Case Report

Subcutaneous implantation of thyroid carcinoma and benign tissue after thyroidectomy: report on two cases and review of the current literature

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Background: Subcutaneous implantation of thyroid tissue after thyroidectomy is a rare occurrence involving both benign and malignant thyroid tissue. Clinically, subcutaneous implantation of thyroid tissue can be challenging to diagnose. We present two cases of subcutaneous implantation of thyroid tissue following thyroidectomy and discuss the differential diagnosis, clinicopathological characteristics, and the possible mechanism of implantation.

Case Description: A 35-year-old woman (age in 2009) who underwent total thyroidectomy in 2009 whose histopathological examination revealed a nodular hyperplasia and lymphocytic thyroiditis complained of palpable mass in her neck 10 years after operation and underwent excision. Follicular adenoma was confirmed in histopathological results. A 58-year-old woman (age in 2010) who underwent lobectomy in 2010 for nodular hyperplasia had a 6 cm sized huge mass in her anterior neck 9 years after operation. Anterior neck mass excision was done and poorly differentiated carcinoma was confirmed in histopathological results. The patient showed no sign of recurrence after 3 years follow-up.

Conclusions: Subcutaneous implantation of benign thyroid tissue or thyroid cancer can occur after thyroidectomy. Minimizing the likelihood of subcutaneous implantation requires careful consideration of various factors at every stage of the surgical procedure. Surgeons should be aware of this potential long-term complication that can occur in both conventional thyroidectomy and remote access surgery, effectively communicate and provide appropriate guidance to their patients, and try to avoid seeding of both malignant and benign thyroid tissue.

Keywords: Subcutaneous implantation; thyroid cancer; benign thyroid tissue; thyroidectomy; case report

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Introduction

Subcutaneous implantation of thyroid tissue following thyroidectomy is an infrequent complication that may involve either benign or malignant thyroid tissue. Although there have been occasional reports of needle-tract implantation of thyroid tissue after fine needle aspiration biopsy (FNAB), the overall prevalence of this phenomenon remains low (1-4). In contrast with the implantation observed after FNAB, the majority of cases documented after thyroid surgery involve benign thyroid tissue (5-8). Nevertheless, there have been a few reported instances of recurrent thyroid carcinoma in cervical soft tissue following

thyroidectomy (5,9-11).

In this case report, we aim to highlight two distinct cases of subcutaneous implantation of thyroid tissue after conventional thyroidectomy: one case involving benign thyroid tissue and another featuring thyroid carcinoma. By examining these cases, we hope to contribute valuable insights to the understanding and management of this rare postoperative complication. We present the both cases in accordance with the CARE reporting checklist (available at https://gs.amegroups.com/article/view/10.21037/gs-23-191/rc).

Case presentation

Case 1

A 35-year-old woman underwent total thyroidectomy due to a multinodular goiter in 2009. In operation findings, there was no capsular or strap muscle invasion, no lymph node hypertrophy was observed. The thyroid gland was completed removed without any intraoperative complications. The final histopathological examination confirmed nodular hyperplasia in both lobes (*Figure 1A*). One year after surgery, follow-up ultrasonography showed no suspicious or specific findings of recurrence.

In 2012, while maintaining thyroid hormone replacement therapy, the patient was admitted to hospital due to a palpable enlarging nodule on the left side of her neck. A neck mass excision was performed under local anesthesia. The palpable nodule was identified in the soft tissue in the middle of the left sternocleidomastoid (SCM) muscle, and histopathological examination confirmed a 1.5 cm thyroid nodular hyperplasia (*Figure 1B*).

In 2019, 10 years after her first operation, the patient complained of a palpable mass on the right side of her neck and underwent ultrasonography. A complex-echoic nodule of about 3.2 cm at right cervical level III was observed in the soft tissue (*Figure 2A*). A core needle biopsy was performed on this nodule, and a bland thyroid follicular epithelium was identified. Thyroid computed tomography (CT) revealed a nodule in the soft tissue in front of the right SCM muscle (*Figure 2B*). The patient underwent excision of the neck lump, and a nodule in the soft tissue between the right platysma muscle and the SCM muscle was confirmed. Histopathological examination confirmed the nodule to be a 3.0 cm multiple follicular adenoma (*Figure 2C*). Since then, no recurrence of the neck nodule has been observed during follow-up over 2 years.

