

# Efficacy and Safety of Central Compartment Neck Dissection for Recurrent Thyroid Carcinoma

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**Objective:** To explore the safety and efficacy of central compartment neck dissection (CCND) in the treatment of well-differentiated thyroid carcinoma (WDTC) recurrences in the central compartment of the neck.

**Design:** Retrospective medical chart review.

**Setting:** Tertiary-care academic hospital.

**Patients:** Eighty-two consecutively treated patients with recurrent WDTC, with a median follow-up of 28 months.

**Main Outcome Measures:** Postoperative complications, disease control posttreatment, and normalization of serum thyroglobulin (Tg) level.

**Results:** Eighty-two patients underwent 86 central compartment procedures. Only CCND was performed in 36 patients (42%), while a lateral neck dissection was also required in the remainder. Postoperative hypoparathyroidism was temporary in 17 patients (20%) and permanent in 6 patients (7%). Postoperative intact serum para-

thyroid hormone level was greater than 15.0 pg/mL (to convert to nanograms per liter, multiply by 1.0) in 81% of patients, accurately predicting eucalcemia postoperatively. Unilateral recurrent laryngeal nerve injury was transient in 3 patients (2% of nerves at risk) and permanent in 3 patients (2%). Seventeen patients (21%) experienced subsequent recurrences after their CCND—2 patients (2%) had recurrence in the central neck, 8 (9%) in the lateral neck, 2 (2%) in the central and lateral neck, and 7 (8%) at distant sites. Twenty-seven patients underwent a CCND alone and were deemed appropriate for efficacy analysis. The Tg level was normalized in 15 patients (56%) in the group overall. Normalization occurred in 10 of the 20 patients (50%) who received sodium iodide I 131 ablation and in 5 of the 7 patients (71%) who did not.

**Conclusion:** Central compartment neck dissection is a safe and efficacious procedure for the management of central neck recurrences in WDTC.

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**W**ELL-DIFFERENTIATED thyroid carcinoma (WDTC) accounts for greater than 90% of thyroid cancer and has a generally favorable prognosis, with a 10-year survival rate approaching 95%.<sup>1</sup> Papillary thyroid carcinoma (PTC) represents the majority of these cases, and there is a subset of approximately 14%<sup>2</sup> of patients with PTC who develop locally persistent or recurrent disease. The management of WDTC in these patients can be controversial. Revision surgery of the central neck is a treatment option, and its relative safety has been shown in recent retrospective series.<sup>3-6</sup> Among series examining efficacy, there is variation in reporting postoperative serum thyroglobulin (Tg) levels and there is a lack of long-term follow-up of serum Tg levels. As a result, it is difficult to comment on the efficacy of revision central neck surgery in achieving a clinical and biochemical cure.

The purpose of this study was to retrospectively review a single surgeon's ex-

perience with revision surgery of the central neck for locally persistent or recurrent WDTC. The aims were to describe the surgical approach, to determine the incidence of surgical complications, and to quantify clinical and biochemical cure.

## METHODS

### DATA COLLECTION

A retrospective medical chart review was performed on consecutively treated patients with WDTC (papillary and follicular variants) who were suspected of having a recurrence in the central neck (level VI or superior mediastinum).<sup>7</sup> All patients were treated by the senior author (J.L.F.) in the Department of Otolaryngology Head & Neck Surgery at Mount Sinai Hospital, Toronto, Ontario, Canada, between 2002 and 2009. All patients subsequently underwent surgical exploration of the central and/or lateral neck compartments. Approval was obtained from the institutional ethics review board at Mount Sinai Hospital prior to proceeding with data collection or analysis.

