Intrathyroid Parathyroid Adenoma: Incidence and Location—The Case against Thyroid Lobectomy

Arnold Goodman, MD, Doug Politz, MD, Jose Lopez, MD, and James Norman, MD

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Abstract

Objective. It has been taught that a missing parathyroid adenoma can be within the thyroid. Therefore, thyroid lobectomy is appropriate when an adenoma cannot be found. Unfortunately, this technique is often futile. The purpose of this study is to examine the frequency of unsuccessful thyroid lobectomy in parathyroid surgery and to look at the true incidence and location of intrathyroid parathyroid adenomas (iT-PAs).

Study Design. A retrospective chart review of 11,163 patients undergoing parathyroid surgery identifying the location of more than 40,000 parathyroid glands.

Setting. A tertiary care center specializing in parathyroid surgery.

Subjects and Methods. A total of 1163 reoperations for persistent primary hyperparathyroidism (PHPT) were examined for the incidence and outcomes of thyroid lobectomy performed to find iT-PA. A second study examined 10,000 patients undergoing first-time parathyroidectomy to classify the location and incidence of iT-PA.

Results. Thyroid lobectomy had been previously unsuccessfully performed in 77% cases of PHPT undergoing reoperation. Two or fewer glands were found in 82% prior to lobectomy. The adenoma was subsequently found on the lobectomy side in 64% and on the opposite side in 36%. True iT-PA occurred in only 0.7% of 10,000 primary cases. Another 1.2% were closely adherent to or partially within the thyroid substance. The most common location was the lower lateral quadrant of the thyroid.

Conclusion. The incidence of true iT-PA is less than 1%, occurring in predictable locations. Thyroid lobectomy for a missing parathyroid adenoma is typically unsuccessful and should only rarely, if ever, be performed.

Keywords
parathyroid, parathyroidectomy, intrathyroid parathyroid, parathyroid surgery, thyroid, thyroidectomy

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B ased on embryologic development, the ectopic locations of abnormal parathyroid glands at surgery for hyperparathyroidism are well known, and the entity of intrathyroid parathyroid adenoma (iT-PA) is well described in the literature.1-4 The exact origin and incidence of intrathyroid parathyroid glands remain controversial, however. The superior parathyroid glands originate from the epithelium of the dorsal portion of the fourth pharyngeal pouch and attach themselves to the dorsal surface of the thyroid.5 It has been suggested that the primordium of the superior parathyroid gland may become trapped within the thyroid as the lateral and medial lobes fuse, resulting in an intrathyroidal superior parathyroid gland.6,7 The inferior parathyroid glands, which originate from the epithelium of the dorsal portion of the third pharyngeal pouch, are pulled by the thymus during its descent, explaining its typical association with the thymus; however, the inferior glands could presumably become trapped by the same mechanism as the superior glands and become intrathyroidal as well.1

The incidence of iT-PAs has been reported from a low of 1.3% to a high of 6.7%.1,6-10 Some authors believe that intrathyroid parathyroid tumors are mainly superior parathyroid glands,4 whereas others believe the intrathyroid lesions mainly involve the inferior parathyroid glands.2,11 It is commonly taught that when performing a parathyroid exploration, if a missing gland cannot be found, it may lie in an intrathyroid location and performing a thyroid lobectomy is appropriate.

In this study, 2 groups of operative patients are examined. The first examines the incidence and outcome of thyroid lobectomy in a large series of reoperations for patients

1Norman Parathyroid Center, Wesley Chapel-Tampa, Florida, USA

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Corresponding Author:
Arnold Goodman, MD, Norman Parathyroid Center, 2400 Cypress Glen Drive, Wesley Chapel-Tampa, FL 33544
Email: agoodman@parathyroid.com
with persistent primary hyperparathyroidism (PHPT) who have failed at least 1 prior surgery. In a second series, the incidence and location of intrathyroid parathyroid glands (normal and adenoma) are examined in patients undergoing first-time parathyroid surgery. Based on this information, the conventional wisdom of performing a thyroid lobectomy when the missing gland cannot be found is called into question and we believe should rarely, if ever, be performed.

Methods

The medical records of 11,163 patients operated on at the Norman Parathyroid Center for PHPT during a 9-year period ending in July 2009 were examined. All data were collected in a nonidentifiable fashion in accordance with the principles outlined in the Declaration of Helsinki\textsuperscript{12} and approved by our Institutional Review Board at Tampa General Hospital. Two subgroups of patients were examined, the first consisting of 10,000 patients who were undergoing their first parathyroid operation and were cured of their disease by the removal of 1 or more abnormal parathyroid glands. Tumors found at surgery were proven by measurement of hormone production from each gland as previously described\textsuperscript{13-16} and established as diseased glands by histology. To be included, the laboratory values indicating PHPT must have been reversed and normal values reestablished postoperatively indicating cure. Postoperative labs were obtained in the recovery room, at 1 month and yearly as described by our team recently.\textsuperscript{12} Mean follow-up is 3.2 years. Patients with secondary (renal) HPT or tertiary (post-transplant) HPT were not included.

