Management of Small (3–5-mm) Pulmonary Nodules at Chest CT: Global Survey of Thoracic Radiologists[1]

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Purpose: To prospectively determine management strategies used by international thoracic radiologists in evaluation of small (3–5-mm) pulmonary nodules at chest computed tomography (CT).

Materials and Methods: Institutional review board exemption was granted for this study, which included consenting participants. An electronic survey was sent to members of major thoracic radiology societies in North America, Europe, and Asia. The main part of the survey consisted of four management questions with clinical scenarios. Associations between recommendations and years of experience, location in a region endemic for granulomatous disease, country, and practice type were assessed. Univariate analysis was performed to determine differences in follow-up recommendations on the basis of patient characteristics, percentage of chest CT scans obtained at follow-up, years of experience in radiology, and professional society affiliation of respondents. Differences in categorical variables were examined by using Pearson χ^2 and Fisher exact tests.

Results: Two hundred two (25%) of approximately 800 online surveys were completed. Surveys from respondents from the United States comprised 61% of completed surveys. Median experience of respondents was 11–20 years. Fifty-two percent practice in an area endemic for granulomatous disease. Only 35% of practices have a policy in place for nodule management. In scenarios in which patients had a low likelihood of malignancy, respondents' preferential recommendation was short-term CT follow-up (3–6 months) rather than intermediate-term CT follow-up (12 months) for patients older than 40 years compared with their recommendation in patients younger than 40 years, in whom recommendations for short- or intermediate-term follow-up were roughly equal. In scenarios in which patients had a high risk of malignancy, follow-up was also strongly favored instead of biopsy, with short-term follow-up more commonly advocated. Location in an area endemic for granulomatous disease and years of experience also influenced recommendations.

Conclusion: Globally, the most common recommendation for CT evaluation of nodules is short-term follow-up, with a tendency toward less aggressiveness in scenarios in which patients had lower risk of malignancy and increased aggressiveness in scenarios in which patients had higher risk of malignancy.

Supplemental material: *http://radiology.rsnajnls.org/cgi/content/full/2473061514/DC1*

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The early detection of lung cancer remains a major challenge, with only about 16% of lung cancers found at a localized stage (1). Several investigators have evaluated various lung cancer screening protocols to help address this issue. More recently, the addition of thin-section computed tomography (CT) by using multidetector CT has shown promise in the detection of early lung cancer, but the benefit of lung cancer screening remains in question (2–4). Aside from screening, a large number of nodules are detected incidentally in the daily practice of interpreting CT scans for clinical purposes, primarily because of the improved resolution afforded by newer generations of multidetector CT scanners. These small nodules in the 3–5-mm range are usually not amenable to further characterization by using positron emission tomography or percutaneous needle biopsy. Thus, the realistic options for management include a recommendation for no follow-up, short-term follow-up, long-term follow-up, or surgical intervention. A recommendation in regard to the appropriate follow-up of these small nodules, whether by using serial repeat CT or tissue sampling, is often left to the discretion of the radiologist who bases that judgment on the perceived importance of the findings. Thus, selection of an appropriate recommendation for the management of small nodules is a common problem in daily practice for radiologists who interpret chest CT scans.

In 1996, Munden and Hess surveyed members of the Society of Thoracic Radiology (Rochester, Minn) to obtain a better understanding of recommendation patterns. They published their results in a study (5) in 2001. The study offered insights into the range of opinions in regard to this topic. In the decade since this survey was conducted, two major trends have occurred: *(a)* A greater number of small nodules are being detected, and detection is primarily related to advances in imaging technology. *(b)* A greater understanding of the importance of those nodules has evolved, and research findings have shown that most of the nodules smaller than 5 mm are benign, even among high-risk smokers (2–4,6). With these factors in mind, the purpose of our study was to prospectively determine management strategies used by the international thoracic radiology community in the evaluation of small (3–5-mm) pulmonary nodules on chest CT scans.

Advances in Knowledge

- Recent recommendations have been published by the Fleischner Society, but results of our survey indicate that current management of small pulmonary nodules is not consistent with those recommendations.
- The management strategies for small pulmonary nodules have not substantially changed from those found in a survey 10 years ago.