Case 2

In 2010, a 58-year-old woman with hypertension and diabetes presented to the hospital due to a palpable mass on the right side of her neck. A 4.3 cm right thyroid mass was observed, and an FNAB confirmed that it was benign follicular nodule. The patient underwent conventional open lobectomy without central lymph node dissection. Intraoperative complications such as tumor rupture did not occur. In gross description, the mass showed a mixed appearance consisting of cystic and solid portions and nodular hyperplasia was confirmed through histopathological examination (*Figure 3*).

In 2019, after 9 years without follow-up, the patient returned to the hospital with a suddenly enlarged palpable mass in her neck. Neck ultrasonography revealed a 6 cm lobulated complex-echoic nodule in the anterior portion of the neck beneath the skin (*Figure 4A*). Neck CT revealed an irregular enhancing mass extending from the anterior lower neck to the left thyroid lobe, and a malignant tumor was suspected (*Figure 4B*). However, an FNAB confirmed a benign follicular nodule with a high abundance of follicle cells.

The patient underwent neck mass exploration and excision. The mass was found in the soft tissue anterior to the strap muscle, and there was adhesion between the left SCM muscle and the mass. Histopathological examination

Highlight box

Key findings

- Our report describes rare cases of subcutaneous implantation of benign thyroid tissue and thyroid cancer following thyroidectomy.

What is known and what is new?

- Although the occurrence of needle tract implantation of thyroid tissue is occasionally reported after fine needle aspiration biopsy (FNAB), it is less likely to happen following conventional thyroidectomy compared to FNAB.
- This case report presents two cases of subcutaneous implantation of thyroid tissue after conventional thyroidectomy, one involving benign thyroid tissue and the other demonstrating the presence of poorly differentiated thyroid carcinoma.

What is the implication, and what should change now?

- Careful consideration of various factors during thyroid surgery is necessary to minimize the likelihood of subcutaneous implantation. Long-term postoperative evaluation and follow-up of patients are crucial to prevent overlooking this potential complication.

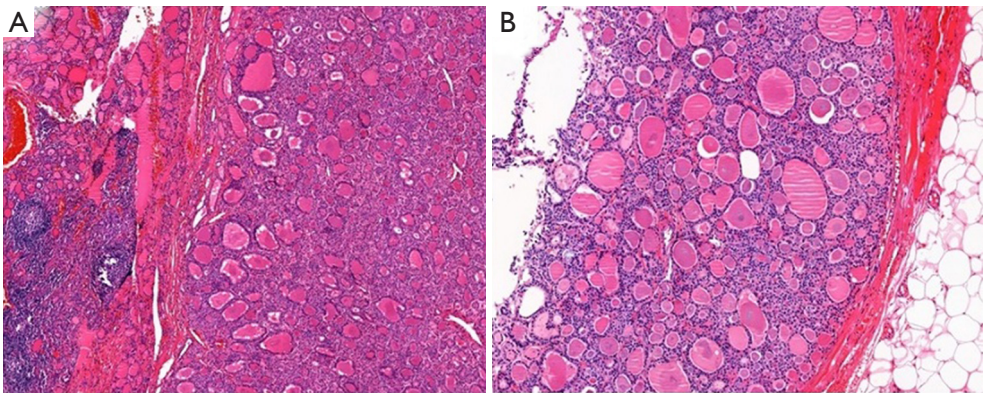

Figure 1 Histopathological examination in Case 1 (hematoxylin and eosin stain, scanning view). (A) Examination showing thyroid nodular hyperplasia at the time of the patient's first surgery [2009] (magnification: ×10); (B) a palpable subcutaneous implanted nodule presenting diagnosed as thyroid nodular hyperplasia at the time of the second surgery [2012] (magnification: ×20).