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Data regarding the patients' original treatment for WDTC were collected, including age, sex, details of past operative procedures, adjuvant treatments, histopathologic features, and tumor staging. With regard to the treatment of patients' recurrent WDTC, time to recurrence, investigational modalities used (serum Tg, fine-needle aspiration biopsy, computed tomography, magnetic resonance imaging, positron-emission tomography, ultrasonography, or sodium iodide I 131 [<sup>131</sup>I] scanning), operative details, location of recurrence and pathologic details, postoperative complications, postoperative parathyroid hormone level, and follow-up details including serum Tg levels were collected. A central compartment neck dissection (CCND) was defined as surgical lymph node dissection of level VI and the superior mediastinal contents. A lateral neck dissection was defined as a surgical lymph node dissection of levels II, III, and IV and level V when clinically indicated. Normalization of serum Tg level postoperatively was examined. A normal serum Tg level was defined as less than or equal to 2 ng/mL (to convert to micrograms per liter, multiply by 1.0). All of the data were collected and analyzed using Microsoft Excel 2008 (Microsoft Corp).

### SURGICAL TECHNIQUE

The senior author's surgical technique for central compartment and superior mediastinal neck dissection in the setting of recurrent WDTC has been published previously<sup>5</sup> and is summarized herein. The patient is positioned, prepared, and draped in the usual manner appropriate for thyroid surgery. The original thyroidectomy skin incision is excised, and the incision is carried through the platysma muscle, after which superior and inferior subplatysmal flaps are developed. The sternohyoid and sternothyroid muscles are divided transversely at their midpoint after ligation of the anterior jugular veins, exposing the trachea and thyroid bed.

A technique of blunt dissection involving cotton dental pledgets held with a hemostat is used to identify the recurrent laryngeal nerve (RLN). Gentle strokes are made in a superomedial-to-inferolateral direction along the course of the RLN. Identification of the RLN can be difficult because it can be located anywhere in the surgical bed owing to scarring and wound contracture from the previous surgical procedure(s). It is often easiest to identify the RLN in previously undissected areas where scar tissue will be absent or minimal. This is usually inferiorly in the paratracheal or superior mediastinal region. Intraoperative nerve monitoring of RLN function is not used by the senior author for these operations. Once the RLN has been identified, sharp dissection is used to identify the common carotid artery and it is followed from the hyoid bone into the superior mediastinum. The innominate artery serves as the inferior extent of the dissection. The superior mediastinal contents can then be dissected free from the major vessels and the trachea using a combination of sharp and microbipolar ("pinch-burn" technique) dissection. The RLN is carefully dissected free from the central neck contents such that these can be removed en bloc with the superior mediastinal contents.

Identification and preservation of vascularized parathyroid glands can be challenging. Our experience is that a combination of blunt and sharp dissection, along with a high level of vigilance for potential parathyroid tissue, usually results in the identification of at least 1 parathyroid gland on each side. If the identified parathyroid tissue appears to be well vascularized at the end of the procedure, it is left in situ. Only if it is deemed to lack adequate vascular supply is it removed, cut into several small pieces, and autotransplanted into vascularized muscle (usually the ipsilateral sternocleidomastoid muscle).

Eighty-two patients were identified who underwent a CCND for suspected recurrent WDTC. These 82 patients underwent 86 central compartment procedures—4 patients experienced a subsequent recurrence in the central compartment requiring a second revision operation. The data presented are based on these 86 procedures.

### INITIAL THYROID OPERATION

Of the patients in the study, 57 (70%) were female. At the time of the original thyroid operation, the mean patient age was 42.6 years (range, 19-75 years). The senior author conducted the initial thyroid procedure in 25 patients (30%), while the remaining procedures were completed by other surgeons. The histopathological diagnosis was papillary carcinoma in 80 patients (98%) and follicular carcinoma in 2 patients (2%). **Table 1** summarizes the data pertaining to the patients' initial thyroid operation.

### RECURRENCE

In 13 cases (15%) of recurrence, the central neck disease was clinically palpable. The majority of patients (83 of 86 procedures [97%]) had imaging results that were highly suggestive of recurrence in the central compartment of the neck. Imaging modalities included computed tomography, magnetic resonance imaging, ultrasonography, and computed tomography-positron emission tomography. The 3 recurrences that did not have suspicious imaging results had elevated serum Tg levels and RAI uptake in the central neck.

