

## Incidental scintigraphic detection of struma ovarii following total thyroidectomy for papillary thyroid cancer

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A postmenopausal female presented with an enlarging multinodular goiter. Microcalcifications within the largest thyroid nodule found by ultrasound prompted her to elect a total thyroidectomy. Histopathologic evaluation led to the diagnosis of confined papillary thyroid carcinoma (follicular variant). Elevated serum thyroglobulin levels were noted on postoperative laboratory workup, with the differential diagnosis of residual thyroid tissue, substernal extension of an adenomatoid multinodular goiter, and/or metastatic thyroid cancer. The patient then underwent thyrogen-stimulated I-131 ablation therapy, with postablation scans detecting a solitary focus of intensely increased radiotracer accumulation in the midline pelvis. Ultrasound of the pelvis revealed a corresponding right ovarian mass with mixed solid and cystic components. These combined findings were highly suggestive of struma ovarii. An exploratory laparotomy/bilateral salpingo-oophorectomy was performed, and pathologic examination confirmed a mature teratoma with predominant benign thyroid component consistent with struma ovarii.

### Introduction

Teratomas are the most common ovarian germ-cell neoplasm. They may be found in any combination of mature and immature tissues exhibiting various histological cell types. The most common of these is the mature cystic teratoma, also known as a dermoid cyst. These benign lesions typically contain mature tissues of ectodermal, mesodermal, and endodermal origins and must include well-differentiated tissues from at least two of these three germ-cell layers. Mature cystic teratomas are among the most

common ovarian masses found in children and are typically asymptomatic due to their slow growth rate. The gross appearance is characteristic, with the majority being lined with squamous-cell epithelium and filled with sebaceous material. Hair follicles, brain, teeth, and muscle tissue may all be present within the cyst (1).

In rare cases, a single germ-cell layer may predominate, creating a monodermal teratoma and taking on the appearance, and sometimes functionality of the specific histological cell type. While approximately 15% of all teratomas contain a small, nonsignificant focus of thyroid tissue, the definition of struma ovarii is an ovarian tumor with thyroid tissue occupying greater than 50% of the lesion (2). The gross appearance differs from a mature cystic teratoma, as it is often solid-cystic in architecture and may consist of a mixture of hemorrhagic, fibrotic, necrotic, and amber-colored thyroid tissues (1,3). The majority of these tumors are nonfunctional, and only 3% to 8% of patients present with hyperthyroidism. Struma ovarii is most common in an older age group, with the majority of cases occurring between ages 40 and 60 years (4). Women with struma ovarii may present with pelvic pain and/or an asymptomatic pelvic mass (3). For the majority of patients, struma ovarii is benign and carries an excellent prognosis (5).

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Struma ovarii is very uncommon, accounting for less than 3% of all mature cystic ovarian teratomas (3). Pre-operative diagnosis is difficult, because this rare tumor has no differentiating signs or symptoms (6,7). Imaging modalities such as ultrasound, CT, MRI, and scintigraphy of the pelvis can make the diagnosis when suspicion of struma ovarii exists. Even with the availability of these studies, to our knowledge only two other cases of preoperative, scintigraphically detected struma ovarii have been described in the literature.

### Case report

A 57 y/o Palauan female with a medical history of noninsulin-dependent diabetes mellitus, obesity, and exercise-induced asthma was referred to Tripler Army Medical Center (TAMC) for the evaluation of an enlarging multinodular goiter (MNG) diagnosed by ultrasound (US). As she was initially euthyroid, she was started on low-dose synthroid for thyroid-stimulating hormone (TSH) suppression; however, she reported that the MNG continued to enlarge. She began experiencing tightness in her throat, difficulty breathing, weight gain, and fatigue, prompting followup US and clinical studies that confirmed continued growth.

At TAMC, she denied compressive or hyper/hypothyroid symptoms. Although an increased incidence of thyroid cancer is observed in Pacific Island females, the patient has no other known risk factors nor a family history of thyroid cancer (8). Physical exam revealed a nontender, bilaterally enlarged thyroid gland with US findings of MNG with the largest nodule exhibiting microcalcifications. The patient was counseled on management options, including total thyroidectomy vs. watchful waiting, and elected to proceed with surgery. Pre-operative free T4 (FT4) measured 1.1ng/dL, and TSH was 1.232 uIU/mL.