Materials and Methods

From October 2004 to February 2005, the presidents of five major global thoracic radiology societies were contacted, and permission was received to send an electronic survey invitation to their societal members. The survey was sent during this time. The survey was developed at the institution of one author (P.M.B.) in consultation with the remaining authors, each of whom is a thoracic radiologist (with experience ranging from recent completion of a fellowship to 20 years of experience in thoracic imaging). All survey responses were completed online and were automatically electronically returned to the authors for collection and tabulation of results. Each member of the Society of Thoracic Radiology, Fleischner Society (Houston, Tex), Japanese Society of Thoracic Radiologists, Korean Society of Thoracic Radiologists (Seoul, Korea), and European Society of Thoracic Imaging (Vienna, Austria) received an e-mail containing an invitation to complete the Web-based survey, as well as survey instructions. Only radiologists who were members were asked to complete the survey. To avoid duplication from individual respondents who were members of more than one society, the instructions specifically stated that the survey was to be completed only once. An institutional review board exemption was granted for this study, although all society members contacted by e-mail were informed of the purpose of our study before they consented to participate.

In the survey, a "ditzel" was defined as a 3–5-mm parenchymal nodule (4). The main part of the survey consisted of four questions that were based on specific clinical scenarios in which a recommendation was asked of the participant (Appendix E1 [*http://radiology.rsnajnls.org/cgi/content/full/2473061514/DC1*]). Two questions were asked in regard to incidental detection of a small nodule in a patient without a history of a prior malignancy in a patient younger than 40 years (scenario 1) and in a patient older than 40 years (scenario 2). The third question surveyed recommendations for discovery of a small nodule in a patient at high risk (eg, one with a history of smoking) but without prior malignancy (scenario 3). The fourth question pertained to the detection of a small nodule in a patient with a new diagnosis of extrathoracic malignancy (scenario 4).

In addition to the four clinical case scenarios, information in regard to indi-

Implication for Patient Care

- The results of our study should raise awareness of the differences in the recommendations of radiologists and in current suggested guidelines for the management of small pulmonary nodules in patients.

Published online before print
10.1148/radiol.2473061514

Radiology 2008; 247:847–853

Author contributions:
Guarantors of integrity of entire study, C.S.W., P.M.B.; study concepts/study design or data acquisition or data analysis/interpretation, all authors; manuscript drafting or manuscript revision for important intellectual content, all authors; manuscript final version approval, all authors; literature research, all authors; clinical studies, C.S.W., P.M.B.; statistical analysis, J.J., C.S.W.; and manuscript editing, all authors

Authors stated no financial relationship to disclose.

vidual demographic data, clinical practice, and society membership was also collected (Appendix E1 [*http://radiology.rsnajnls.org/cgi/content/full/2473061514/DC1*]). To facilitate reporting, years of practice experience were grouped as less than 10 years, 11–20 years, 21–30 years, and more than 30 years.

Univariate analysis was performed to determine the differences in follow-up recommendations on the basis of patient characteristics, percentage of chest CT scans obtained as a part of follow-up procedure, years of experience in radiology, and professional society affiliation of the respondent.

Differences in categorical variables were examined by using Pearson χ^2 and Fisher exact tests to determine whether there was any effect of practicing in an area that was or was not endemic for granulomatous disease on the recommendations for different types of follow-ups in young patients (< 40 years old), older patients (> 40 years old), patients at high risk for malignancy, and patients with a new diagnosis of extrathoracic malignancy. Similarly, respondents were classified in two broad groups on the basis of years of experience, and the Pearson χ^2 test was performed to determine the relationship between years of experience and follow-up recommendations for young patients, older patients, patients at high risk for malignancy, and patients with a new diagnosis of extrathoracic malignancy.

All statistical analyses were performed by using software (SPSS 13.0 for Windows; SPSS, Chicago, Ill). A difference with $P < .05$ was considered significant for all analyses.

