

Unintentional parathyroidectomy during total thyroidectomy surgery

A single surgeon's experience

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Abstract

In this study, we investigated incidental parathyroidectomy during total thyroidectomy surgery that required central lymph node dissection and the potential risk factors. Patients requiring total thyroidectomy and tracheoesophageal groove node dissection were enrolled in the study from January 2013 to June 2015 and we obtained all medical information, including pathology reports. Furthermore, we recorded the parathyroid hormone level in all patients prior to operation and then 3 further times: 1 day, 1 week, and 3 months after surgery. A total of 341 patients (66 male and 275 female) were enrolled in the study. Microscopic examination of postoperative specimens revealed that incidental parathyroidectomy existed in 35 (10.3%) cases: 32 (91.4%) patients had 1 parathyroid gland excised, 3 (8.6%) patients had 2 parathyroid glands excised, and no patients had 3 or more parathyroid glands resected. The mean size of the resected glands was 4.6 mm. Parathyroid tissue from 16 (42.1%) cases was located in the intrathyroidal position, 6 glands were located in central lymphatic adipose tissue, and 16 glands were located within or along with thymus tissue. Lateral neck dissection significantly increased the risk of incidental parathyroidectomy ($P < 0.001$). No other factors including age, sex, and postoperative symptomatic hypocalcemia were significantly associated with incidental parathyroidectomy (all $P > 0.05$), though incidental parathyroidectomy tended to cause transient hypoparathyroidism ($P = 0.051$). Therefore, the risk of incidental parathyroidectomy in total thyroidectomy is relatively low; the majority of the resected parathyroid tissue is situated outside the thyroid, therefore we suggest future operations focus on preserving the parathyroid gland when the node dissection is close to the thymus. Incidental parathyroidectomy appears to have an effect on the expression of parathyroid hormone and it is significantly associated with lateral cervical lymph node dissection.

Abbreviation: PTH = parathyroid hormone.

Keywords: incidental parathyroidectomy, lateral neck dissection, thyroid cancer, total thyroidectomy

1. Introduction

Thyroid cancers are now detected more rapidly due to development of the ultrasound technique^[1] and surgery is the most frequently recommended treatment. Postoperative hypocalcemia is a potential complication that significantly results in a profound decline in a patient's quality of life.^[2] A recent study noted that patients with incidental parathyroidectomy are more likely to have biochemical and symptomatic hypocalcemia following thyroid surgery.^[3] However, even in the hands of an

experienced surgeon, an incidental parathyroidectomy may still occur.

A number of previous studies have investigated unintentional parathyroidectomy during thyroid surgery,^[4–6] but there is no consensus about its incidence and risk factors; moreover, most of these studies describe different types of thyroid surgery. In fact, incidental parathyroidectomy would be most likely to happen during total thyroidectomy requiring central lymph node dissection. Therefore, we investigated incidental parathyroidectomy during total thyroidectomy surgery that requires central lymph node dissection and the potential associated risk factors.

2. Methods

The Zhengzhou University institutional research committee approved our study and all participants signed an informed consent agreement.

2.1. Patients

From January 2013 to June 2015, patients requiring total thyroidectomy and tracheoesophageal groove node dissection were enrolled. Exclusion criteria involved the following conditions: revision surgery for recurrent disease, parathyroid gland disease, and locally advanced thyroid cancer requiring throat or trachea or esophagus resection. We obtained all medical information on patients, including pathology reports.

Editor: Maohua Xie.

The authors have no conflicts of interest to disclose.