Gross examination of the removed specimen revealed an enlarged gland (R lobe: 4.7x3.3x3.1 cm, L lobe: 4.8x2.7x2.6 cm, Isthmus 1.9x0.8x1.8 cm) with multiple, well-defined nodules and an area of focal peripheral calcification around the largest nodule. Histopathologic study found that the cytologic features of papillary thyroid carcinoma (nuclear clearing, grooves, nuclear enlargement, and overlap) were not uniform throughout the nodule, but focally present. The specimen was sent to the Armed Forces Institute of Pathology for expert consultation. The final diagnosis was made of a confined, 2.5-cm papillary thyroid carcinoma (follicular variant) with surrounding MNG and negative margins.

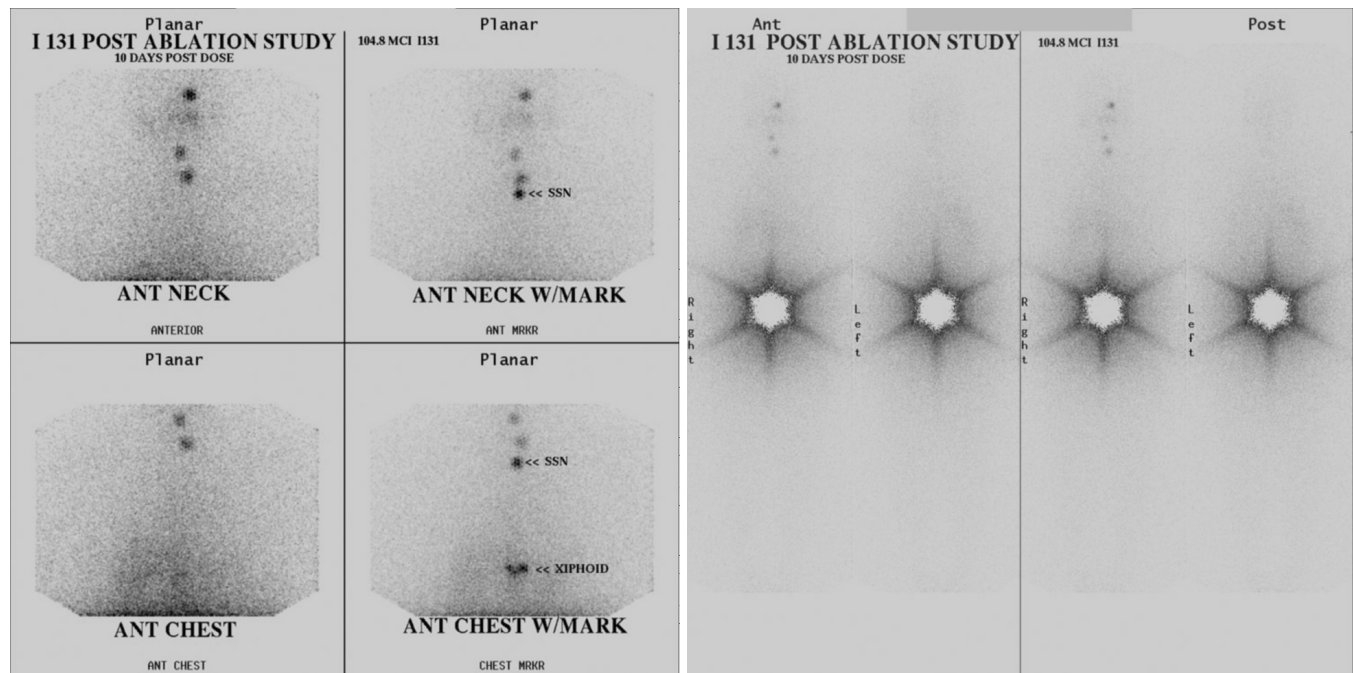


Figure 1. 57-year-old female with struma ovarii. Scintigraphic images ten days after the administration of 104.8 mCi I-131 sodium iodide demonstrate (upper) a solitary focus of intensely increased radiotracer accumulation within the midline pelvis (☒) and (lower) two small foci of radionuclide accumulation in the region of the thyroid bed (☒) with an additional third focus of mildly increased uptake present in the region of the nasopharynx/maxilla, likely representing a mucous retention cyst (☒). The intense focus located in the midline pelvis (☒), resembling a six pointed star, is referred to as “star artifact” and occurs when a high-energy radionuclide is concentrated within a small volume. (“<< SSN” and “<< XIPHOID” in the “ANT NECK W/MARK” and “ANT CHEST W/MARK” panes represent markers placed at the patient’s suprasternal notch and xiphoid process, respectively, and are used for anatomical orientation.)

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Followup lab reports showed normal FT4 (0.9 ng/dL) and TSH (1.071 uIU/mL) but an elevated thyroglobulin (Tg) level measuring 335 ng/mL. Endocrinology offered the differential diagnosis for elevated Tg level as lab error, residual thyroid tissue, substernal extension of adenomatoid MNG and/or metastatic thyroid cancer. Thyrogen (rTSH) stimulated I-131 therapy was recommended for remnant ablation. Subsequent lab results drawn prior to this therapy revealed an elevated FT4 (1.8 ng/dL), decreased TSH (0.049 uIU/mL), and an elevated but stable Tg (339 ng/mL).

