Incision Length for Standard Thyroidectomy and Parathyroidectomy

When Is It Minimally Invasive?

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Hypothesis: Current techniques for open conventional thyroidectomy or parathyroidectomy have evolved to enable a shorter incision (main proposition), and the length of the incision is influenced by objective factors.

Design: Case series.

Setting: University referral center.

Patients and Intervention: Retrospective study of the most recent 200 primary consecutive routine thyroid and parathyroid operations (excluding neck dissections).

Main Outcome Measures: The length of incision was routinely measured with a ruler before the incision. Univariate and multivariate analysis was performed to distinguish variables affecting length of incision.

Results: Mean length of the incision was 5.5 cm for total thyroidectomy, 4.6 cm for lobectomy, and 3.5 cm for parathyroidectomy ($P<.001$). It was 4.1 cm for bilateral parathyroid exploration, but was reduced to 3.2 and 2.8 cm for unilateral ($P<.001$) and local ($P<.001$) explorations, respectively. By multiple regression analysis, thyroid specimen volume and patient body mass index were independent predictors of incision length in thyroidectomy. Extent of exploration and resident training level were independent predictors of incision length in parathyroidectomy.

Conclusions: Current techniques for open conventional thyroidectomy or parathyroidectomy have evolved to enable a shorter incision. Thyroid volume, patient body mass index, extent of the planned parathyroid exploration, and the resident clinical training stage are important variables for incision length in open operation and should be taken into account when minimally invasive thyroidectomy and parathyroidectomy are evaluated.

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THERE ARE many definitions of “minimally invasive” thyroidectomy and parathyroidectomy in the literature.1 2 No matter how they are defined, the main advantage is a shorter cervical incision. Many surgeons who perform “minimally invasive” surgery make a misleading comparison to the traditional Kocher incision of 8 to 10 cm, which is rarely necessary. The aim of this study was to determine our current standard neck incision length for open conventional thyroidectomy and parathyroidectomy and to determine what variables may influence this length of incision.

METHODS

Patients and Procedures

Data from 200 consecutive patients undergoing either thyroid or parathyroid operations were reviewed. We excluded all reoperations and patients undergoing neck dissection. All procedures were performed by 1 of 2 of us (Q.-Y.D. and O.H.C.). All procedures were performed with the patient under general anesthesia. There was at least 1 surgical resident and a scrub nurse assisting the surgeon. A transverse lower midcervical skin incision was made for all patients, at the level of the isthmus, usually 1 cm below the cricoid cartilage. This incision was preferably placed in one of the skin creases of the neck. The superior margin of dissection extended usually to just above the notch of the thyroid cartilage. The inferior flap was created similarly and the dissection extended inferiorly to the level of the sternal notch. Retractors were used to provide and maintain exposure.

Examined Variables

The data were collected by reviewing the prospectively kept endocrine surgery database and patients’ medical charts. These variables included the following: (1) body mass index (BMI), (2) patient’s age, (3) duration of operation, and (4) resident clinical training stage. Variables related to thyroid surgery included, more specifically, (1) type of operation (unilateral lobectomy or total thyroidectomy), (2)
industries for operation, (3) thyroid specimen volume and
weight, (4) substernal extension, and (5) number of recurrent
laryngeal nerves or parathyroid glands identified. Variables re-

tained for analysis were as follows: (1) type of operation (bilateral, unilateral, or focal parathyroid exploration), (2) extent of cervical exploration (number of parathyroid glands located and number of parathyroid glands re-
sected), (3) indications for surgery (primary or secondary hyperparathyroidism), (4) size of resected parathyroid gland(s), and (5) whether or not thymectomy was performed.

The intended incision line was routinely drawn and measured with a ruler, so that skin incision lengths were increased incrementally by 0.5 cm. A few of the incisions (6 patients) were extended when the surgeon believed that the initial incision was too short to provide an adequate exposure to perform the procedure. For these we used the final length after extension for analysis.

