

Quist, S., Andreassen, U. K., Christensen, N. R. (1997) Klagesager kan sætte fokus på problemer. *Journal for Sundhedsvæsen* **4:** 28–29.

Ready, A. R., Barnes, A. D. (1994) Complications of thyroidectomy. *British Journal of Surgery* **81:** 1555–1556.

Reeve, T. S. (1992) Total thyroidectomy. Personal view. *Australian and New Zealand Journal of Surgery* **62:** 90.

Rojeski, M. T., Gharib, H. (1985) Nodular thyroid disease. Evaluation and management. *New England Journal of Medicine* **62:** 428–436.

Shindo, M. L., Sinha, U. K., Rice, D. H. (1995) Safety of thyroidectomy in residency: A review of 186 consecutive cases. *Laryngoscope* **105:** 1173–1175.

Steinberg, J. L., Khane, G. J., Fernandes, C. M. C., Nel, J. P. (1986) Anatomy of the recurrent laryngeal nerve: A redescription. *Journal of Laryngology and Otology* **100:** 919–927.

Wagner, H. E., Seiler, C. (1994) Recurrent laryngeal nerve palsy after thyroid surgery. *British Journal of Surgery* **81:** 226–228.

Address for correspondence:
Jens Thomsen, M.D., D.M.Sc., F.R.C.P.S.,
Department of ENT, Head and Neck Surgery,
Gentofte University Hospital,
DK-2900 Hellerup,
Denmark.

Fax: ++ 45 3977 7634