The incidence and location of intrathyroid parathyroid glands (normal and adenomas) in these 10,000 patients undergoing their first operation were noted. The locations of more than 40,000 parathyroid glands were mapped with respect to their relationship to the thyroid gland. An important distinction is made between true intrathyroid adenomas and glands that were beneath the thyroid capsule or partially within the thyroid gland, and the locations were noted as such. Thyroid lobectomy for a missing parathyroid tumor is not a part of our surgical protocol and was never performed. Instead, a thyroidotomy (as discussed below) is performed over the lower one-third of the thyroid and only when a lower gland is missing, the ipsilateral thymus is examined and removed, and 3 other glands have been found.

A second group of 1163 patients underwent reoperation for persistent PHPT during this same period, and as with the previous group, they were included in this analysis only if cured biochemically after removal of 1 or more parathyroid tumors. Each patient had at least 1 (range, 1-5; mean, 1.3; mode, 1) unsuccessful parathyroid surgery performed at another center prior to referral to our center. The incidence of thyroid lobectomy during the initial or subsequent unsuccessful surgeries was examined. The number and location of glands identified prior to lobectomy and side of the thyroid lobectomy were determined from review of prior operative reports and pathology reports. Operative findings and location of the previously unfound parathyroid adenoma(s) were noted.

Results

Among the 10,000 first-time parathyroid operations for primary HPT, a true iT-PA was found in 72 cases, for an incidence of 0.7% (Figure 1; type III). In another 120 cases, or 1.2%, the abnormal gland was found subcapsular and partially within the thyroid substance but visible with careful dissection along the thyroid capsule (Figure 1; type II). An additional 238 (2.4%) parathyroid glands were found just under the thin loose tissues surrounding the thyroid but completely outside of the substance of the thyroid (Figure 1; type I) and therefore were not classified as true iT-PAs. Importantly, these glands are adherent to the surface of the thyroid but in no way contained within the thyroid.

Figure 2 shows the location of the true intrathyroid adenoma (type III), illustrating that 63 (90%) occurred within the lower lateral quadrant of the thyroid. In 5 cases (7%), the iT-PA was found near the recurrent nerve in the posterior (dorsal) region of the middle part of the thyroid gland and in 2 cases (3%) within the upper pole. All but 2 of the parathyroid adenomas found within the lower/lateral aspect of the thyroid lobe (Figure 2; type III) were lower parathyroid glands (proven by location of the other ipsilateral gland). All of the intrathyroid adenomas located at the upper pole of the thyroid or in the middle/dorsal aspect were upper parathyroid glands. Thus, 85% of iT-PAs were lower parathyroid glands.

In our series of 1163 reoperations for unsuccessful parathyroid surgery, thyroid lobectomy had been previously performed in 895 cases (77%). A thyroid lobectomy was performed as part of the first failed operation in 71%, occurring in another 6% during a second or subsequent unsuccessful operation. Per the operative and pathology reports, 2 or fewer glands were found prior to performing the lobectomy in 733 of these cases, or 82%. In 455 (39%) of all cases,
1 or more parathyroid glands were missing from both sides of the neck prior to thyroid lobectomy. In 21 cases, zero parathyroid glands were found prior to thyroid lobectomy for the stated purpose of finding an iT-PA. At reoperation, the adenoma that was causing the HPT was found on the side of the prior lobectomy in 572 cases, or 64%. The adenoma was found on the opposite of the prior lobectomy in 322 cases, or 36%. The missing adenoma(s) was found in the neck in 99.5%. Just less than 0.4% were undescended, located below the angle of the jaw, with another 6% located in the thymus, which was removed via a neck incision. Only 5 were ectopically located within the chest requiring an anterior thoracotomy for removal. The overwhelming majority were located in positions that would be considered normal and/or routine.

Discussion

IT-PAs are well described in the literature, but various authors have reported a wide range of incidence, ranging from 1.3% to 6.7%.\textsuperscript{1,6-10} These findings are used as a justification for the conventional (historical) teaching that in the course of surgical exploration for parathyroid adenoma, if a missing gland cannot be found, it may lie in an intrathyroid location, and it is reasonable to perform a thyroid lobectomy in hope of removing the abnormal gland. We are careful to make the distinction between 3 different presentations of parathyroid glands that can all be confused with iT-PA, as shown in Figure 1. The incidence of true iT-PA in this series of 10,000 patients is lower than previously reported at 0.7% but increases to 1.9% when tumors located partially intrathyroid (type II) are included.

Those that are not within the substance of the thyroid should not be confused as iT-PA, but they can be difficult to appreciate when they are normal glands. When an adenoma is present as a type I gland (adherent to the thyroid, but not within its capsule), it is usually quite easy to identify if the loose areolar tissues are teased off the surface of the thyroid. When a normal gland is in this location, however, it can be more difficult to appreciate. In previously reported series, this distinction is usually not made clear.\textsuperscript{18} Proye et al\textsuperscript{10} reported that 34 of 47 histologically proven intrathyroid parathyroid glands were visible at the surface of the thyroid gland, which we would consider type I (not true intrathyroid) or type II IT-PA. Five were felt on palpation and 8 discovered during examination of the lobectomy specimen, both of which we would consider type III. Feliciano\textsuperscript{1} reported an iT-PA rate of 4% and noted that in no patient was there obvious parathyroid tissue visualized prior to partial, subtotal, or total thyroid lobectomy. Our data on a much larger series of patients do not support such a high rate of true iT-PA.