Results

Overall Findings

Surveys were electronically mailed to 800 radiologists who were included in the membership lists of the various thoracic societies. A total of 202 responses, which represents a 25% response rate, were received. Respondents from the United States accounted for 61% (123 of 202) of completed surveys (Table 1). The median experience of all respondents was 11–20 years of practice. Fifty-two percent stated that they practiced in an area endemic for granulomatous disease. Only 35% of practices had a formal policy in place for management of small nodules. More than 50% of radiologists responded that less than 10% of all CT scans interpreted daily were obtained solely for follow-up of nodules. Eighty-eight percent of respondents used multidetector CT for routine chest CT evaluation at the time of the survey.

Clinical Scenario Findings

For patients younger than 40 years with a small nodule and no previous malignancy (scenario 1), 50% of respondents recommended some form of CT follow-up. Overall, 23% recommended short-term 3–6-month follow-up and 27% recommended intermediate-term 12-month follow-up (Table 2, Appendix E1 [*http://radiology.rsnajnls.org/cgi/content/full/2473061514/DC1*]). Forty-nine percent made no recommendations for follow-up. For patients older than 40 years without a history of previous malignancy (scenario 2), almost 50% of all respondents recommended short-term 3–6-month follow-up. An additional 30% recommended intermediate-term 12-month follow-up.

Results of overall comparison of these first two scenarios indicates that respondents were much more likely to recommend either short-term or intermediate-term CT follow-up for a patient older than 40 years (80% of respondents) as compared with the recommendation for a patient younger than 40 years (51% of respondents).

Seventy percent of all respondents

Table 1

Responses according to Country

Country	No. of Responses
Australia	2
Austria	3
Belgium	3
Canada	8
China	1
Denmark	1
Germany	1
Greece	1
Ireland	1
Israel	1
Italy	2
Japan	15
Korea	24
New Zealand	1
Republic of Macedonia	1
Slovenia	2
Spain	2
Switzerland	2
Taiwan	1
Turkey	1
United Kingdom	6
United States	123
Total	202

Table 2

Clinical Recommendations according to Scenario in 202 Responses

Scenario	No Recommendation		Short-term 3–6-month CT Follow-up	Intermediate-term 12-month CT Follow-up	Biopsy or Surgical Resection	Metastatic or Malignant and No Biopsy Needed
	Nodule Not Mentioned	Nodule Mentioned				
Patients < 40 y with no previous malignancy	9 (4.5)	89 (44.1)	47 (23.3)	55 (27.2)	1 (0.5)	1 (0.5)
Patients > 40 y with no previous malignancy	3 (1.5)	36 (17.8)	99 (49.0)	62 (30.7)	1 (0.5)	1 (0.5)
Patients at high risk with no prior history of malignancy	1 (0.5)	9 (4.5)	142 (70.3)	37 (18.3)	12 (5.9)	1 (0.5)
Patients with new diagnosis of extrathoracic malignancy	1 (0.5)	11 (5.4)	153 (75.7)	3 (1.5)	24 (11.9)	10 (5.0)

Note.—Data are numbers of recommendations. Numbers in parentheses are percentages.

recommended short-term follow-up for patients at high risk for malignancy but with no prior history of malignancy (scenario 3). Three-fourths of responding radiologists recommended short-term follow-up for patients with a new diagnosis of extrathoracic malignancy (scenario 4). When we compared responses for patients with a high risk and no prior history of malignancy with responses for patients with a new diagnosis of extrathoracic malignancy, respondents strongly favored short- or intermediate-term follow-up CT rather than biopsy, with short-term follow-up strongly advocated (70% of respondents for scenario 3 and 75% of respondents for scenario 4).

There was no significant difference in follow-up recommendations in any category among radiologists who had a departmental policy in place compared with those who did not have such a policy.

Practice Experience

Overall, differences between years of experience and management recommendations were not found to be significant in patients younger than 40 years with no previous malignancy or in the two high-risk scenarios (patients at high risk with no prior history of malignancy and patients with a new diagnosis of extrathoracic malignancy) (Table 3, Appendix E1 [*http://radiology.rsnajnls.org/cgi/content/full/2473061514/DC1*]).

