ABSTRACT

BACKGROUND AND PURPOSE: There are no guidelines for reporting incidental thyroid nodules seen on CT and MR imaging. We evaluated radiologists’ current reporting practices for incidental thyroid nodules detected on these imaging modalities.

MATERIALS AND METHODS: Radiologists were surveyed regarding their reporting practices by using 14 scenarios of incidental thyroid nodules differing in size, patient demographics, and clinical history. Scenarios were evaluated for the following: 1) radiologists’ most commonly selected response, and 2) the proportion of radiologists selecting that response (degree of agreement). These measures were used to determine how the patient scenario and characteristics of the radiologists affected variability in practice.

RESULTS: One hundred fifty-three radiologists participated. In 8/14 scenarios, the most common response was to “recommend sonography.” For the other scenarios, the most common response was to “report in only body of report.” The overall mean agreement for the 14 scenarios was 53%, and agreement ranged from 36% to 75%. Smaller nodules had lower agreement: 43%–51% for 8-mm nodules compared with 64%–75% for 15-mm nodules. Agreement was poorest for the 10-mm nodule in a 60-year-old woman (36%) and for scenarios with additional history of lung cancer (39%) and multiple nodules (36%). There was no significant difference in reporting practices and agreement when radiologists were categorized by years of practice, practice type, and subspecialty (P > .55).

CONCLUSIONS: The reporting practice for incidental thyroid nodules on CT or MR imaging is highly variable among radiologists, especially for patients with smaller nodules (≤10 mm) and patients with multiple nodules and a history of cancer. This variability highlights the need for practice guidelines.

ABBREVIATIONS: ASNR – American Society of Neuroradiology; ITN – incidental thyroid nodule
Category 2 nodules are those of any size in patients younger than 35 years of age, and category 3 is nodules associated with suspicious lymph nodes, local invasion, or focal metabolic activity on PET. Nodules not meeting the criteria for category 1 are considered to have indeterminate imaging findings on CT and MR imaging.

The Duke 3-tiered system, which was devised for guiding work-up for ITNs detected on CT and MR imaging,1,4 These criteria are divided into 3 mutually exclusive categories: Category 1 consists of nodules of any size with aggressive imaging findings, including associated suspicious lymph nodes, local invasion, or focal metabolic activity on PET. Nodules not meeting the criteria for category 1 are considered to have indeterminate imaging findings on CT and MR imaging and are grouped into categories 2 and 3. Category 2 nodules are those of any size in patients younger than 35 years of age, and category 3 is nodules ≥15 mm in patients 35 years of age or older. The 3 categories represent a descending risk of malignancy and need for work-up. ITNs that do not belong to any of the 3 categories are not selected for work-up. Younger patients are in category 2 because other studies have shown that there is a higher ratio of malignant-to-benign nodules in younger patients.5-7-11

Survey takers were given the following 5 response choices for each scenario: A) do not report, B) report in only body of report, C) report in impression without recommendation, D) recommend sonography ± biopsy, and E) I have no consistent practice. The survey also obtained information regarding the radiologists, including years in practice, current practice type, and subspecialty training.

The survey was created by using the Web site http://www.surveymonkey.com and was sent electronically to 3 groups: 1) radiologists in all subspecialties at a tertiary care academic institution (Duke University Medical Center), 2) radiologists attending the American College of Radiology head and neck radiology course, and 3) members of the American Society of Neuroradiology (ASNR). The survey was sent via e-mail lists to the first 2 groups. For ASNR members, the survey was featured in one of the monthly ASNR on-line newsletters that was e-mailed to all ASNR members. Only responses from board-certified radiologists were included. Responses were collected between September 18, 2012, and December 11, 2012.

**Analysis of Survey Results**

The results were evaluated for the following: 1) the most commonly selected response (A–E) for the 14 ITN scenarios, and 2) the degree of agreement for the most commonly selected response. The degree of agreement was the proportion of respondents who chose the most common response. A higher proportion would indicate high agreement and little variability in practice. The degree of agreement was categorized into high (≥75%), moderate (50%–74%), and low (<50%).

**Response and Agreement by Scenario**

The response and degree of agreement for all respondents were evaluated to determine how nodule size, patient demographics, multiplicity of nodules, and cancer history would affect the reporting practice and variability in practice.

**Response and Agreement by Radiologist Groups**

Response and degree of agreement were compared for radiologists with different years in practice, practice type, and subspecialty training to determine whether these characteristics would affect the reporting practice and variability in practice.

The mean agreement was calculated for radiologists of each group. The paired t test was used to compare differences in agreement between 2 groups of practices (academic versus private/hybrid). One-way ANOVA was used to compare differences in agreement for years in practice (fellow, attending of <10 years, and attending of >10 years) and differences in agreement in subspecialty training (neuroradiology, body imaging, and other).