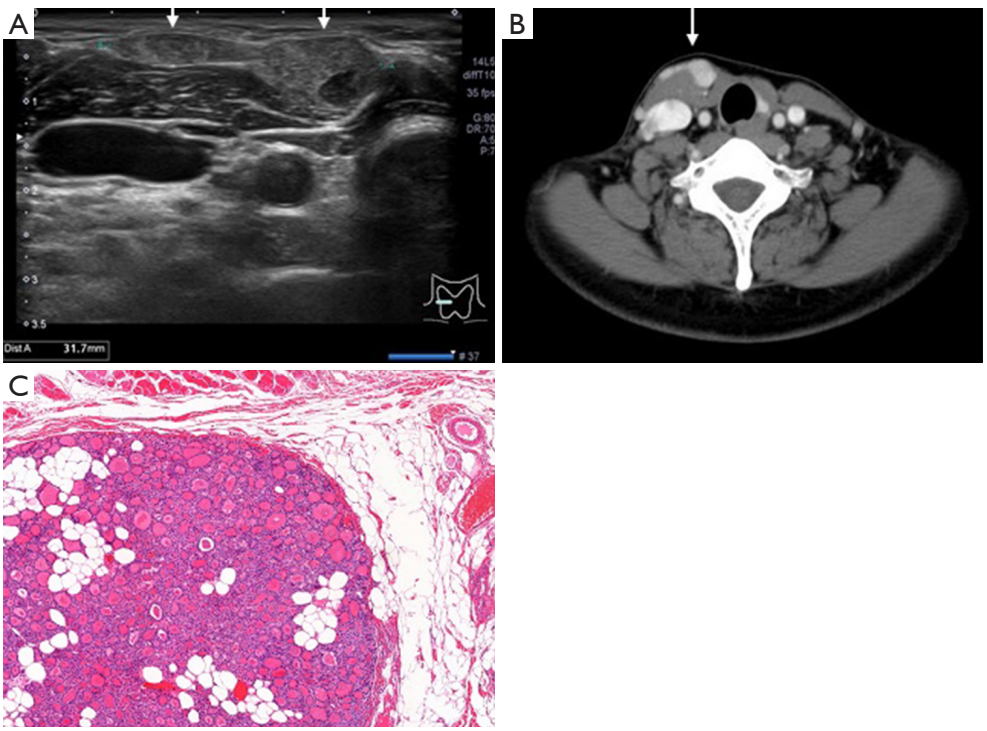

Figure 2 Ultrasonography (A) and computed tomography (B) showing a subcutaneously implanted mass on the right side of patient's neck (white arrows); (C) histopathological examination showing follicular adenoma at the time of the third surgery (2019, hematoxylin and eosin stain, scanning view, magnification: ×10).

after TTF-1, PAX8, and thyroglobulin immunostaining confirmed a poorly differentiated thyroid carcinoma (*Figure 4C*). Postoperatively, the patient underwent thyroid ultrasonography, CT, and bone scan follow-up examinations every 6 months. Follow-up for 3 years until 2022, no evidence of recurrence has been observed.

Ethical statement

All procedures performed in this study were in accordance

with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). The study was approved by the Institutional Review Board (IRB) of the Uijeongbu St. Mary's Hospital (No. UC22ZISE0148). Written informed consent was obtained from the patients for publication of this case report and accompanying images. A copy of the written consent is available for review by the editorial office of this journal.

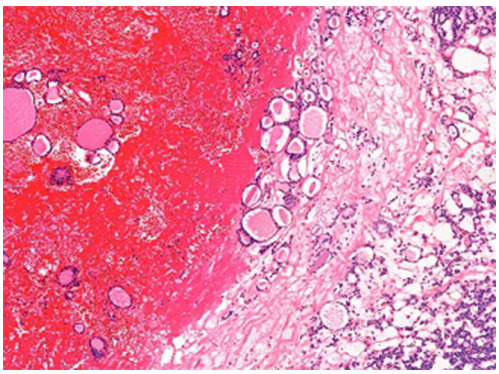

Figure 3 Histopathological preparations in Case 2 showing thyroid nodular hyperplasia at the time of the patient's first surgery (2010, hematoxylin and eosin stain, scanning view, magnification: ×20).