However, a significant difference in recommendations was noted in one area. For patients older than 40 years without a history of previous malignancy, radiologists with more than 30 years of experience as a group recommended intermediate-term follow-up significantly more often compared with the recommendation of radiologists with fewer than 30 years of experience ($P = .018$, Fisher exact test = 10.763).

Areas Endemic for Granulomatous Disease

In regions endemic for granulomatous disease, there was no significant difference in recommendations for follow-up in patients younger than 40 years who had no history of prior malignancy (Table 4, Appendix E1 [*http://radiology.rsnajnls.org/cgi/content/full/2473061514/DC1*]). Radiologists practicing in areas endemic for granulomatous disease rec-

Table 3

Responses according to Scenario and Radiologists' Years of Experience

Scenario and Radiologists' Years of Experience	No Recommendation: Nodule Not Mentioned	No Recommendation: Nodule Mentioned	Short-term 3–6-month Follow-up	Intermediate-term 12-month Follow-up	Biopsy or Surgical Resection	Metastatic or Malignant and No Biopsy Needed
Low-risk scenarios						
Patients < 40 y with no previous malignancy						
< 5 y experience	2 (8.33)	12 (50.00)	7 (29.17)	3 (12.50)	0	0
5–10 y experience	3 (6.82)	22 (50.00)	9 (20.45)	10 (22.73)	0	0
11–20 y experience	2 (2.82)	32 (45.07)	15 (21.13)	21 (29.58)	1 (1.41)	0
21–30 y experience	0	12 (30.77)	12 (30.77)	15 (38.46)	0	0
> 30 y experience	2 (8.33)	11 (45.83)	4 (16.67)	6 (25.00)	0	1 (4.17)
Patients > 40 y with no previous malignancy						
< 5 y experience	1 (4.17)	3 (12.50)	14 (58.33)	6 (25.00)	1 (4.17)	0
5–10 y experience	1 (2.27)	12 (27.27)	23 (52.27)	8 (18.18)	0	0
11–20 y experience	1 (1.41)	13 (18.31)	33 (46.48)	23 (32.39)	1 (1.41)	0
21–30 y experience	0	4 (10.26)	22 (56.41)	13 (33.33)	0	0
> 30 y experience	0	4 (16.67)	7 (29.17)	12 (50.00)*	0	1 (4.17)
High-risk scenarios						
Patients at high risk with no prior history of malignancy						
< 5 y experience	1 (4.17)	2 (8.33)	16 (66.67)	4 (16.67)	1 (4.17)	0
5–10 y experience	0	1 (2.27)	30 (68.18)	9 (20.45)	4 (9.09)	0
11–20 y experience	0	4 (5.63)	51 (71.83)	12 (16.90)	4 (5.63)	0
21–30 y experience	0	0	32 (82.05)	5 (12.82)	2 (5.13)	0
> 30 y experience	0	2 (8.33)	13 (54.17)	7 (29.17)	1 (4.17)	1 (4.17)
Patients with new diagnosis of extrathoracic malignancy						
< 5 y experience	1 (4.17)	3 (12.50)	15 (62.50)	0	3 (12.50)	2 (8.33)
5–10 y experience	0	2 (4.55)	36 (81.82)	0	3 (6.82)	3 (6.82)
11–20 y experience	0	3 (4.23)	54 (76.06)	0	10 (14.08)	4 (5.63)
21–30 y experience	0	2 (5.13)	28 (71.79)	3 (7.69)	6 (15.38)	0
> 30 y experience	0	1 (4.17)	20 (83.33)	0	2 (8.33)	1 (4.17)

Note.—Data are numbers of recommendations. Numbers in parentheses are percentages.

* $P = .018$, Fisher exact test = 10.763.

