**Hypothesis:** Surgeon-performed ultrasound (SUS) and fine-needle aspiration (FNA) may guide the management of dominant thyroid nodules of the isthmus.

**Design:** Retrospective review of prospectively collected data.

**Setting:** Tertiary academic referral center.

**Patients:** Of 942 patients who underwent preoperative SUS and FNA, followed by thyroidectomy, between January 1, 2002, and April 10, 2010, a total of 28 patients had a dominant thyroid nodule of the isthmus.

**Main Outcome Measures:** Preoperative SUS features and FNA findings and final pathologic results.

**Results:** Of 28 patients (3%) who had a dominant thyroid nodule of the isthmus, 16 had benign final pathologic results, with all having at least 2 benign SUS features and 9 having 3 benign SUS features; 15 of 16 patients had an FNA finding that was benign or indeterminate. Of 12 patients with malignant final pathologic results, 8 had 3 malignant SUS features, and all had an FNA finding that was malignant or suspicious for a malignant neo-

plasm. Among these 12 patients, final pathologic results demonstrated multifocal disease (8 patients), extracapsular invasion (4 patients), or lymph node involvement (7 patients). When 11 patients with a malignant dominant thyroid nodule of the isthmus were compared with an overall group of 270 other well-differentiated papillary thyroid carcinomas 1 cm or larger on final pathologic results, patients with isthmus nodules trended toward having higher rates of multifocal disease ($P=.08$), extracapsular invasion ($P=.09$), and lymph node involvement ($P=.09$).

**Conclusions:** Preoperative SUS features and FNA findings in patients with dominant thyroid nodules of the isthmus can accurately predict malignant or benign thyroid disease and direct the extent of thyroidectomy. For malignant isthmus nodules, total thyroidectomy and possible central node dissection are recommended owing to high rates of multifocal disease and lymph node involvement. For benign isthmus nodules, thyroid lobectomy with isthmusectomy or isthmusectomy alone may be appropriate.


**METHODS**

Different thyroid nodules of the isthmus are a rare indication for surgical resection. Although the overall frequency of isthmus nodules is uncertain, cancers arising within such nodules among all malignant thyroid nodules reportedly range from 1% to 9%. Although the American Thyroid Association and the British Thyroid Association have overall recommendations for well-differentiated thyroid cancer, no specific guidelines exist for the management of thyroid nodules confined to the isthmus. As such, the appropriate surgical treatment of dominant thyroid nodules of the isthmus remains unclear.

Current workup of a thyroid nodule often consists of preoperative ultrasonography and fine-needle aspiration (FNA). Studies have documented the efficacy of surgeon-performed ultrasound (SUS) in predicting benign and malignant disease. When combined with FNA findings, surgeons may be able to determine the proper extent of surgical treatment. Total thyroidectomy for a benign isthmus nodule may be unnecessary and result in hypothyroidism, whereas isthmusectomy alone for a malignant isthmus nodule may be inadequate for correct oncologic resection. This study examines the role of preoperative SUS and FNA in the appropriate surgical management of dominant thyroid nodules of the isthmus.

Clinical and pathologic data on 1336 consecutive patients who underwent thyroidectomy between January 1, 2002, and April 10, 2010, were collected prospectively in an institutional review board–approved database at the University of Miami Health System, Miami, Florida.

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Prospectively collected SUS features of thyroid nodules included size (height, width, and length), echogenicity (hypoechoic, isoechoic, or hyperechoic), borders (regular or irregular), calcifications (microcalcification vs coarse or none), cystic component (vs solid), shape (taller vs wider on transverse view), number of nodules (single vs multiple), and location (unilobar vs bilobar).

Within this series, 28 patients underwent surgical resection for a solitary or dominant thyroid nodule of the isthmus 1 cm or larger by preoperative SUS. Patient demographics and preoperative SUS features and FNA findings were evaluated as predictors of a malignant neoplasm and the appropriate surgical procedure in these patients.

All the patients underwent either thyroid lobectomy with isthmusectomy or total thyroidectomy with or without central node dissection. Lateral neck dissection was performed in patients when clinically evident nodal metastases were detected before surgery by physical examination or by SUS or FNA confirmation of metastatic disease.