The patient was admitted for thyrogen stimulation and was given a dose of 104.8 mCi I-131 sodium iodide, by mouth, two days later. In addition to residual iodine-avid tissue in the thyroid bed, postablation scans the following week revealed that within the midline pelvis, there was a solitary focus of intensely increased radiotracer accumulation with no other abnormal focal accumulations (Fig. 1). Metastatic disease vs. struma ovarii was suggested as possible etiologies, and anatomic imaging was recommended. A right ovarian mass with mixed solid and cystic components was discovered by US in the corresponding vicinity of increased radiotracer uptake (Fig. 2). These findings were highly suggestive of ectopic thyroid tissue, most likely struma ovarii. Given the patient's postmenopausal status, an exploratory laparotomy/bilateral salpingo-oophorectomy and peritoneal washings were performed.

Gross examination of the removed right ovarian mass revealed a 7.0x6.9x5.0-cm enlarged and multilobulated ovary filled with colloidal/gelatinous yellow-green material. Microscopic examination confirmed a mature teratoma with predominant benign thyroid component consistent with struma ovarii (Fig. 3). On postsurgical followup, FT4 measured 1.6 ng/mL, TSH measured 0.055 uIU/mL, and Tg and Tg antibody levels were undetectable. Full TSH suppression was not recommended, given the low risk for recurrence in this patient. Tg levels would be used as a marker of residual thyroid tissue, but aggressive thyroid cancer followup scanning was not advised given her low risk status. The patient was restarted on levothyroxine with a target TSH of 0.2-2.5 uIU/mL and has returned to Palau for regular followup.

### Discussion

Struma ovarii (SO) remains a rare preoperative diagnosis when considering ovarian teratomas and accounts for less than 3% of confirmed lesions. Yoo et al. report that the most common presenting symptoms of SO were a palpable lower abdominal mass (23.5%), followed by lower abdominal pain (20.6%), and abnormal vaginal bleeding (8.8%). In a small minority of cases, SO can also present as ascities, hydrothorax, elevated thyroid function, and rarely thyroid tumors. However, in 41.2% of patients, no definite presenting symptoms were found (9). With only 3% to 8% of patients presenting with hyperthyroid symptoms, clinicians may be left with little suspicion of SO as an etiology (4).