Discussion

Thyroid tissue found in extrathyroidal areas requires a precise diagnosis. Possible diagnoses include implantation caused by FNAB or surgery, lymph node metastases of thyroid carcinoma, true ectopic thyroid tissue, and detached thyroid nodules (5,12). There are several case reports of FNAB-induced differentiated thyroid carcinoma and anaplastic carcinoma implantation (3). Ito *et al.* compared the characteristics of the main tumors and implanted tumors of patients who had FNAB implantations. The authors encountered seven cases of needle-tract implantation, suggesting an estimated incidence rate of 0.14% (13). Most implanted tissues were located along the path of the needle. There have been no reports of thyroid tissue implantation after FNAB for benign thyroid lesions. Compared with

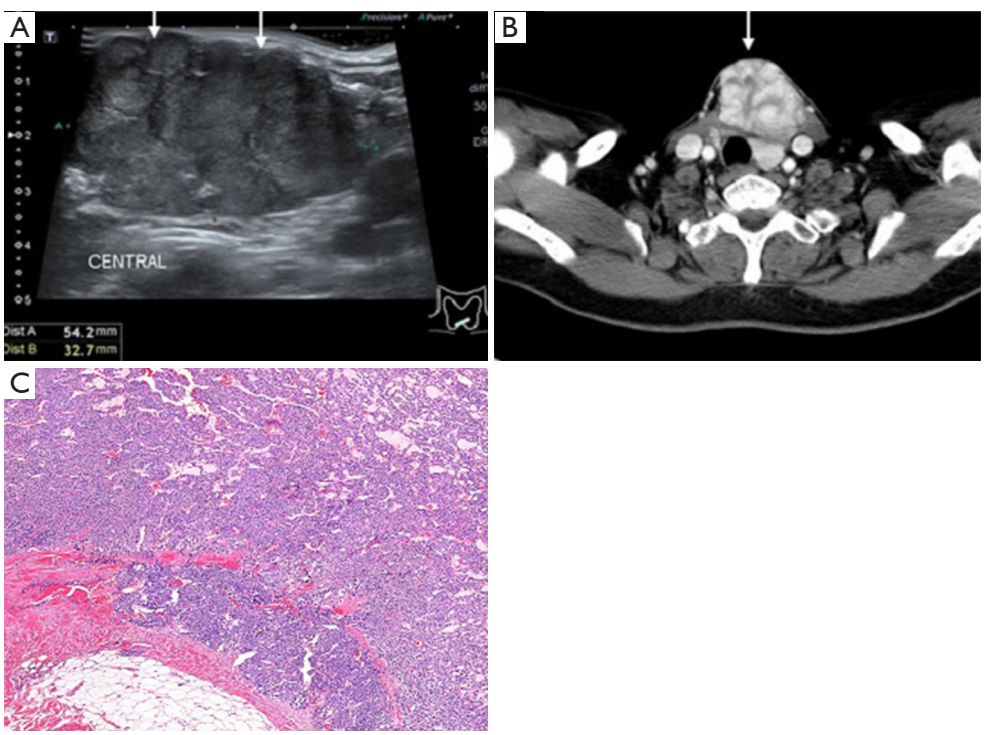

Figure 4 Ultrasonography (A) and computed tomography (B) showing subcutaneous implantation of thyroid tissue (approximately 6 cm in diameter) in the anterior neck 9 years after the second patient's first surgery (white arrows); (C) histopathological findings of poorly differentiated carcinoma at the time of the second surgery (2019, hematoxylin and eosin stain, scanning view, magnification: ×10).

FNAB, there have been fewer reported cases of implanted thyroid tissues after surgery, with most cases involving benign tissue implantation (5,13,14). However, there have been a few instances wherein papillary thyroid carcinoma was implanted after surgery (9-11). The likelihood of surgical implantation is high when tissues are discovered near a prior surgical site or when multiple nodules are observed (5). The cutting of thyroid tissue or the rupture of nodules during surgery is often considered to be the cause of implantations (5,6).