Patients with a differentiated thyroid carcinoma 1 cm or larger on final pathologic results were then subdivided into 2 groups based on the location of their primary tumor. The first group had a dominant thyroid nodule of the isthmus (11 patients), and the second group had 1 or more dominant nodules elsewhere in the thyroid gland (270 patients).

Statistical analysis was performed using commercially available software (SPSS 18.0; IBM Co) to compare rates of multifocal disease, extracapsular invasion, and lymph node involvement between groups. *P < .05 was considered statistically significant.

### RESULTS

Of 942 patients with no history of thyroid cancer who underwent thyroidectomy in this series, 28 patients (3%) underwent surgical treatment of a dominant thyroid nodule of the isthmus 1 cm or larger by preoperative SUS. The mean age of the 28 patients was 50 years. The mean nodule size by preoperative SUS was 2.3 cm. On final pathologic results, 16 nodules were benign, and 12 nodules were malignant (43%). Characteristics of the benign and malignant groups are given in the Table.

Of 16 patients with benign disease on final pathologic results, the indications for surgical resection were an enlarging thyroid nodule (9 patients), indeterminate or suspicious FNA findings (6 patients), and toxic nodule (1 patient). Most patients (14 of 16 patients [88%]) had palpable lesions; only 1 patient with benign pathologic results was initially seen with obstructive symptoms (dysphagia and shortness of breath).

Of 12 patients with malignant disease on final pathologic results, the indication for surgical resection was a preoperative FNA finding that was malignant or suspicious for a malignant neoplasm. All the patients had palpable nodules of the thyroid isthmus, with no obstructive symptoms. Final pathologic results were consistent with classic papillary thyroid carcinoma in 10 patients and with follicular variant of papillary thyroid carcinoma in 2 patients. Six patients (50%) had 1 or more cancerous lymph nodes in the central compartment, and 1 patient had a positive lateral neck lymph node. On final pathologic results, 11 of 12 patients had cancerous nodules 1 cm or larger, while 1 patient had a cancerous lesion measuring 0.8 cm. Among 12 patients, multifocal disease was seen in 8 patients, extracapsular invasion in 4 patients, and lymph node involvement in 7 patients. The tumors of 11 patients with a cancerous nodule 1 cm or larger showed one of these aggressive features.

Of 942 patients, 281 underwent thyroidectomy for well-differentiated papillary thyroid carcinoma 1 cm or larger on final pathologic results. Among this group, the frequency of well-differentiated papillary thyroid carci-

### Table. Characteristics of 28 Patients With Benign vs Malignant Dominant Thyroid Nodules of the Isthmus

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Benign Group (n = 16)</th>
<th>Malignant Group (n = 12)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patient Demographics</strong></td>
<td></td>
<td></td>
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<tr>
<td>Age, mean, y</td>
<td>52</td>
<td>47</td>
</tr>
<tr>
<td>Male sex, %</td>
<td>13</td>
<td>25</td>
</tr>
<tr>
<td>Nonwhite race/ethnicity, %</td>
<td>50</td>
<td>67</td>
</tr>
<tr>
<td><strong>Surgeon-Performed Preoperative Tests</strong></td>
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<td></td>
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<tr>
<td>Ultrasonography features</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nodule size, mean, cm</td>
<td>2.7</td>
<td>1.8</td>
</tr>
<tr>
<td>Dominant nodule</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Echogenicity</td>
<td>Isoechoic or hyperechoic</td>
<td>Regular Hypoechoic Microcalcifications</td>
</tr>
<tr>
<td>Borders</td>
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<td></td>
</tr>
<tr>
<td>Calcification</td>
<td>No microcalcifications</td>
<td>Microcalcifications</td>
</tr>
<tr>
<td>Total No. of features</td>
<td>9 Patients had all 3 features; all patients had ≥2</td>
<td></td>
</tr>
<tr>
<td>Fine-needle aspiration findings, No. of patients</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benign</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>Indeterminate</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Suspicious</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Malignant</td>
<td>0</td>
<td>8</td>
</tr>
</tbody>
</table>