Results from the on-line survey were exported on a spreadsheet for analysis (Excel; Microsoft, Redmond, Washington). Sta-

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**Table 1: The 14 survey scenarios**

| Scenario |
|----------|
| 8-mm nodule |
| 12-year-old girl |
| 30-year-old woman |
| 30-year-old man |
| 60-year-old woman |
| 10-mm nodule |
| 12-year-old girl |
| 30-year-old woman |
| 30-year-old man |
| 60-year-old woman |
| 15-mm nodule |
| 12-year-old girl |
| 30-year-old woman |
| 30-year-old man |
| 60-year-old woman |
| 8-mm nodule in 60-year-old woman with history of treated lung cancer |
| 10-mm nodule in 60-year-old woman with 7 thyroid nodules |

*Radiologists were given an introduction that an indeterminate thyroid nodule was incidentally seen on CT or MRI with the above descriptions of nodule size and patient history.

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**MATERIALS AND METHODS**

This study was approved by our institutional review board. The need for written informed consent was waived due to the design of this survey study and the anonymity of the survey respondents.

**Survey and Study Group**

A survey was designed to query radiologists about their reporting practices for 14 scenarios of ITN, differing in nodule size, age and sex of the patient, multiplicity of nodules, and presence of a history of treated lung cancer. The scenarios are listed in Table 1. The survey scenarios were designed to simulate the spectrum of ITNs encountered in clinical practice and to cover categories in the Duke 3-tiered system, which was devised for guiding work-up for ITNs detected on CT and MR imaging.1,4 These criteria are divided into 3 mutually exclusive categories: Category 1 consists of nodules of any size with aggressive imaging findings, including associated suspicious lymph nodes, local invasion, or focal metabolic activity on PET. Nodules not meeting the criteria for category 1 are considered to have indeterminate imaging findings on CT and MR imaging and are grouped into categories 2 and 3. Category 2 nodules are those of any size in patients younger than 35 years of age, and category 3 is nodules ≥15 mm in patients 35 years of age or older. The 3 categories represent a descending risk of malignancy and need for work-up. ITNs that do not belong to any of the 3 categories are not selected for work-up. Younger patients are in category 2 because other studies have shown that there is a higher ratio of malignant-to-benign nodules in younger patients.5-7-11

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Agreement was similar for scenarios with different ages except for the 10-mm nodule in the 60-year-old patient, which had 36% agreement compared with 53%–56% for the same size nodule in younger patients. The sex of the patient in the scenario did not influence the response or agreement as evidenced by the scenarios with the male and female 30-year-old patients. The 2 special scenarios of a patient with an additional history of lung cancer and a patient with multiple nodules had poor agreement (39% and 36%, respectively).

**Response and Agreement by Radiologist Subgroups**

The On-line Table shows that when comparing the 3 different groups of years in practice, there were 3 scenarios that had differences in the most commonly selected responses among the groups: 8-mm nodules in 30-year-old men, 10-mm nodules in 60-year-old women, and multiple nodules (footnote a on On-line Table). The mean agreement for fellows, attendings of <10 years, and attendings of ≥10 years was 52%, 51%, and 54%, respectively, and it was not significantly different (P = .81).

When practice type was considered, the most commonly selected responses differed between academic and private/hybrid practice radiologists for 2 scenarios in which the private/hybrid radiologists were more conservative, choosing “recommend sonography” and “report in impression without recommendation” rather than “report only in body” (On-line Table). These were 10-mm nodules in a 60-year-old woman and a patient with multiple nodules, respectively. The mean agreement for academic and private/hybrid for both was 52%, and it was not significantly different with the paired t test (P = .55).

The type of subspecialty training led to differences in the reporting for 4 scenarios. Radiologists with “other” training had “recommend sonography” rather than “report only in body” as the most commonly selected response for 8-mm nodules in male and female patients 30 years of age. Body-trained radiologists differed from the other subspecialties by choosing “report only in body” rather than “recommend sonography” for 10-mm nodules in 60-year-old women and patients with multiple nodules. The mean agreement for neuroradiology, body imaging, and other training was 52%, 54%, and 53%, respectively, and it was not significantly different (P = .91).

**DISCUSSION**

In contrast to thyroid nodules detected on sonography, there are presently no specific recommendations or guidelines offered by professional radiology organizations that deal specifically with the problem of ITNs discovered on CT or MR imaging. This factor may contribute to confusion, inconsistent reporting, and even overinvestigation of small thyroid nodules. This study evaluates how radiologists claim to report thyroid lesions incidentally detected on CT and MR imaging and quantifies the variability in this self-described practice. We found that with the exception of relatively large nodules of 15 mm, there is substantial variability in reporting practices, with <50% of radiologists having the same practice of reporting ITNs. Additionally, variability is high even within groups similar in practice experience, practice type, and subspecialty.