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Medicine (2017) 96:11(e6411)

Received: 2 June 2016 / Received in final form: 10 January 2017 / Accepted: 25 February 2017

<http://dx.doi.org/10.1097/MD.00000000000006411>

2.2. Surgical procedures

All operations were performed by highly experienced surgeon Ming Zhao, who has conducted total thyroidectomy on more than 3000 patients. In each surgery, parathyroid glands were preserved in situ as far as possible following the capsular principle of dissection, but excessive dissection to identify all the parathyroid glands was avoided. Moreover, autotransplant in the sternocleidomastoid muscle was performed when there were devascularized or removed parathyroid glands during operation. Central lymph node dissection refers to region VI dissection and lateral neck dissection refers to regions II, III, IV, V node dissection. The nodes relate to specific regions as follows: region II includes nodes located along the internal jugular vein from the skull base superiorly to the inferior body of hyoid bone inferiorly; region III nodes refer to nodes on the internal jugular vein from the inferior body of hyoid bone superiorly to the omohyoideus inferiorly; region IV nodes refer to nodes on the internal jugular vein from the omohyoideus superiorly to the neck root inferiorly; region V nodes refer to nodes in the posterior cervical triangle.

2.3. Biochemistry test

The parathyroid hormone (PTH) level was recorded in each patient prior to the operation, then subsequently recorded 1 day, 1 week, and 3 months after surgery. If the postoperative PTH level returned to normal within 3 months hypoparathyroidism was considered to be transient, if not, then it was permanent.

2.4. Statistical analysis

The χ^2 test, Fisher exact, or t test were used to assess these variables and all statistical analyses were performed by SPSS 13.0. A $P < 0.05$ was considered to be statistically significant.

3. Results

A total of 341 patients (66 male and 275 female) were enrolled in the final study. The mean age was 45.7 years old and 204 (59.8%) patients underwent total thyroidectomy and central lymph node dissection (level VI). The other 137 patients (40.2%) received a total thyroidectomy, central lymph node dissection, and unilateral or bilateral lateral neck dissection (levels II, III, IV, V).

Microscopic examination of postoperative specimens reported incidental parathyroidectomy existed in 35 (10.3%) cases. A total of 32 (91.4%) patients had 1 parathyroid gland excised, 3 (8.6%) patients had 2 parathyroid glands excised, none had 3 or more parathyroid glands resected. The mean size of the resected glands was 4.6 mm.

A total of 38 parathyroid glands were removed, 4 cases were resected in male patients, and 34 were in female. Parathyroid tissue from 16 (42.1%) cases was in the intrathyroidal position, defined as being completely or mostly surrounded by thyroid, 6 glands were located in central lymphatic adipose tissue, and 16 glands were located within or alongside thymus tissue.

As described in Table 1, in patients requiring additional unilateral or bilateral neck dissection, 26 (18.9%) cases had incidental parathyroidectomy; in patients without additional unilateral or bilateral neck dissection, 9 (4.4%) cases had incidental parathyroidectomy, the difference was significant ($P < 0.001$).

Moreover, in patients with incidental parathyroidectomy, 14 (40.0%) cases had transient hypoparathyroidism, in patients without incidental parathyroidectomy, One hundred one

Table 1

Risk factor analysis information.

| Factor | Incidental parathyroidectomy (n=35) | Not-incidental parathyroidectomy (n=306) | P |
|-------------------------|-------------------------------------|------------------------------------------|--------|
| Sex | | | |
| Male | 4 | 62 | |
| Female | 31 | 244 | 0.308* |
| Age (mean) | 45.6 | 45.7 | 0.946† |
| Lateral neck dissection | | | |
| Required | 26 | 111 | |
| Not required | 9 | 195 | 0.000* |
| PTH | | | |
| Transient | 14 | 101 | 0.051* |
| Permanent | 0 | 1 | 0.898* |
| Clinical hypocalcemia | | | |
| Transient | 10 | 123 | 0.186‡ |
| Permanent | 0 | 1 | 0.898* |

PTH=parathyroid hormone.

* Fisher exact test.

† Student t test.

‡ χ^2 test.

(33.0%) cases had transient hypoparathyroidism, the difference was not significant ($P=0.051$).

No other factors including age, sex, and postoperative symptomatic hypocalcemia were significantly associated with incidental parathyroidectomy (all $P > 0.05$).