While there are no specific distinguishing criteria, postoperative implantation typically manifests as multiple subcutaneous nodules located within the previous operating field, exhibiting histological resemblance to the previously resected intrathyroid tumors. However, ectopic thyroid tissue typically develops around the normal thyroid gland, primarily along the midline. It is extremely rare to find ectopic thyroid tissue located laterally to the midline (15). Several case reports have documented the presence of ectopic thyroid tissue within the SCM muscle (16,17). However, the submandibular and lingual areas are the most commonly reported sites of occurrence (18-20). Detached thyroid nodules have the same histology as nodules found in the thyroid gland and are usually located deeper than those resulting from surgical implantation (14,21).

Our report summarizes two cases wherein benign thyroid tissue and thyroid carcinoma were implanted subcutaneously following previous thyroid surgery. No lymph node components were found on histopathological examination after surgery, and there were no signs of ectopic thyroid in the preoperative evaluations. The nodules were observed in the more superficial soft tissue rather than in the deep neck layer. Differentiating implantation from FNAB is more difficult. However, benign nodule implantation rarely occurs after FNAB, and the procedure does not disrupt the inner layer of the SCM muscle.

The interval range of implantation after surgery for thyroid disease varies across studies. Gao *et al.* demonstrated a wide range of intervals between surgical implantation and the initial operation, spanning from 3 months to 12 years (9). We observed two distinct cases. In Case 1, the interval between recurrence and the first operation was 3 years, followed by a second interval of 10 years. In Case 2, there was an interval of 9 years between the initial operation and recurrence. It is important to note that our patients were temporarily lost to follow up, which could have impacted the interpretation of the reported findings. Given the variability in follow-up periods and intervals reported in previous studies, as well as the small number of cases analyzed, establishing a typical implantation interval remains a challenge. Nevertheless, health providers should be aware that recurrences can occur even after 10 years.

There have been multiple instances of subcutaneous implantation of differentiated thyroid carcinoma following thyroid surgery. Gao *et al.* found that the incidence of cervical soft tissue recurrence after thyroidectomy was 0.33% in their entire cohort. The prevalence was 0.3% among patients with papillary thyroid carcinoma and 2.8% among patients with follicular thyroid carcinoma (9). Interestingly, only a limited number of reports of poorly differentiated carcinoma implantation have been documented (22). Poorly differentiated thyroid carcinoma is more likely to metastasize to regional lymph nodes, with a reported frequency of 50–85% of cases, compared with 40–75% for differentiated thyroid carcinoma (23-25). Furthermore, distant metastasis occurs at a significantly higher rate in association with poorly differentiated thyroid carcinoma than with differentiated thyroid carcinoma (26,27). In our case, it is challenging to ascertain whether the implantation, ultimately confirmed as poorly differentiated thyroid carcinoma through histopathological examination, progressed from benign follicular nodule to poorly differentiated thyroid carcinoma over several years or if it initially possessed the characteristics of poorly differentiated thyroid carcinoma at the time of diagnosis. To better comprehend the subcutaneous implantation of poorly differentiated thyroid carcinoma, a more thorough histopathological review is necessary.

In addition to conventional thyroidectomy, several studies have reported cases of thyroid tissue implantation in remote access surgery. Several studies have reported cases of benign thyroid tissue seeding occurring along the track of endoscopic trans-axillary thyroidectomy, involving the thyroid bed, soft tissue in the neck, or the anterior chest wall (6,28,29). Fregoli *et al.* recently reported the first case of benign thyroid tissue seeding occurring in the pectoralis major muscle, under the sternal bound of the SCM muscle, and a remnant in the thyroid bed, three years after robot-assisted transaxillary thyroidectomy, which is currently accepted as a safer and more feasible alternative than conventional thyroidectomy in selected patients (30).

