The Impact of Uniform Capsular Dissection Technique of Total Thyroidectomy on Postoperative Complications: An Experience of More Than 1000 Total Thyroidectomies from an Endocrine Surgery Training Centre in North India

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Abstract

Background: Total thyroidectomy (TT) with a uniform technique of capsular dissection (CD) is the preferred technique worldwide. The aim of study is to analyze the impact of uniform technique of CD for done as primary surgery at an endocrine surgery training centre.

Patients and Methods: Retrospective review from 1995 to 2009. Data collected from hospital records and follow-up.

Results: One thousand and thirty-eight cases were included, with mean age 42.91 ± 13.48 years; male:female – 1:2.2; mean duration of goiter – 99.83 ± 105.1 months; 67.8% were euthyroid and 30.7% – hyperthyroid at initial presentation; 35.5% were malignant. Surgery includes TT alone – 77.7% and TT with lymph nodes dissection – 22.3%; sternotomy required in 1.2% and thoracotomy in 0.1%; tracheomalacia present in 3.9%; however, tracheostomy required in 4.5% and parathyroid autotransplantation in 21%; Peroperative mean gross gland weight was 124.34 ± 129.85 g. Complications include hypocalcemia (temporary – 35.9%; permanent – 1.3%); recurrent laryngeal nerve palsy (temporary – 2.7%; permanent – 91%); hemorrhage – 1.3%; and various others.

Conclusion: TT with uniform technique of CD is a safe procedure. Certain risk factors may predispose to complications, which can be avoided and managed adequately if anticipated beforehand.

Keywords: Capsular dissection, complications, primary total thyroidectomy, uniform technique

Introduction

There is continuous evolution in the field of thyroid surgery, from a highly morbid to highly sophisticated and refined surgical procedure with minimal morbidity and virtually no mortality.[1-12] The total thyroidectomy (TT) performed with a standard technique of capsular dissection (CD) was initially introduced by Theodore Kocher in 1880,[11] however, it was abandoned due to development of “cachexia strumipriva”. Later on, with the availability of thyroxin replacement, this technique was again being adopted by thyroid surgeons and gradually replaced sub-TT (STT) and near TT (NTT) for benign and malignant goiters, respectively, at many centers[13-16] including ours.[7-10]

The aim of the present study is to analyze the impact of uniform technique of CD for TT performed in primary setting, on the complication rates at a specialized thyroid surgery training institute in North India.
The mean age was 42.96 ± 13.5 years. The female:male was 2.2:1. The duration of goiter was 99.8 ± 105 months. Majority of the patients were euthyroid (67.7%) with multinodular goiter (49.1%) of which 1038 underwent TT. 15 years of duration, a total of 1350 patients underwent bilateral thyroid surgery as initial procedure, out of which 1038 underwent TT. The mean age was 42.96 ± 13.5 years. The female:male was 2.2:1. The duration of goiter was 99.8 ± 105 months. Majority of the patients were euthyroid (67.7%) with multinodular goiter (49.1%) of which 1038 underwent TT. The mean age was 42.96 ± 13.5 years. The female:male was 2.2:1. The duration of goiter was 99.8 ± 105 months. Majority of the patients were euthyroid (67.7%) with multinodular goiter (49.1%) on clinical examination. Major indications for surgery were clinically visible goiter, based on patient’s demand (47.3%), suspicion of malignancy (39.8%), hyperthyroidism (30.6%), hypothyroidism (29.8%) and other reasons (34.6%). The statistical analysis was performed using SPSS 17.0 (IBM Corporation, Armonk, New York, USA). Data were analyzed, in terms of mean ± standard deviation, median, range, frequency and percentages. The Chi-square tests, independent sample Student’s t-test and logistic regression were used for analysis. P ≤ 0.05 is considered statistically significant.

Results

During 15 years of duration, a total of 1350 patients underwent bilateral thyroid surgery as initial procedure, out of which 1038 underwent TT. The mean age was 42.96 ± 13.5 years. The female:male was 2.2:1. The duration of goiter was 99.8 ± 105 months. Majority of the patients were euthyroid (67.7%) with multinodular goiter (49.1%) on clinical examination. Major indications for surgery were clinically visible goiter, based on patient’s demand (47.3%), suspicion of malignancy (39.8%), hyperthyroidism (30.6%), hypothyroidism (29.8%) and other reasons (34.6%). The statistical analysis was performed using SPSS 17.0 (IBM Corporation, Armonk, New York, USA). Data were analyzed, in terms of mean ± standard deviation, median, range, frequency and percentages. The Chi-square tests, independent sample Student’s t-test and logistic regression were used for analysis. P ≤ 0.05 is considered statistically significant.
malignancy (25.4%), compressive symptoms (21.9%), and retrosternal extension (RSE) (12.5%).