4. Discussion

Previous studies have evaluated the incidence of unintended parathyroidectomy in thyroid surgery, but almost all the research focused on different thyroid procedures such as total, near-total, subtotal, lobe, and partial thyroidectomies.^[4–6] To the best of our knowledge, only 1 study has assessed this issue in total thyroidectomy. Manouras et al^[4] reported that incidental thyroidectomy occurred in 100 (19.7%) of the 508 patients undergoing total thyroidectomy, which seemed to be consistent with the finding in current study, however, taking the fact that less than 30% patients in the above-mentioned study received central neck dissection into consideration, it could be concluded that the incidental parathyroidectomy rate in our study was much lower. It may have been achieved by careful dissection using the capsular separating technique and the fact that all the operations were performed by a highly experienced surgeon.

The mean size of excised parathyroid tissue in the current study was 4.6 mm and this finding was consistent with that reported by Sasson et al^[5] and Lee et al.^[6] However, previous authors described the average diameter of a normal parathyroid gland to be about 6 mm.^[7,8] The finding might suggest that a smaller parathyroid gland was more likely to be resected, and also that only a portion of a parathyroid gland was inclined to be removed.

Numerous studies have located the resected parathyroid gland.^[4–6,9,10] Although they varied in classification method, all the excised glands could be divided into intrathyroid (parathyroid tissue completely contained within the thyroid capsular or completely surrounded by thyroid tissue) or not. The finding that as high as 42.1% of our resected glands were situated intrathyroidly shocked us and it was contrary to most previous reports.^[4–6,9,10] In fact, careful and discreet dissection was required in every thyroid surgery. Further analysis revealed that the incidence of resected parathyroid completely surrounded by

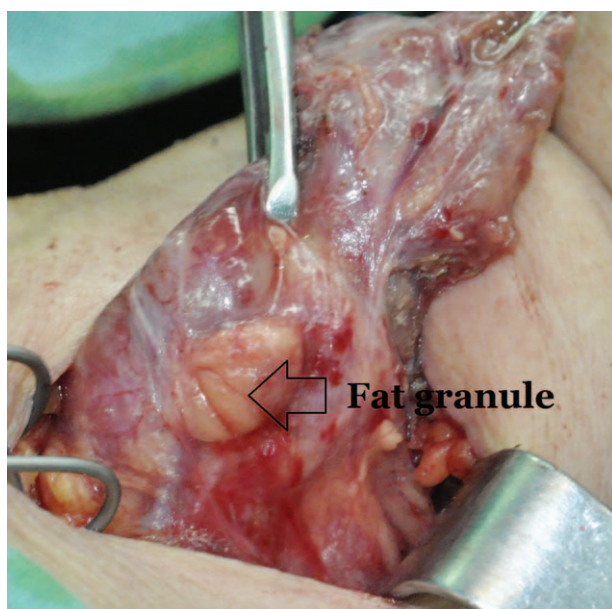


Figure 1. Fat granule out of thyroid capsular.

thyroid tissue was relatively low, and the majority of resected parathyroid tissue in intrathyroid actually existed along with the thyroid gland. This is supported by autopsy research that reported only 0.2% of parathyroid glands are located intrathyroidally (parathyroid tissue completely surrounded by thyroid tissue).

Most previous studies reported that excised parathyroid tissue outside the thyroid was not common. Manouras et al^[4] described 34 (32%) of 106 parathyroid glands were located extracapsularly, defined as lying outside the thyroid capsular. However, the author did not give more detailed positioning information. Even Lee et al^[6] described the incidence of parathyroid tissue outside the thyroid to be just 5%. However, in our study, it was noted that as high as 58% of the glands were located outside the thyroid. Several reasons would account for this discrepancy. During 1 operation, we found that a small but significant number of parathyroid glands were completely surrounded by fat tissue (Figs. 1 and 2; unpublished data), they were at great potential risk of being resected. Furthermore, we note quite a few parathyroid glands situated along with the thymus (Fig. 3), and in former central neck dissection procedure, the thymus was always defined as the inferior bound of region VI node dissection. Therefore, future operations should pay more attention to the preservation of the parathyroid gland when node dissection is close to the thymus.