Serum Tg measurements were available preoperatively for 78 of the 86 central neck procedures (91%); 41 were stimulated Tg measurements and 37 were non-stimulated Tg measurements. Three patients (4%) had nondetectable (<2 ng/mL) serum Tg levels but positive anti-Tg antibodies. The serum Tg data (prior to revision CCND) are given in **Table 2**.

In 37 cases (43%), a fine-needle aspiration biopsy of the specimens suggestive of central compartment disease was performed. Biopsy results were based on cytologic analysis only; Tg staining of the aspirate was not performed. The majority (31 of 37 [84%]) of these biopsy results were positive for thyroid carcinoma.

### REVISION CENTRAL COMPARTMENT NECK DISSECTION

Thirty-nine of the 86 central compartment procedures (45%) were unilateral. Of these patients, 11 (28%) underwent revision CCND alone, 27 (69%) underwent the CCND and a unilateral lateral neck dissection, and 1 (3%) underwent the CCND and a bilateral lateral neck dissection. The remaining 47 (55%) central compartment procedures were bilateral. Of these patients, 25 (53%) underwent revision CCND alone, 7 (15%) underwent the CCND and a unilateral lateral neck dissection, and 15

**Table 1. Details of Initial Thyroid Operation in 82 Patients**

Detail	Patients, No. (%)
Tumor staging	
T category	
T1	32 (39)
T2	14 (17)
T3	15 (18)
T4a	3 (4)
Unknown	18 (22)
N category	
N0	40 (49)
N1a	27 (33)
N1b	11 (13)
Unknown	4 (5)
M category	
M0	80 (98)
M1	2 (2)
Initial thyroid operation	
Hemi	3 (4)
Total	79 (96)
Initial neck dissection	
None	50 (61)
Node sampling	2 (2)
Location	
Central	
Unilateral	5 (6)
Bilateral	8 (10)
Lateral	
Unilateral	12 (15)
Bilateral	1 (1)
Central and lateral	4 (5)
Postoperative <sup>131</sup> I ablation	
Yes	70 (85)
No	10 (12)
Unknown	2 (2)
External beam radiation	
No	82 (100)
Postoperative complications	
Hypocalcemia	
Temporary	9 (11)
Permanent	5 (6)
RLN injury	
Temporary	2 (2)
Permanent	4 (5)

Abbreviations: <sup>131</sup>I, sodium iodide I 131; RLN, recurrent laryngeal nerve.

(32%) underwent the CCND and a bilateral lateral neck dissection. The majority of patients (50 of 86 procedures [58%]) were treated with postoperative RAI therapy. The postoperative surgical histopathologic details are given in **Table 3** and **Table 4**.

Postoperative complications relevant to revision CCND are summarized in **Table 5**. Postoperative serum PTH levels were available for 70 procedures (81%). The mean postoperative serum PTH level was 33.7 pg/mL (range, 2.8-94.0 pg/mL) (to convert to nanograms per liter, multiply by 1.0). The majority (81%) were above the critical threshold of 15.0 pg/mL.<sup>8</sup>

The median follow-up after CCND was 28 months (range, 10-119 months). During follow-up, 17 patients (20%) experienced a further recurrence of their WDTC. Two patients (2%) had recurrence in the central neck only, 8 (9%) in the lateral neck only, 2 (2%) in the central and lateral neck, and 7 (8%) at distant

**Table 2. Serum Thyroglobulin (Tg) Levels Prior to Revision Central Compartment Neck Dissection**

Serum Tg Level, ng/mL	Procedures, No. (%) (n = 86)
Not available	8 (9)
Stimulated Tg (n = 41)	
<2	2 (2)
<2 with Abs	0
2-10	8 (9)
11-99	22 (26)
>100	9 (10)
Nonstimulated Tg (n = 37)	
<2	6 (7)
<2 with Abs	3 (3)
2-10	10 (12)
11-99	16 (19)
>100	2 (2)

Abbreviation: Abs, antibodies.