TT alone was performed in 77.7% of patients, while TT with Lymph node dissection was done in 22.3%, which includes TT + Central Compartment Lymph Node Dissection (CCLND) in 8.8%, TT + CCLND + Lateral Neck Dissection in 13% and TT+CCLND+ MRND with Mediastinal lymph node dissection in 0.5% [Table 2]. Tracheomalacia was diagnosed, as per the features described by Agarwal et al. [13] in 40 (3.9%) cases, out of which tracheostomy was required in 31 and rest managed with prolonged incubation. Tracheostomy was done in 47 (4.5%) cases, out of which 31 had tracheomalacia, 2 had tracheal injury, and 14 had locally advanced thyroid carcinoma with tracheal invasion. Similarly, out of 130 cases with RSE, 8 required sternotomy and 1 required thoracotomy; others were delivered by cervical approach only. Four other cases with sternotomy had locally advanced carcinoma requiring mediastinal lymph node dissection. The mean gross gland weight was 124.34 ± 129.85 (7–963) g. The autotransplantation of at-risk parathyroid gland was done in 21% cases. The final histopathology was benign in 64.5% and malignant in 35.5% cases.

**Complications**

**Peroperative complications**

In the present series, tracheal injury occurred in 8 (0.7%) cases (3 - benign and 5 - malignant). Esophageal injury occurred in 03 (0.3%) patients (all were Malignant) [Figure 2]; Accidental RLN injury in 2(0.2%) patients [Figure 3]; Internal Jugular Vein injury developed in 10 (1.0%) patients (1 in benign & 9 in malignant) and carotid injury occurred in one patient with locally advance thyroid cancer. On histopathology, parathyroid gland was identified (inadvertent parathyroidectomy) in 62 (6.0%) cases [Table 3].

**Postoperative complications**

Postoperatively, 373 (35.9%) cases developed hypocalcemia, where 116 (11.2%) cases had only biochemical hypocalcemia (101 were managed with oral calcium and Vitamin D and 15 with oral calcium only). 257 (24.7%) had clinical hypocalcemia (requiring intravenous calcium in

### Table 1: Clinicopathological profile of the patients

| Clinical details                  | n (%)      |
|----------------------------------|------------|
| Mean age (range) (years)         | 42.91±13.48 (8-85) |
| Female:male                      | 718:320 (2.2:1) |
| Mean duration of goiter:SD (months) | 99.83±105.1 (1-720) |
| Grade of goiter (WHO)            |            |
| Grade 1                          | 99 (9.5)   |
| Grade 2                          | 936 (90.2) |
| Functionality                    |            |
| Euthyroid                        | 703 (67.8) |
| Hyperthyroid                     | 320 (30.7) |
| Hypothyroid                      | 15 (1.5)   |
| Clinical presentation            |            |
| Multinodular goiter              | 510 (49.1) |
| Solitary thyroid nodule          | 207 (21.2) |
| Grave’s disease                  | 189 (18.2) |
| Toxic MNG                        | 129 (12.4) |
| Autonomous functioning thyroid nodule | 3 (0.3) |

| Neoplasm                         |            |
| Benign                            | 669 (64.5) |
| Malignant                         | 369 (35.5) |

| Compressive symptoms              | 227 (21.9) |
| Retrosternal extension            | 130 (12.5) |

| Indications for surgery*           |            |
| Large goiter                      | 491 (47.3) |
| Compressive symptoms              | 227 (21.9) |
| Retrosternal extension            | 130 (12.5) |
| Uncontrolled hyperthyroidism      | 318 (30.6) |
| Grave’s ophthalmopathy            | 113 (10.9) |
| Suspicious of malignancy          | 413 (39.8) |
| Malignancy                        | 264 (25.4) |

*Aggregate is >100% since many patients had >1 indication for surgery.