The precise mechanisms underlying local soft tissue recurrence following thyroid surgery remain uncertain. One possible explanation is the attachment of cells via hematogenous spread. Panunzi *et al.* hypothesize that immunodeficiency caused by multiple myeloma and/or

therapy-related immune suppression might contribute to implantation (1). However, this hypothesis is not directly applicable to our cases. Additionally, several other studies have posited that high cellular proliferative activity, as a characteristic of the original nodule, may contribute to the invasive nature of implanted tissue (2,19,31). Further research is needed to better understand the mechanisms underlying local soft tissue recurrence after thyroid surgery and to develop more effective preventive and therapeutic strategies for affected patients.

In related to thyroid tissue implantation, there is an article that reviews thyroid autotransplantation (32). Levothyroxine (L-T4) replacement therapy after total thyroidectomy has its limitations, including difficulties in maintaining optimal thyroid hormone levels and potential long-term complications. Heterotopic thyroid autotransplantation has emerged as an alternative to overcome these challenges. Since 1967, animal experimentation provided early evidence supporting the viability and functionality of transplanted thyroid tissue. Subsequent human studies further confirmed that thyroid autotransplantation can maintain thyroid function, thereby offering the potential for sustained euthyroidism following thyroidectomy. However, few clinical trials reported satisfactory results and methodology was not consistent. Regarding this content, in both of our cases, there was no change in L-T4 therapy in relation to thyroid function after implantation was confirmed.

Various treatments have been reported for addressing thyroid implantation, including surgical intervention, radioiodine therapy, and thyroid hormone suppression therapy, such as levothyroxine therapy (5,6,33).

It has been suggested that subcutaneous implantation of thyroid tissue might result from the rupture of thyroid nodules during surgical procedures. To minimize the risk of implantation, it is essential to consider multiple factors throughout the treatment process. These may include employing meticulous surgical techniques, ensuring the appropriate handling and containment of tissue samples, and taking necessary precautions to prevent the dissemination of potentially viable thyroid cells. Further research is needed to identify the most effective strategies for reducing the risk of thyroid implantation, thereby improving patient outcomes and long-term prognosis.

A limitation of this study is that it had to rely on previous surgical records because the author did not perform the operation at the time. Another limitation of this study is that, in Case 2, as mentioned earlier, lies in the difficulty of determining whether the implantation, which was ultimately identified as poorly differentiated thyroid carcinoma on histopathological examination, evolved from benign nature to poorly differentiated thyroid carcinoma over a span of several years or if it initially exhibited the characteristics of poorly differentiated thyroid carcinoma at the time of diagnosis.

Conclusions

We present cases of subcutaneous implantation of benign thyroid tissue and thyroid carcinoma following conventional thyroidectomy. Although subcutaneous implantation following thyroid surgery is rare, clinicians should maintain a high index of suspicion when nodules are identified proximal to the thyroid after previous thyroid surgery. It is crucial to consider the possibility of both benign and malignant lesions in such instances. To minimize the risk of cervical soft tissue recurrence, it is essential to exercise meticulous care during surgery to prevent tumor rupture or seeding, and ensuring minimal tumor contact with the surrounding tissues. Long-term postoperative evaluation is warranted for patients in whom benign or malignant nodules were inadvertently ruptured during the procedure. This evaluation should include regular physical examinations, appropriate imaging studies, and monitoring of thyroid function and hormone levels, as well as prompt intervention when abnormalities are detected. By adopting a comprehensive approach to postoperative care, healthcare professionals can enhance patient outcomes and better manage potential complications associated with thyroid surgery.

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Footnote

Reporting Checklist: The authors have completed the CARE reporting checklist. Available at https://gs.amegroups.com/article/view/10.21037/gs-23-191/rc

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Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://gs.amegroups.com/article/view/10.21037/gs-23-191/coif). The authors

have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). The study was approved by the Institutional Review Board (IRB) of the Uijeongbu St. Mary's Hospital (No. UC22ZISE0148). Written informed consent was obtained from the patients for publication of this case report and accompanying images. A copy of the written consent is available for review by the editorial office of this journal.

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