SI conversion factor: To convert Tg to micrograms per liter, multiply by 1.

**Table 3. Location Pathologically Confirmed Recurrence**

Location	Patients Who Experienced a Recurrence, No. (%)
Central neck only	37 (43)
Lateral neck only	10 (12)
Central and lateral neck	30 (35)
Lateral neck and distant site(s)	1 (1)
Residual benign thyroid tissue only	8 (9)

**Table 4. Pathologic Details of Central Neck Compartment Specimens Removed**

Detail	Mean (Range)
Unilateral specimens	
No. of LNs	3.97 (1-15)
No. of LNs positive for carcinoma	1.82 (1-8)
Bilateral specimens	
No. of LNs	5.55 (1-22)
No. of LNs positive for carcinoma	3.04 (1-18)

sites. **Table 6** displays the status of patients at the last available follow-up.

#### POST-CCND THYROGLOBULIN DATA

The proportion of procedures with normalized serum Tg levels postoperatively was examined. Sixty-seven patients (78%) had appropriate serum Tg measurements available. However, to specifically examine the efficacy of revision CCND, we excluded patients who underwent a lateral neck dissection—36 patients underwent a CCND only. From this group, patients were also excluded for the presence of distant metastases, lack of available preoperative and postoperative serum Tg measurements, and absence of carcinoma in the final pathological specimen. One patient with no evidence of carcinoma was included as they had biochemical and imaging evidence

to suggest recurrence, but the final pathologic examination revealed only residual thyroid tissue. Twenty-seven patients remained for the efficacy analysis (**Table 7**).

Fifteen patients had stimulated Tg levels available both preoperatively and postoperatively. Eleven patients had nonstimulated Tg levels available preoperatively and postoperatively. One patient had a preoperative stimulated Tg level available but only nonstimulated Tg available postoperatively. This patient did not normalize his or her serum Tg level postoperatively and thus was included in the analysis because this would tend to bias the calculated efficacy to be an underestimate of the true value. Overall, 15 patients (56%) had a normalization of their serum Tg level. If only patients with stimulated serum Tg levels are considered, 10 patients (62.5%) experienced normalization.

**Table 5. Postoperative Complications Following Revision Central Compartment Neck Dissection**

Complication	No. (%)
Hypocalcemia (n = 86 procedures)	
Temporary	17 (20)
Permanent	6 (7)
RLN injury (n = 133 nerves at risk)	
Temporary	3 (2)
Permanent	3 (2)

Abbreviation: RLN, recurrent laryngeal nerve.

To further analyze the efficacy of CCND alone, the effect of postoperative <sup>131</sup>I ablation was considered. Twenty patients (74%) in this group received <sup>131</sup>I ablation. Of these 20 patients, 10 (50%) experienced normalization of their serum Tg levels. Of the 7 patients who did not receive <sup>131</sup>I ablation, 5 (71%) experienced normalization.

### COMMENT

Up to 20% of patients with WDTC will experience a nodal recurrence.<sup>2,9-11</sup> The optimal management when recurrence has occurred in the central compartment of the neck has generated controversy in the literature. Available options include radioactive iodine ablation therapy, revision surgery (CCND), percutaneous ethanol injection, and close clinical observation.<sup>3,12-14</sup>

**Table 6. Patient Status at Last Available Follow-up After Revision Central Compartment Neck Dissection**

Status at Last Follow-up	No. (%)
Alive, no clinical or biochemical evidence of disease	35 (43)
Alive, no clinical/radiographic evidence of disease, elevated Tg level	21 (26)
Alive, no clinical/radiographic evidence of disease, no Tg measurement available	6 (7)
Alive with distant metastasis	9 (11)
Dead of disease	1 (1)
Lost to follow-up	10 (12)