STATISTICS

All values are expressed as mean ± SEM except in the box plot showing resident level. Statistical analysis was performed with the unpaired, 2-tailed t test. A nonparametric test (Mann-Whitney test) was performed when distribution was nonnormal. Correlations were evaluated by means of a correlation matrix and backward multiple regression analysis. Statistical significance was accepted when P < .05. The data were analyzed and compared by means of StatView 5.0 software (Abacus Concepts, Berkeley, Calif).

RESULTS

Seventy-three patients (36%) underwent total thyroidectomy and 60 patients (30%) unilateral lobectomy. Sixty-seven patients (34%) underwent parathyroidectomy. Mean age was 49.9 ± 1.2 years. There were 159 women (80%) and 41 men. Mean length of the incision was 5.5 ± 0.1 cm for total thyroidectomy, 4.6 ± 0.1 cm for unilateral thyr-

dotomy, and 3.5 ± 0.1 cm for parathyroidectomy.

EXAMINED VARIABLES FOR THYROIDECTOMY

The mean incision length was longer in patients with sub-

ternal thyroid extension and in patients with obstructive signs (P < .001) (Table 2). The shortest incision length was observed for benign nodules: 4.4 ± 0.1 cm. In comparison, thyroidectomy for cancer, Graves disease, and multinodular goiter was associated with a longer incision (P < .01) (Table 2). The matrix correlation analysis showed a significant positive correlation for thyroidectomy between length of incision and thyroid volume or weight (Table 3).

The length of the incision was significantly shorter when an R4 or R5 resident assisted the surgeon for total thyroidectomy (P < .03) (Figure 1). The matrix correlation analysis showed a significant negative correlation between length of incision and resident clinical training stage (Table 3). A positive correlation was found between length of incision and patient BMI, age, and duration of operation (P < .001).

EXAMINED VARIABLES FOR PARATHYROIDECTOMY

The mean length of incision was 4.1 ± 0.2 cm for bilateral exploration. This length was reduced to 3.2 ± 0.1 cm and 2.8 ± 0.1 cm for a unilateral (P < .001) or a focal parathyroid (P < .001) exploration (Table 1). Although these incisions were significantly shorter than those for bilateral exploration, no statistically significant difference was noted between unilateral and focal parathyroid explo-

ations. The matrix correlation showed a positive correlation between length of incision and extent of cervical exploration, and duration of operation (Table 3).

We also found that incisions were longer when a uni-

lateral (4.1 ± 0.5 cm vs 3.4 ± 0.1 cm; P < .05) or bilateral (5.0 ± 0.5 cm vs 3.4 ± 0.1 cm; P < .001) thymic resection was added to the parathyroid exploration, and in patients with secondary hyperparathyroidism (5.4 ± 0.2 cm vs

<table>
<thead>
<tr>
<th>Procedure</th>
<th>No. of Patients</th>
<th>Length, cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total thyroidectomy</td>
<td>73</td>
<td>5.5 ± 0.1</td>
</tr>
<tr>
<td>Lobectomy</td>
<td>60</td>
<td>4.6 ± 0.1</td>
</tr>
<tr>
<td>Multinodular goiter</td>
<td>25</td>
<td>5.0 ± 0.2</td>
</tr>
<tr>
<td>Cancer†</td>
<td>13</td>
<td>4.6 ± 0.3</td>
</tr>
<tr>
<td>Bilateral exploration</td>
<td>28</td>
<td>3.5 ± 0.1</td>
</tr>
<tr>
<td>Unilateral exploration</td>
<td>25</td>
<td>4.1 ± 0.2</td>
</tr>
<tr>
<td>Focal exploration</td>
<td>14</td>
<td>3.2 ± 0.1</td>
</tr>
<tr>
<td>Total</td>
<td>200</td>
<td>4.6 ± 0.1</td>
</tr>
</tbody>
</table>

*Compared with total thyroidectomy.
†Compared with bilateral parathyroid exploration.
‡Compared with total thyroidectomy or lobectomy.
§Compared with total thyroidectomy, lobectomy, or parathyroidectomy.