Table 4

Responses according to Endemic Area

Scenario and Area	No Recommendation		Short-term 3–6-month Follow-up	Intermediate-term 12-month Follow-up	Biopsy or Surgical Resection	Metastatic or Malignant and No Biopsy Needed
	Nodule Not Mentioned	Nodule Mentioned				
Patients < 40 y with no previous malignancy						
Nonendemic area	2 (2.08)	44 (45.83)	20 (20.83)	28 (29.17)	1 (1.04)	1 (1.04)
Endemic area	7 (6.60)	45 (42.45)	27 (25.47)	27 (25.47)	0	0
Patients > 40 y with no previous malignancy						
Nonendemic area	1 (1.04)	14 (14.58)	40 (41.67)	39 (40.63)	1 (1.04)	1 (1.04)
Endemic area	2 (1.89)	22 (20.75)	59 (55.66)*	23 (21.70)	0	0
Patients at high risk with no prior history of malignancy						
Nonendemic area	0	5 (5.21)	64 (66.67)	19 (19.79)	7 (7.29)	1 (1.04)
Endemic area	1 (0.94)	4 (3.77)	78 (73.58)	18 (16.98)	5 (4.72)	0
Patients with new diagnosis of extrathoracic malignancy						
Nonendemic area	0	5 (5.21)	72 (75.00)	2 (2.08)	13 (13.54)	4 (4.17)
Endemic area	1 (0.94)	6 (5.66)	81 (76.42)	1 (0.94)	11 (10.38)	6 (5.66)

Note.—Data are numbers of recommendations. Numbers in parentheses are percentages.

* $P = .047$, $\chi^2 = 3.947$.

ommended short-term follow-up for patients older than 40 years who had no history of previous malignancy significantly more often than did the radiologists practicing in areas that were not endemic for granulomatous disease ($P = .047$, $\chi^2 = 3.947$).

There was no significant difference in follow-up recommendations in patients at high risk but without prior malignancy or in patients with a new diagnosis of extrathoracic malignancy for radiologists practicing in areas endemic for granulomatous disease as compared with radiologists practicing in areas that were not endemic for granulomatous disease.

No significant differences in management recommendations were observed across respondents from the different countries.

Discussion

Our survey results provide a snapshot of the widely divergent strategies used in the management of small pulmonary nodules, or ditzels. Although a clear trend toward more aggressive management was demonstrated with scenarios involving increased risk, the variability of management within each scenario was considerable. These findings reflect the complex decision-making pathways that factor into a recommendation for management of the small pulmonary nodule, as well as the absence of consensus recommendations for such management at the time the survey was undertaken.

Findings in several studies (4,6–10) suggest that growth in small nodules is, in most cases, too slow or too subtle to measure accurately by using current techniques, thus negating the value of short-term follow-up. For example, a nodule that is 5 mm in diameter must grow to approximately 7.1 mm to double in two-dimensional area but need only grow to 6.4 mm to double in three-dimensional volume. Similarly, a 4-mm nodule needs to increase to only 5 mm to have doubled in three-dimensional volume. The accuracy of measuring such minute growth remains a challenge even with currently available imaging tools (11,12).

Researchers in previous investigations (2,3,7) have demonstrated that even small nodules have a potential to be malignant. Results of a survey of members of the Society of Thoracic Radiologists performed by Munden and Hess (5) indicated that, given a variety of clinical scenarios, radiologists were most likely to recommend short-term follow-up of 3–6 months for small pulmonary nodules discovered incidentally on a CT scan.

Our results parallel those of the survey performed by Munden and Hess (5). In all but two of their clinical scenarios (the scenario with the patient with a bronchogenic carcinoma and a ditzel present in the contralateral lung and the scenario with a patient previously treated for bronchogenic carcinoma and a new ditzel revealed at follow-up CT), the most frequent management recommendation from radiologists was short-term follow-up, a recommendation similar to the findings in our survey. In patients considered at low risk for malignancy, radiologists in areas endemic for granulomatous disease, compared with radiologists in regions that were not endemic for granulomatous disease, more often recommended follow-up. Length of experience was also observed to influence decisions within this same category of patients.

Respondents with more experience chose follow-up more often than did those with less experience, and those with less experience made a recommendation for no follow-up. It is interesting that practice patterns have not changed substantially during the past decade despite our deeper understanding of the natural history of such nodules and improved CT technology.