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A solitary or dominant thyroid nodule of the isthmus is an uncommon clinical entity requiring surgical evaluation. The present study reports an overall 3% (28 of 942 patients) frequency of dominant thyroid nodules of the isthmus treated by surgical resection. In addition, of all the patients with well-differentiated papillary thyroid carcinomas 1 cm or larger on final pathologic results, 4% (11 of 281 patients) had a dominant isthmus nodule, which falls within the reported range from previous series.1-3

When 11 patients with a malignant dominant thyroid nodule of the isthmus were compared with the overall group, patients with isthmus nodules trended toward having higher rates of multifocal disease (P = .08), extracapsular invasion (P = .09), and lymph node involvement (P = .09).

In conclusion, preoperative SUS and FNA for thyroid nodules of the isthmus can accurately predict malignant or benign thyroid disease and direct the extent of thyroidectomy. For malignant isthmus nodules, total thyroidectomy and possible central node dissection are recommended owing to high rates of multifocal disease and lymph node involvement. For benign isthmus nodules, thyroid lobectomy with isthmusectomy or isthmusectomy alone may be appropriate.

**COMMENT**

Figure. Algorithm for the management of dominant thyroid nodules of the isthmus. CND indicates central neck dissection (performed in the case of preoperative or intraoperative diagnosis of a malignant neoplasm); FNA, surgeon-performed fine-needle aspiration. ‡Performed in the case of obstructive symptoms, cosmetic concerns, or very suspicious surgeon-performed ultrasound (SUS) features. §In the case of follicular cells of undetermined significance or follicular adenoma. ¶May consider molecular testing.

Owing to their unique anatomical location, lymphatic drainage, and blood supply, nodules originating from the thyroid isthmus have higher rates of multifocal cancer and extracapsular invasion. In this series, 67% (8 of 12) of patients with thyroid cancer in the isthmus had multifocal disease, which is higher than the 48.6% reported in the literature. Furthermore, 33% (4 of 12) of patients had extracapsular invasion, which is less than the 70% reported in the literature. Nevertheless, as seen herein, well-differentiated thyroid carcinoma of the isthmus had higher rates of multifocal disease and extracapsular invasion compared with tumors arising from dominant nodules in the right or left thyroid lobes. In this study, the few patients with thyroid cancer of the isthmus may have contributed to the results not reaching statistical significance.

In addition, 6 of 12 patients (50%) in the present study had 1 or more metastatic lymph nodes compared with an overall group having well-differentiated papillary thyroid carcinomas.3,4 However, rates of aggressive pathologic findings and lymph node involvement are much higher in the present study than those reported in another series,5 possibly owing to their inclusion of lesions smaller than 1 cm.

Small case series in the literature advocate isthmusectomy alone for solitary isthmus nodules, detailing the ease and low morbidity of the procedure with good long-term outcomes, even for well-differentiated papillary thyroid carcinoma.6,7 However, the present study and others1,2 demonstrate high rates of multifocal disease, extracapsular invasion, and lymph node involvement, indicating that total thyroidectomy should be strongly considered for any thyroid nodule of the isthmus that is suggestive of a malignant neoplasm. Conversely, for thyroid nodules of the isthmus that are consistent with benign disease, if neither the tracheal space is violated nor any dissection is attempted beyond the limits of isthmus resection, isthmusectomy alone may be an acceptable alternative to diagnostic lobectomy in select circumstances when no other small nodules are identified in either lobe by preoperative ultrasonography and when the lesion is truly midline.

For lesions of the isthmus that do not fall into 1 of these 2 categories, FNA is recommended. According to the present study, surgeons can more confidently plan the extent of operation for thyroid isthmus nodules when SUS features are combined with FNA findings (Figure).
Author Contributions: Study concept and design: Goldfarb, Rodgers, and Lew. Acquisition of data: Goldfarb. Analysis and interpretation of data: Goldfarb and Lew. Drafting of the manuscript: Goldfarb and Lew. Critical revision of the manuscript for important intellectual content: Rodgers and Lew. Statistical analysis: Goldfarb. Study supervision: Rodgers and Lew.

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REFERENCES