Figure 1. Length of incision for total thyroidectomy, lobectomy, or parathyroidectomy. The mean incision length was longer in patients with sub-

ternal thyroid extension and in patients with obstructive signs (P < .001) (Table 2). The shortest incision length was observed for benign nodules: 4.4 ± 0.1 cm. In comparison, thyroidectomy for cancer, Graves disease, and multinodular goiter was associated with a longer incision (P < .01) (Table 2). The matrix correlation analysis showed a significant positive correlation for thyroidectomy between length of incision and thyroid volume or weight (Table 3).

The length of the incision was significantly shorter when an R4 or R5 resident assisted the surgeon for total thyroidectomy (P < .03) (Figure 1). The matrix correlation analysis showed a significant negative correlation between length of incision and resident clinical training stage (Table 3). A positive correlation was found between length of incision and patient BMI, age, and duration of operation (P < .001).
surgeons and patients is to minimize “surgical invasiveness,”

erally used to achieve this goal. Since one of the goals for
technology imaging systems and new surgical tools are gen-

Variables (independent predictors.

Pdent level of clinical training (P < .001) remained

when the operation can be done safely, the length of inci-

sion is consequently one of the key variables in defining mini-

mally invasive surgery. 1,5 In endocrine surgery, minimally

invasive surgical techniques have been widely applied in

thyroid and parathyroid surgery since 1996. 1

We found that the cervical incision length rou-

tinely used at the University of California, San Fran-

cisco, for standard total thyroidectomy and unilateral

lobectomy was 5.5 and 4.6 cm, respectively. The inci-
sion length was 4.1 cm for bilateral parathyroid explo-
rati on but was reduced to 3.2 and 2.8 cm when unilat-
eral and focal parathyroid approaches, respectively, were

performed. Thus, we confirmed that current techniques

for open conventional thyroidectomy or parathyroidec-
tomy have evolved to use a shorter incision. This evolu-
tion in shortening the incision is not specific to our in-
stitution and has been widely observed.4 Indeed, Yim and

Carty5 recently showed by questionnaire that the mean

incision length used by 27 internationally respected prac-
ticing endocrine surgeons was 5 cm for thyroid surgery

(lobectomy and total thyroidectomy). They also prospec-
tively showed that mean incision length in their group

was 5.9 and 5.1 cm for open conventional total thyroidec-
tomy and unilateral lobectomy, respectively.3 This trend
has also been observed for open conventional parathy-
roidectomy, with an average length of incision less than

5 cm.6,7

MULTIPLE REGRESSION ANALYSIS

In multiple regression analysis, thyroid specimen vol-

ume (P < .001) (Figure 2) and BMI (P = .02) remained

independent predictors of incision length for thyroid sur-
gery. For parathyroid surgery, extent of cervical explo-
rati on (number of parathyroids seen) (P < .001) and resi-
dent level of clinical training (P < .001) remained

independent predictors.

Table 2. Factors Associated With Length of Incision for Thyroidectomy

<table>
<thead>
<tr>
<th>Criteria</th>
<th>No. of Patients</th>
<th>Mean ± SEM</th>
<th>Range</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Related to thyroid volume</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No substandard thyroid</td>
<td>116</td>
<td>4.9 ± 0.1</td>
<td>3.0 to 8.0</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Substandard thyroid</td>
<td>17</td>
<td>6.4 ± 0.3</td>
<td>4.0 to 9.0</td>
<td></td>
</tr>
<tr>
<td>No obstructive sign</td>
<td>114</td>
<td>4.9 ± 0.1</td>
<td>3.0 to 8.0</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Obstructive signs</td>
<td>19</td>
<td>6.5 ± 0.3</td>
<td>4.0 to 9.0</td>
<td></td>
</tr>
<tr>
<td>Pathologic findings</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benign nodule</td>
<td>38</td>
<td>4.4 ± 0.1</td>
<td>3.0 to 8.0</td>
<td></td>
</tr>
<tr>
<td>Cancer</td>
<td>38</td>
<td>4.9 ± 0.1</td>
<td>4.0 to 7.0&lt;.01*</td>
<td></td>
</tr>
<tr>
<td>Graves disease</td>
<td>8</td>
<td>5.5 ± 0.5</td>
<td>3.0 to 8.0</td>
<td>&lt;.01*</td>
</tr>
<tr>
<td>Multinodular goiter</td>
<td>49</td>
<td>5.8 ± 0.2</td>
<td>4.0 to 9.0</td>
<td>&lt;.001*</td>
</tr>
</tbody>
</table>