In the minority of patients who are symptomatic, US is an ideal first choice for imaging, as it is readily available

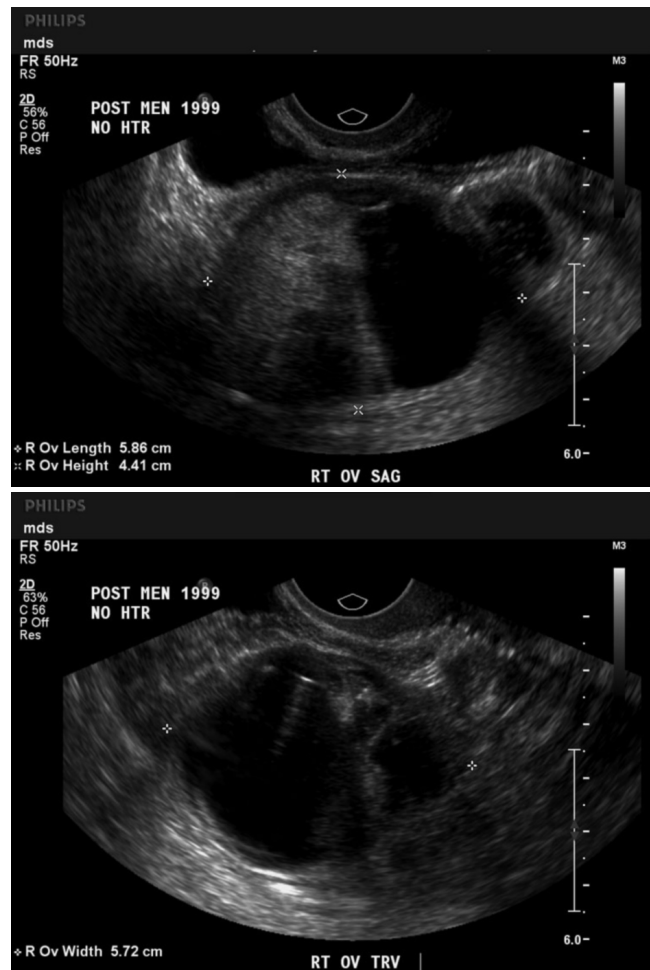


Figure 2. 57-year-old female with struma ovarii. Sagittal (upper) and transverse (lower) sonographic images of the right adenexa demonstrate a large, mixed-solid and cystic mass measuring 5.9 x 4.4 x 5.7 cm corresponding to the location of the increased radiotracer accumulation on the comparison nuclear medicine study. ("POST MEN 1999" refers to the patient becoming postmenopausal in 1999. "NO HTR" clarifies that the patient is not currently taking hormonal replacement therapy at the time of the study.)

and does not use ionizing radiation. Unfortunately, Yoo et al. found that sonographic studies were able to correctly diagnose SO in only 11.8% of patients (9). There also remains difficulty in distinguishing between SO and dermoid cysts on the basis of their sonographic appearance alone, although the characteristic findings of teeth, bone, cartilage, and fatty material within a dermoid cyst can easily be seen with CT and MRI and may aid in the separation of the two diagnoses (2,10). Diagnostic images obtained by US, CT, and MRI can be similar to those seen in ovarian cancer, especially when marked thickening of a peripheral cyst wall or septum is found (11). In addition, immature teratomas (malignant) and solid mature teratomas (benign)