There has been considerable debate regarding whether intrathyroid parathyroids originate from the superior or inferior glands. Akerstrom et al\textsuperscript{4} felt that intrathyroid parathyroid glands were more likely to be found at the superior pole based on a small series. Other authors have held the view that the intrathyroid parathyroids originate from the inferior glands. Proye et al\textsuperscript{10} found that in 43 of 47 cases (91%), the abnormal gland was an inferior parathyroid. Figure 2 demonstrates the location of IT-PA found in our series and clearly supports the idea that the vast majority (90%) of intrathyroid parathyroids are found in the lower lateral quadrant of the thyroid consistent with inferior glands. However, when the location of the ipsilateral gland is taken into consideration, we found that just more than 85% of all IT-PAs were lower parathyroid glands. Only a small percentage were found near the recurrent nerve or within the superior pole, and all of these were upper glands.

Examination of the results of our 1163 reoperative cases reveals a telling picture of the actual utilization of thyroid lobectomy in the surgical management of PHPT. It is impossible to know how many thyroid lobectomies were successfully performed to cure PHPT. However, in our series of cases with persistent disease, 77% of the cases had thyroid lobectomy performed with the justification of possible iT-PA. This is in contrast to our practice, in which thyroid lobectomy is never used for this purpose.

\begin{figure}
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\caption{Location of intrathyroid parathyroid glands in 10,000 patients. Intrathyroid parathyroids occur in predictable locations within the thyroid gland, with the vast majority occurring in the lower lateral quadrant and a small percentage near the recurrent nerve and superior pole.}
\end{figure}
The fact that 2 or fewer glands were found in 82% of the cases prior to making the decision to proceed with thyroid lobectomy suggests that lobectomy has become a last-ditch effort prior to wound closure. In 39%, the surgeon was unable to find 1 or more parathyroid glands on both sides of the neck, and thus the thyroid lobe that was removed was chosen by random. In many cases, the surgeon acknowledges the randomness of this decision in the operative report. In almost 2%, zero parathyroid glands were found prior to performing a thyroid lobectomy in a randomly chosen fashion.

The parathyroid adenoma was subsequently found on the side of the previous lobectomy in 64% of the cases and on the opposite side in 36% of cases. These data would indicate that thyroid lobectomy is all too often performed indiscriminately and prematurely, without regard to identification of the remaining gland and relevant anatomy.

This large study would indicate that iT-PAs do not occur nearly as frequently as many surgeons think. When they do occur, they are found in very predictable locations, as seen in Figure 2. We feel that the missing gland is almost always identifiable with meticulous dissection of the thyroid capsule, particularly along the inferior lobe, as shown in Figure 2. Our practice has been to perform a thyroidotomy (or several) over the lower one-fourth of the thyroid lobe and even convert this to a partial thyroid lobectomy, removing the lower one-third of the thyroid if necessary. This would be done only if 3 glands had already been found, the missing gland was a lower gland, and the ipsilateral thymus had been examined and/or removed.

Based on the locations of iT-PA, and from reviewing the surgical processes undertaken in more than 1100 failed parathyroidectomy operations, we would suggest that it is imperative that the surgeon find as many parathyroid glands as possible, refraining from removing them until the others are found. Knowing which gland is missing is paramount to the subsequent maneuvers aimed at finding the missing adenoma, which can almost always be found without thyroid lobectomy.

Conclusion

The incidence of true intraparenchymal iT-PA is rare, occurring in less than 1% of cases. Another 1.2% of parathyroid adenomas are found beneath the thyroid capsule and partially within the thyroid substance but still visualized with careful dissection along the thyroid capsule since part of the gland is extrathyroid. Intrathyroid parathyroids occur in predictable locations, with the vast majority, 90%, occurring in the lower lateral quadrant of the thyroid, 7% near the recurrent nerve, and only 3% in the superior pole. In surgical practice, thyroid lobectomy, justified by historical teaching, in search for an intrathyroid parathyroid is often performed indiscriminately and is typically unsuccessful. Armed with appropriate anatomic information, the missing gland can be found by careful dissection of the loose tissue surrounding the thyroid, thyroidotomy, or meticulous exploration of the lateral inferior lobe. Thyroid lobectomy for a missing parathyroid adenoma should only rarely be performed.

Author Contributions

Arnold Goodman, corresponding author, data acquisition and analysis, drafting article, final approval; Doug Politz, study design, data acquisition, interpretation of data, revision of content, final approval; Jose Lopez, data acquisition and interpretation, critical review and revision, final approval; James Norman, study design, data acquisition and interpretation, drafting and revision, final approval.

Disclosures

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References