Abbreviations: BMI, body mass index; CI, confidence interval.

*A significant positive correlation for thyroidectomy was evident for all variables (P < .001).

3.4 ± 0.1 cm; P < .001). The incision was significantly

shorter when an R4 or R5 resident helped the surgeon
during surgery (P = .009) (Figure 1). Similar to thyroidec-
tomy, a negative correlation was found between length

of incision and resident clinical training stage (Table 3).

Minimally invasive surgery is defined as the ability of

the surgeon to perform traditional surgical procedures in novel

ways to minimize the trauma of surgical exposure.3 High-
technology imaging systems and new surgical tools are gen-

erally used to achieve this goal. Since one of the goals for

surgeons and patients is to minimize “surgical invasiveness,”

We think that it is essential to recognize that current
techniques for open conventional thyroidectomy and par-
athyroidectomy can routinely be performed through inci-
sions of 3.5 to 5.5 cm. Consequently, this reduced aver-
age length of incision for open conventional thyroidectomy
and parathyroidectomy currently should be taken into ac-
count when advantages and disadvantages of new mini-
mally invasive approaches are evaluated. Historical de-
scription should no longer be used for comparison when
minimally invasive thyroidectomy and parathyroidec-
tomy are studied.8-10 For example, minimally invasive pro-
cedures should not be compared with “a wide transverse
skin incision in the exposed anterior neck region”11 or “a
6 to 8 cm, or bigger, transverse wound on the lower neck.”12

Furthermore, we showed that the length of inci-
sion is determined by other factors. We confirmed that
thyroid volume is a main independent predictor of inci-
sion length for thyroidectomy, as previously observed with

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minimally invasive surgery. We also confirm that patient BMI influences incision length. This last criterion is rarely reported in studies describing minimally invasive thyroidectomy and is not considered by most authors. For parathyroidectomy, predictors of incision length are the extent of the planned exploration and the clinical training level of the resident helping the staff surgeon during the procedure. In the literature, the number of parathyroid glands seen was rarely used to discriminate among the various minimally invasive parathyroid procedures. Although the skill and level of assisting surgeons (residents) may influence the conduct of the operation, how they affect the surgical procedure has rarely been studied. In our opinion, this implies that thyroid volume (gland volume and/or nodule volume), patient BMI, extent of the planned parathyroid exploration, and the resident clinical training stage should be taken into account when minimally invasive thyroidectomy and parathyroidectomy are evaluated.

Our study raises the question of what is a minimally invasive neck surgery and what is not. Many criteria are used to define and discriminate among minimally invasive techniques (pain, duration of operation, general or local anesthesia, cost, cosmetic results, and cure of the disease). The length of incision is only one of the criteria, and it varies among these procedures. The incision length for these procedures sometimes comes very close to the length observed with open and conventional thyroidectomy and parathyroidectomy. The term minimally invasive, when used in the context of thyroid and parathyroid operations, currently is not specific enough and overlaps with conventional open operation. We propose that this term be used only to describe thyroid and parathyroid procedures that are routinely associated with an incision shorter than 3.0 cm for thyroidectomy and 2.5 cm for parathyroidectomy. These threshold values correspond to the minimum lengths observed in this study.

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