In all but one case, recommendations from respondents practicing in areas en-

demic for granulomatous disease were not significantly different from their counterparts in areas that were not endemic for granulomatous disease. Interestingly, short-term follow-up for patients older than 40 years with no previous malignancy was recommended significantly more often among radiologists from regions that were endemic for granulomatous disease than it was among the radiologists in regions that were not endemic for granulomatous disease. This result cannot be easily explained; however, we acknowledge this finding as an honest representation of practice recommendations among this group of radiologists.

In 2005, members of the Fleischner Society published a consensus statement that provided recommendations for the management of small pulmonary nodules accompanied by literature that supported their recommendations (13). Our survey was largely completed before the publication of the Fleischner Society's guidelines, and differences exist between the criteria used in our survey and the criteria in the statement of that society (eg, we did not specify smoking in our higher-risk categories, whereas the Fleischner Society's guidelines do). In addition, slightly different size categorizations were used in our study, compared with those in the published Fleischner Society recommendations. Nevertheless, it is instructive to compare our survey results, which reflect current clinical practice, with the proposed guidelines of the Fleischner Society, which are based on best evidence from the literature.

For patients with low risk for malignancy, the recommendation in the Fleischner Society guidelines is for no additional follow-up for nodules smaller than 4 mm, and a single follow-up study at 12 months is recommended for nodules of 4–6 mm. In our study population, almost 50% of respondents recommended short-term CT follow-up for low-risk patients older than 40 years. Radiologists who practice in areas endemic for granulomatous disease favored short-term follow-up, as compared with radiologists who practice in areas that were not endemic for granulomatous disease, and the difference was significant ($P = .047$, $\chi^2 = 3.947$). Radiologists with more than 30 years of experience significantly favored intermediate-term follow-up ($P = .018$, Fisher exact test = 10.763). In a study by Henschke and colleagues (7), referred to by the Fleischner Society guidelines, the authors determined that noncalcified nodules that were smaller than 5.0 mm in diameter at initial CT screening can safely be followed up at annual screening.

The Fleischner Society guidelines are slightly less conservative for the same categorization of nodules in patients determined to be at higher risk for lung cancer. The recommendation is a single follow-up study at 12 months for a nodule smaller than 4 mm. If the nodule is 4–6 mm, there is an initial follow-up study at 3–6 months, with an additional follow-up study at 18–24 months. Seventy percent of our survey respondents favored short-term follow-up for patients at high risk for malignancy but with no prior history of malignancy. Approximately 75% of responding radiologists suggested short-term follow-up for patients with a new diagnosis of extrathoracic malignancy. No significant differences in management recommendations were seen regardless of the radiologists' experience or whether or not they practiced in an area endemic for granulomatous disease.

The guidelines note that, because of the rarity of primary lung cancer in patients younger than 35 years and the potential increased risk from radiation exposure, follow-up of incidental nodules in young patients should be avoided if possible. Fifty percent of respondents recommended follow-up of an incidental nodule in patients younger than 40 years with no prior history of malignancy. No significant differences in management recommendations were observed regardless of radiologists' experience or whether they practiced in an area endemic for granulomatous disease. Overall, the survey results suggest that the current clinical approach to small nodules, as indicated by the respondents' recommendations, is more aggressive than that suggested by the Fleischner Society guidelines. It is uncertain whether clinical practice will change to reflect these more conservative guidelines.

Technology now permits assessment by means of electronic survey of management strategies across the globe to investigate different practices in various parts of the world. This survey is one of the first, to our knowledge, to employ this capability in an imaging context. In this study, the absence of differences according to geographic location may reflect the small sample size from other parts of the world. However, one must also acknowledge the increased access and dissemination of literature electronically around the globe and, subsequently, some standardization of practice. Thus, the lack of substantial differences between North American and other respondents, although not documented previously, was not unexpected. Our survey may provide a paradigm for global sampling of the opinion of radiologists on a variety of issues.

Several limitations of our survey should be noted. Although our study presents an accurate reflection of management strategies, our clinical scenarios were basic and did not account for the many nuances encountered in daily practice. This limitation may have led to some variability of response. We did not explicitly define whether a high risk was equated with a history that was positive for smoking, which may have confounded responses. We may not have received responses from certain individuals because the survey was in English and some international radiologists may not have been comfortable with this language. Our survey response rate of 25% is typical of the response rate in similar physician surveys (14,15). However, incorrect e-mail addresses may have contributed to the low response rate. Finally, although we specifically requested that duplicate surveys not be completed, we cannot exclude the possibility that such duplication occurred.