MNG: Multinodular goiter, SD: Standard deviation

### Table 2: Surgical Details

| Surgical Procedure                  | n (%)      |
|-------------------------------------|------------|
| Surgery done                        |            |
| TT alone                            | 807 (77.7) |
| TT with LND                         | 231 (22.3) |
| TT + CCLND + MRND                   | 135 (13.0) |
| TT + CCLND                          | 91 (8.8)   |
| TT + CCLND + MRND + mediastinal LND | 5 (0.5)    |
| Parathyroid autotransplantation     | 218 (21)   |
| Tracheomalacia                      | 40 (3.9)   |
| Sternotomy                          | 12 (1.2)   |
| Thoracotomy                         | 1 (0.1)    |
| Tracheostomy                        | 47 (4.5)   |
| Elective                            | 41 (3.9)   |
| Emergency                           | 8 (0.6)    |
| Gland weight (g)                    | 124.34±129.85 (7–963) |

* TT: Total thyroidectomy, LND: Lymph nodes dissection, CCLND: Central compartment LND, MRND: Modified radical neck dissection.
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238 and oral calcium and Vitamin D in 19 cases). On long-term follow-up, normocalcemia was resumed in all patients except for 14 (1.4%) cases with documented permanent hypoparathyroidism, who were managed with lifelong oral calcium and Vitamin D supplement [Table 3]. The significant postoperative hoarseness was present in 28 (2.7%) cases. We did not perform vocal cord examination at that point in time, and all were advised voice rest. After 6 months of surgery, vocal cord examination documented permanent unilateral RLN paralysis in 11 (91%) cases. Other complications were chyle leak in 10 (1%) and wound complications (surgical site infection, seroma) occurred in 40 (3.8%) cases [Table 3].

One patient who underwent temporary tracheostomy for tracheomalacia, developed tracheal stenosis after five years. Similarly, two patients operated for nodular goiter presented with recurrent thyroid bed swelling after 5 and 9 years, respectively. The histopathology report revealed foreign body granuloma.

The rates of complications were comparable between consultants versus trainees, benign versus malignant goiters, and small goiters (gross gland weight <400 g) versus huge goiters (gross gland weight ≥400 g) [Table 4].

**Mortality**

We did not have surgery-related mortality except for one case with locally advanced thyroid carcinoma with RSE in posterior mediastinum, who succumbed due to hemorrhage.

**Discussion**

The extra CD for thyroidectomy was first described by Theodor Kocher in 1880s, which dramatically reduced the complications of hypoparathyroidism and RLN injury in that era; however, he himself stopped removing complete gland due to apprehension for “cachexia strumipriva.”[1,2] George Murray and Fox et al develop exogenous thyroxin, which help to overcome the problem of post thyroidectomy hypothyroidism, this invention revived the interest of total thyroidectomy among the thyroid surgeons.[1,2] With the aspiration from surgeons like, Halsted who introduced the importance of preservation of parathyroid gland’s vascular supply by ligating the tertiary branches of inferior thyroid artery close to the thyroid capsule; Coller and Boyden advocated the preservation of external branch of superior laryngeal nerve by individual ligation of superior thyroid vessels branches, aftermobilizing the potential space between the cricothyroid muscle and the medial part of the superior pole of the thyroid and Thompson who advocated the total extracapsular lobectomy, by dissecting the plane between thyroid capsule and thyroidartery. The present technique of CD for TT was described by Delbridge et al.[11] They published their experience of 825 cases with TT using

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**Table 3: Peroperative and postoperative complications of total thyroidectomy**

| Complications                          | n (%)  |
|---------------------------------------|--------|
| **Peroperative**                      |        |
| Tracheal injury                       | 8 (0.7) |
| Esophageal injury                     | 3 (0.3) |
| Recurrent laryngeal nerve injury      | 2 (0.2) |
| Internal jugular vein injury          | 10 (1)  |
| Carotid artery injury                 | 1 (0.1) |
| Inadvertent parathyroidectomy         | 62 (6)  |
| **Postoperative**                     |        |
| Hypocalcemia                          | 373 (35.9) |
| Hoarseness                            | 28 (2.7) |
| Wound complications                   | 40 (3.8) |
| Chyle leak                            | 10 (1)  |
| Hematoma                              | 6 (0.6)  |
| Permanent hypoparathyroidism          | 14 (1.4) |
| Permanent RLN palsy                   | 11 (91)  |
| Stitch granuloma                      | 15 (2.2) |
| Tracheal stenosis                     | 1 (0.1)  |
| Foreign body granuloma                | 2 (0.2)  |
| Mortality                             | 1 (0.1)  |