Self-described reporting practices regarding incidental thy-
roid nodules were previously investigated by Johnson et al,6 who
included a scenario of a 1-cm ITN in a 45-year-old woman in a
survey, along with other incidental-finding scenarios seen on
body CT. They concluded that there was good agreement in re-
porting practices for ITNs, with 81% of radiologists recommend-
ing sonography in that scenario. For similar scenarios in our
study, notably of 10-mm nodules in a 30-year-old and a 60-year-
old woman, the most common responses by radiologists were
“recommend sonography” for the younger woman but “report
only in body” for the older woman. Our study also found much
greater variability in reporting practices as demonstrated by a
lower degree of agreement for these responses (53% and 36%,
respectively). The differences between our results and those of
Johnson et al could be attributable to our larger sample size (153
versus 27) and a more heterogeneous group of radiologists. In
their work, Johnson et al specifically surveyed academic radiolo-
gists who had prior fellowship training in body imaging, while our
study surveyed radiologists from a variety of practice types and
subspecialties. We believe that better representation of all types of
radiologists is one of the strengths of our study.

The scenarios with the greatest agreement of reporting
practices were 15-mm nodules, for which the most common
reporting option was to recommend sonography, regardless of
age or sex. In contrast, the agreement was as low as 36% for a
60-year-old woman with a 10-mm nodule and a 10-mm nodule
in a patient with multiple thyroid nodules. An additional his-
tory of lung cancer in a 60-year-old woman with an 8-mm
odule also led to lower agreement (39%) than when there was
no lung cancer history (51%). Low agreement in our survey
reflects a small proportion of radiologists practicing in the
same way. These inconsistent reporting practices could poten-
tially result in confusion for the referring clinician and high-
light the need for evidence-based or expert-opinion practice
guidelines. Such guidelines should have specific recommendations for patient
age, nodule size, and the number of nodules.

A review by Hoang et al3 proposed a
set of criteria for reporting ITNs on CT,
MR imaging, and PET. The work-up sys-
tem, known as the Duke 3-tiered system,
has since been evaluated in a retrospective
study that compared the 3-tiered system
with a ≥10-mm-sized threshold for consec-
tive ITNs detected on CT neck stud-
ies.1 When the investigators applied the
3-tiered system to nodules of ≥10 mm,
they found that the work-up of nodules
could be reduced by 46%. In another
study by Hobbs et al,12 the Duke 3-tiered
system was applied to a cohort of ITNs
undergoing fine-needle aspiration and
found that the system would have pre-
vented biopsy in 35% of patients without
missing any malignant nodules. Thus,
guidelines such as the Duke 3-tiered sys-
tem could reduce unnecessary ITN work-
ups, improve consistency in reporting ITNs, and reduce the cost
of medical care in this population.

When one is comparing our survey results with the results in
the Duke 3-tiered system, it appears that the most commonly
selected responses for scenarios by age and nodule size actually
match the recommendations of the 3-tiered system. The excep-
tion is the 8-mm nodules in the 30-year-old patients, for which
the survey respondents chose “report only in body,” whereas the
3-tiered system does not specify a nodule size cutoff for the
younger than 35-year age group. In clinical practice, the authors
of the 3-tiered system use a 10-mm cutoff in adults younger than
35 years and no cutoff in children. These specifications were not
described and used in the publications to simplify the guidelines
for readers. Overall, the implication of the survey results is that the
3-tiered system is concordant with current practices and could be
implemented in clinical practice.

This study had several limitations. Although we attempted to
survey a diverse group of radiologists, these results may not be
generalizable to all radiologists because of the predominance of
academic radiologists and neuroradiologists in our study popula-
tion. Second, the response from the ASNR members was low at
2%, though this is not surprising given that the survey was sent
only once in an e-mailed newsletter. The absolute number of re-
pondents from the ASNR was still large (86 radiologists), how-
ever, composing 56% of our study group. The response rate was
higher from the other 2 groups of radiologists that received the
survey. We also recognize that some radiology practices may have
already developed guidelines within their groups for reporting
thyroid nodules and that these groups may have already estab-
lished high within-group agreement. In addition, there may be a
nonresponse bias from radiologists who did not participate in the
survey, which is inherent in survey studies. However, we do not
believe that this would add systematic bias in favor of a particular

FIG 1. Degree of agreement for the most commonly selected response for all radiologists. Responses were the following: B = report only in body and D = recommend sonography. The degree of agreement was categorized into high (≥75%), moderate (50%–74%), and low (<50%). Scenarios included 12F = 12-year-old girl, 30M = 30-year-old man, 30F = 30-year-old woman, and 60F = 60-year-old woman.
result. Finally, these are self-described reporting practices and may not reflect the true practice of the reporting radiologists.

CONCLUSIONS
The reporting practice of ITNs on CT or MR imaging is highly variable among radiologists, especially for patients with smaller nodules (≤10 mm) and for patients with multiple nodules and an additional history of cancer. This variability highlights the reality that there is no standard of practice and that there is a need for evidence-based or expert-opinion practice guidelines. Such guidelines could lead to greater reporting consistency and, potentially, decreased cost and medicolegal risk in the evaluation of low-risk ITNs.

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