In conclusion, in this global survey of thoracic radiologists, the most common recommendation for evaluation of small (3–5-mm) pulmonary nodules at CT was

short-term (3–6-month) follow-up, with a bias toward less aggressiveness in cases with a lower risk of malignancy and increased aggressiveness in cases with a higher risk of malignancy. Location in an area endemic for granulomatous disease and years of experience influenced recommendations in some scenarios. More important, our survey results indicate that there is a gap between current clinical practice and evidence-based recommendations. It is hoped that familiarity with and adherence to the Fleischner guidelines will bridge this gap in the near future.

Acknowledgments: We acknowledge the presidents of the Society of Thoracic Radiology, Fleischner Society, Japanese Society of Thoracic Radiologists, Korean Society of Thoracic Radiologists, and European Society of Thoracic Imaging and their members who participated in the survey.

References

1. American Cancer Society. Cancer: facts and figures 2005. Atlanta, Ga: American Cancer Society, 2005; 1–61.
2. Swensen SJ, Jett JR, Hartman TE, et al. CT screening for lung cancer: 5-year prospective experience. Radiology 2005;235(1):259–265.
3. Lindell RM, Hartman TE, Swensen SJ, et al. Five-year lung cancer screening experience: CT appearance, growth rate, location, and histologic features of 61 lung cancers. Radiology 2007;242(2):555–562.
4. Benjamin MS, Drucker EA, McLoud T, Shepard JO. Small pulmonary nodules: detection at chest CT and outcome. Radiology 2003;226(2):489–493.
5. Munden RF, Hess KR. "Ditzels" on chest CT: survey of members of the Society of Thoracic Radiology. AJR Am J Roentgenol 2001;176(6):1363–1369.
6. Henschke CI, Naidich DP, Yankelevitz DF, et al. Early Lung Cancer Action Project: initial findings on repeat screening. Cancer 2001;92(1):153–159.
7. Henschke CI, Yankelevitz DF, Naidich DP, et al. CT screening for lung cancer: suspiciousness of nodules according to size on baseline scans. Radiology 2004;231(1):164–168.
8. Midthun DE, Swensen SJ, Jett JR, Hartman TE. Evaluation of nodules detected by screening for lung cancer with low dose spiral computed tomography [abstr]. Lung Cancer 2003;41(suppl 2):S40.
9. Piyavisetpat N, Aquino SL, Hahn PF, et al. Small incidental pulmonary nodules: how useful is short-term interval CT follow-up? J Thorac Imaging 2005;20(1):5–9.
10. Libby DM, Wu N, Lee IJ, et al. CT screening for lung cancer: the value of short-term CT follow-up. Chest 2006;129(4):1039–1042.
11. Revel MP, Bissery A, Bienvenu M, Aycard L, Lefort C, Frija G. Are two-dimensional CT measurements of small noncalcified pulmonary nodules reliable? Radiology 2004;231(2):453–458.
12. Kostis W, Yankelevitz DF, Reeves AP, Fluture SC, Henschke CI. Small pulmonary nodules: reproducibility of three-dimensional volumetric measurement and estimation of time to follow-up CT. Radiology 2004;231(2):446–452.
13. MacMahon H, Austin JH, Gamsu G, et al. Guidelines for management of small pulmonary nodules detected on CT scans: a statement from the Fleischner Society. Radiology 2005;237(2):395–400.
14. Schuster ME, Fishman JE, Copeland JF, Hatabu H, Boiselle PM. Pulmonary embolism in pregnant patients: a survey of practices and policies for CT pulmonary angiography. AJR Am J Roentgenol 2003;181(6):1495–1498.
15. Baerlocher MO, Asch MR, Hayeems E. Current issues of interventional radiology in Canada: a national survey by the Canadian Interventional Radiology Association. Can Assoc Radiol J 2005;56(3):129–139.