**Table 7. Patients Included in the Efficacy Analysis for Revision Central Compartment Neck Dissection**

Patient No.	Pre-op Tg Level, ng/mL	Post-op Tg Level, ng/mL	Duration Between Measures, mo	Stimulated or Nonstimulated Tg	Post-op <sup>131</sup> I Ablation
1	10	2	4.6	NS	No
2	2.8	<1	18.8	NS	No
3	4	1.8	7.0	NS	No
4	5	<1	36.5	S	No
5	4	4	12.0	NS	No
6	6	4	4.5	NA	No
7	25	<1	10.7	NS	No
8	17	<1	30.7	S	Yes
9	23	<1	15.2	S	Yes
10	35	<1	58.3	S	Yes
11	43	15	60.4	S	Yes
12	43	<1	53.9	S	Yes
13	18	<1	62.5	NS	Yes
14	9	<1	23.6	S	Yes
15	13	<1	21.9	S	Yes
16	4	9	13.3	NS	Yes
17	99	78	30.8	S	Yes
18	264	154	23.4	S	Yes
19	100	41	19.5	NS	Yes
20	11	6	89.1	NS	Yes
21	210	120	57.5	NS	Yes
22	15	<1	54.1	S	Yes
23	10	2	5.8	S	Yes
24	6.1	2	54.1	S	Yes
25	12	17	36.1	S	Yes
26	120	8	54.3	S	Yes
27	5	4	10.3	NS	Yes

Abbreviations: <sup>131</sup>I, sodium iodide I 131; NA, this patient had a stimulated Tg available preoperatively but only a nonstimulated Tg available postoperatively; NS, nonstimulated; Pre-op, preoperative; Post-op, postoperative; S, stimulated; Tg, serum thyroglobulin.

One of the main arguments against revision CCND is the morbidity associated with the procedure. Revision surgery is often challenging owing to scar tissue in the central neck as a result of the original thyroid operation. Safe identification of the RLNs and preservation of viable parathyroid tissue can be difficult, resulting in potential for increased morbidity. The results of our study—permanent hypoparathyroidism in 7% of patients and permanent RLN injury in 2%—would suggest that the morbidity associated with revision CCND is relatively low. Other studies have reported a similar incidence of complications, supporting the safety of revision CCND.<sup>3-6,15,16</sup> Furthermore, when a comparison is made to prophylactic CCND performed at the time of initial thyroid surgery, revision CCND has a similar reported incidence of complications. Studies examining prophylactic CCND have reported an incidence of permanent hypoparathyroidism ranging from 0% to 14% and permanent RLN injury from 0% to 11.5%.<sup>14,17</sup>

The efficacy of revision CCND has been difficult to quantify because of variation in reporting of postoperative serum Tg levels and the lack of long-term follow-up. This study is the largest reported series of patients who underwent revision CCND with a long duration of follow-up and a high proportion (78%) of available postoperative serum Tg measurements. Several exclusions were applied to specifically examine the efficacy of revision CCND. Of the 27 revision CCNDs analyzed, 56% of patients had normalization of their serum Tg levels postoperatively. Although the subgroups were small, the addition of <sup>131</sup>I ablation therapy postoperatively did not seem to elevate the proportion of patients experiencing normalization, supporting the efficacy of the operation itself. However, this must be interpreted in light of potential bias as patients receiving <sup>131</sup>I ablation are more likely to have various risk factors for recurrence, which would have prompted such treatment.

Only 1 other study examining the efficacy of revision CCND with rigorous serum Tg measurements was identified.<sup>6</sup> The authors reported on a total of 79 revision CCNDs, with 38 procedures excluded from the efficacy analysis for various reasons. Of the remaining 41 procedures, 41% had undetectable postoperative stimulated Tg levels.

This study reports one of the largest series of patients undergoing revision CCND. This operation can be a technically challenging procedure with potential for significant morbidity. However, our results would suggest that in experienced hands, revision CCND is a safe procedure with no additional morbidity when compared with CCND performed at the time of the initial thyroid operation. Furthermore, our results demonstrate that a significant proportion of patients experience normalization of their serum Tg levels postoperatively. Controversy exists regarding the most appropriate management of recurrent WDTC in the central neck; however, our study supports that revision CCND is a safe and effective option.

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