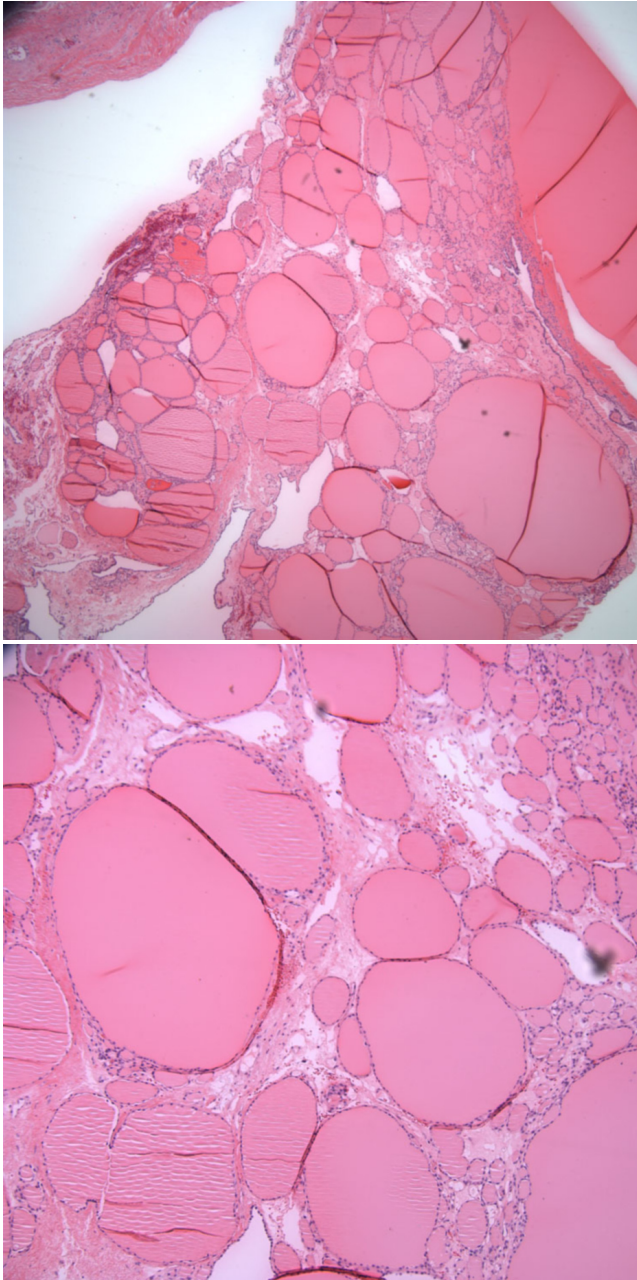


Figure 3. 57-year-old female with struma ovarii. Prepared slides from the resected ovarian mass show thyroid follicles lined by a single layer of epithelium containing amorphous colloid material.

share characteristic appearances on MR imaging that make them virtually indistinguishable (10). The often-encountered nonspecific findings and unclear nature of these ovarian masses prompt the removal of the lesion and lead to the postoperative diagnosis of SO. It is in this manner that the majority of SO cases are diagnosed.

Scintigraphic I-131 whole-body scan (WBS) can be effective in the preoperative diagnosis of SO; however, this study

is reserved for patients with potential metastatic or recurrent differentiated thyroid carcinoma after total thyroidectomy. The potential diagnostic capability of I-131 in detecting ectopic (SO) and malignant thyroid tissues was illustrated in studies by Fujie et al., reporting a sensitivity of 61% and specificity of 98% for I-131 ablation and following I-131 WBS in this patient population (12). Along with US, serial thyroid function tests, and serum Tg levels, I-131 remains a cornerstone for the surveillance of high-risk recurrent thyroid disease (13). With its restricted use, radiation exposure, limited availability, and cost, I-131 is not an appropriate screening tool for SO. However, in our patient the I-131 ablation and WBS results proved to be the critical finding that raised our suspicion and eventually led to the pathologically confirmed diagnosis of SO.

Scintigraphic Iodine-123 (I-123) WBS could represent an equally sensitive and lower-dose alternative to I-131 WBS as a potential exam for the preoperative confirmation of SO. The diagnostic indications of I-123 are identical to those of I-131. When compared with I-131, I-123's shorter half-life (13.2 hours vs. 8.04 days), lack of beta emission, and similar sensitivity make it a favorable isotope for the imaging of thyroid tissue (14). The relative disadvantages of I-123 include lower availability, variable purity, and relatively increased cost. In addition, the short half-life of I-123 prevents routine storage in some low-volume radiopharmacies, making advanced notice for imaging a necessity (14). Given the rarity of SO, the utility of scintigraphic screening is limited, but its high sensitivity makes it a viable option when pre-operative confirmation of suspected SO is desired.

Considering the paucity of symptoms, the restricted population of patients eligible for scintigraphic studies and the nonspecific anatomic imaging findings, SO remains an incidental postoperative diagnosis (6). Since its first description in 1889, fewer than 500 cases of SO have been reported (15). To our knowledge, only two other cases of an incidentally discovered SO following an I-131 whole-body scan after ablation for thyroid carcinoma have been reported in the literature by Ghander et al. and MacDonald & Armstrong (6, 16). Our patient may represent only the third time that this rare presentation and diagnosis have been reported.

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