RLN: Recurrent laryngeal nerve

**Table 4: Comparison of complications rates between various known risk factors, n (%)**

| Complications          | Benign (n=669) | Malignant (n=369) | P | Small goiters* | Large goiters* | P | Consultants | Residents | P |
|------------------------|----------------|-------------------|---|---------------|---------------|---|-------------|-----------|---|
| Temporary hypocalcemia | 36.7           | 35.1              | 0.64 | 38.6         | 33.4         | 0.09 | 35         | 39.7      | 0.19 |
| Permanent hypocalcemia | 1.6            | 1.7               | 1.00 | 1.2          | 1.9          | 0.43 | 1.1        | 1.6       | 0.52 |
| Temporary hoarseness   | 2.8            | 1.9               | 0.53 | 2            | 3.1          | 0.32 | 2.5        | 2.4       | 1.00 |
| Permanent RLN palsy    | 0.9            | 2                 | 0.20 | 1.3          | 1.2          | 1.00 | 0.8        | 0.8       | 1.00 |

*Small goiter with gross gland weight <400 g and large goiter with gross gland weight ≥400 g. RLN: Recurrent laryngeal nerve
similar technique with permanent hypoparathyroidism in 0.6% and permanent RLN palsy in 0.5% cases.[14] After them, different centers including ours had initially attempted in some cases and gradually adopted the technique for bilateral thyroid disorders against STT, NTT, and Dunhill procedures.[8-10] Since total thyroidectomy with capsular dissection, aims to remove all visible thyroid tissue completely, thus avoiding long term of thyroid bed recurrence. It is desired as the redosurgery in a scarred thyroid bed due to previous surgery is a nightmare to any surgeon and it is associated with more chances of RLN injury and permanent hypoparathyroidism than the surgery performed in primary setting both for benign or malignant thyroid disorders.[13]

Being a tertiary care referral center catering an iodine endemic region, we use to manage patients with long-standing (mean duration of goiter 99.83 ± 105.1 months) and large (mean gross gland weight 124.34 ± 129.85 g) neglected goiters. Approximately one-third (35.5%) of our cases were malignant, one-fifth (21.9%) had compressive symptoms, one-eighth (12.5%) had retrosternal extension, and 3.9% had tracheomalacia. Furthermore, being a world-renowned endocrine surgery training center, the patients were being operated by six consultants and trainee residents; despite such complexity and diversity, we observed that if performed with dexterity, even the trainees can do it with acceptably low morbidity. Similar results were observed by Reeve et al.[17-20]

The strong factors with our study are its large number of sample size with uniform technique of similar procedure, from an iodine-deficient endemic region and a longer duration of study and follow-up. However, it has some limitations, which are inherent to any retrospective study.

**Conclusion**

TT with a uniform standard technique of CD is increasingly being preferred by thyroid surgeons for bilateral thyroid disorders. This technique can be easily learned by general surgeons, and despite complex and diverse situations, if the uniform standard technique is followed, one can keep the complication rates to acceptably low limits, even in the hands of surgical trainees.

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**Conflicts of interest**

There are no conflicts of interest.

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**Table 5: Comparison of complication rates (%) of the present study with published series**

| Complications                  | Present study (n=1038) | Khadra et al.[14] (n=825) | Serpell and Phan[18] (n=336) | Bhattacharyya and Fried[19] (n=517) | Etremidou et al.[20] (n=932) |
|--------------------------------|------------------------|---------------------------|-----------------------------|------------------------------------|-----------------------------|
| Temporary hypoparathyroidism   | 35.9                   | -                         | 38.9                        | 6.2                                | 7.3                         |
| Temporary hoarseness           | 2.7                    | -                         | -                           | 1.16                               | 1.3                         |
| Permanent hypoparathyroidism   | 1.4                    | 0.6                       | 1.8                         | -                                  | 0.3                         |
| Permanent recurrent laryngeal nerve palsy | 1.0                   | 0.5                       | 0.3                         | 1.0                                | 0.2                         |
| Wound complications            | 3.8                    | 1.2                       | 1.5                         | 0.2                                | 0.0                         |
| Hemorrhage                     | 0.6                    | 1.9                       | 0.9                         | 1.0                                | 0.2                         |
| Deaths                         | 0.1                    | 0.0                       | 0.0                         | 0.2                                | 0.0                         |
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