Hypocalcemia was common following thyroid surgery. In the current study, transient symptomatic hypocalcemia occurred in 133 (39%) patients, and only 1 (0.3%) patient had permanent symptomatic hypocalcemia. The finding was consistent with previous reports.^[7,11] Moreover, we found incidental parathyroidectomy did not increase the risk of symptomatic hypocalcemia. Similarly, Sasson et al^[5] described 1 (5%) of 21 patients with incidental parathyroidectomy and 8 (7%) of 120 patients without incidental parathyroidectomy had transient symptomatic hypocalcemia, respectively; the difference was not significant ($P=0.99$). A possible explanation for this was that most cases had only 1 parathyroid gland resected and a single normal parathyroid gland was enough to meet physiological needs.

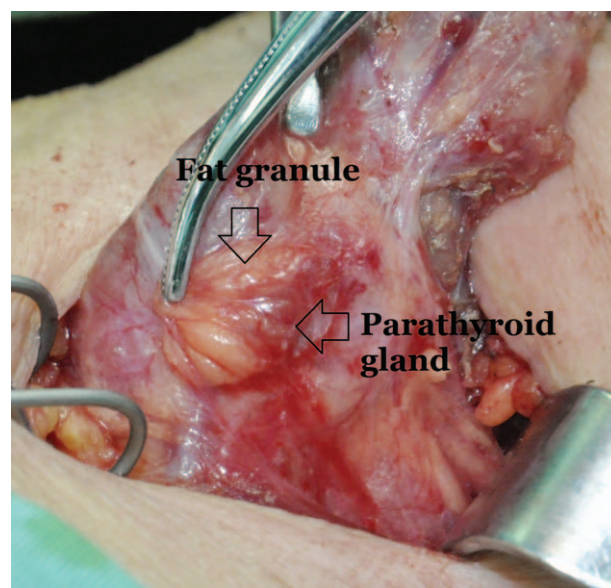


Figure 2. Parathyroid gland is noted to exist in the fat granule after careful dissection.

Few authors investigated how incidental parathyroidectomy affects parathyroid hormone.^[12] We were the first to report this issue. Our study suggests that incidental parathyroidectomy tends to cause transient hypoparathyroidism. However, it was difficult to determine if it was caused by unintentional excision of parathyroid gland or inadequate blood flow to the reserved parathyroid tissue. More studies are needed to provide clarification.

Many researchers have aimed to identify potential risk factors associated with incidental parathyroidectomy. Youssef et al^[13] found concomitant central neck dissection and reoperation for recurrent goitre sustained as risk factors of incidental parathyroidectomy through multivariate analysis. And Sippel et al^[14] reported younger age, malignant pathology, and bilateral thyroid resection existed as risk factors of inadvertent parathyroid resection. In the current study, we discovered that lateral cervical lymph node dissection would significantly increase the risk of incidental parathyroidectomy. Node metastasis in the lateral cervical region might mean more radical node metastasis in the

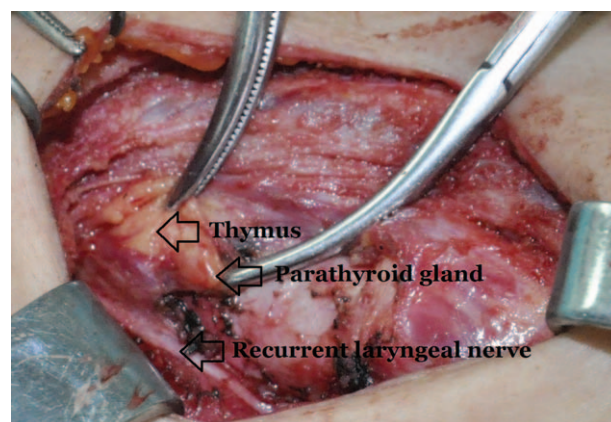


Figure 3. Parathyroid gland is noted to exist within the thymus.

central region, making it more difficult to identify and preserve parathyroid glands.

In summary, incidental parathyroidectomy in total thyroidectomy is relatively low, the majority of the resected parathyroid tissue is situated outside the thyroid, and more attention should be paid to preserving the parathyroid gland when node dissection is close to the thymus. Incidental parathyroidectomy seems to have little effect on the expression of parathyroid hormone and is significantly associated with lateral cervical lymph node dissection.

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