Current Opinions on Medical Radiation: A Survey of Oncologists Regarding Radiation Exposure and Dose Reduction in Oncology Patients

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Purpose: The aim of this study was to evaluate oncologists' opinions about the use of ionizing radiation in medical imaging of oncology patients.

Methods: An electronic survey was e-mailed to 2,725 oncologists at the top 50 National Cancer Institute–funded cancer centers. The survey focused on opinions on CT dose reduction in oncology patients and current philosophies behind long-term imaging in these patients.

Results: The response rate was 15% (415 of 2,725). Eighty-two percent of respondents stated that their patients or families have expressed anxiety regarding radiation dose from medical imaging. Although fewer than half of oncologists (48%) did not know whether CT dose reduction techniques were used at their institutions, only 25% were concerned that small lesions may be missed with low-dose CT techniques. The majority of oncologists (63%) follow National Comprehensive Cancer Network guidelines for imaging follow-up, while the remainder follow other national guidelines such as those of the Children's Oncology Group, the American Society of Clinical Oncology, or clinical trials. Ninety percent of respondents believe that long-term surveillance in oncology patients is warranted, particularly in patients with breast cancer, melanoma, sarcoma, and pediatric malignancies. The majority of oncologists would consider the use of low-dose CT imaging in specific patient populations: (1) children and young women, (2) those with malignancies that do not routinely metastasize to the liver, and (3) patients undergoing surveillance imaging.

Conclusions: Cumulative radiation exposure is a concern for patients and oncologists. Among oncologists, there is support for long-term imaging surveillance despite lack of national guidelines.

Key Words: Oncology imaging, radiation exposure

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INTRODUCTION

With improving diagnostic capabilities and image resolution, the use of CT has dramatically risen, with >85 million CT scans performed in the United States in 2011 [1]. Patients with cancer typically undergo repeated CT evaluations to diagnose and stage malignancy, evaluate response to chemotherapy or radiation, and monitor for recurrence after apparent remission or cure. Recent research has attempted to quantify the amount of radiation exposure to specific cancer populations. In the pediatric oncology population, the literature estimates that the average cumulative radiation dose in all patients undergoing repeat PET/CT during a 5-year period is 78.9 mSv [2]. Similarly, in the adult oncology population, research in lung and gastric cancer populations showed that the majority of those patients received an annual effective dose of >50 mSv [3,4].

With this rising use of CT and the increasing concerns regarding medical radiation exposure in the radiology literature, it is unknown whether these concerns are also applicable in the oncology patient population, whose average life expectancy is substantially lower than that of the non-oncology population [5,6]. The purpose of this survey was to determine (1) opinions regarding cumulative radiation dose to oncology patients, (2) what criteria oncologists are using to determine interval imaging surveillance, and (3) if there are subsets of oncology patients who are thought to benefit from more long-term imaging surveillance or low-dose CT techniques.

METHODS

Our institutional review board waives the requirement for approval for a survey of this nature. All recipients

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of the survey were informed of the purpose of the study. An anonymous electronic survey was sent to 2,725 oncologists at the top 50 US National Center Institute–funded cancer centers. Those oncologists were identified via online web pages of the oncology departments at their respective centers. Participants were removed from the e-mail database and were not counted toward the results if they did not currently practice clinical oncology. Survey responses were anonymous.

The survey was sent by electronic mail using an online survey program (SurveyMonkey.com, Palo Alto, California). The survey consisted of 30 questions and was sent a total of 3 times at 2-week intervals to each oncologist to maximize the response rate. The survey was open for responses for a total of 6 weeks. The survey included single-best-answer questions (n = 21), a question asking the participants to rate their levels of agreement with a statement ("strongly agree," "agree," "neutral," "disagree," or "strongly disagree") (n = 1), and "select all that apply" questions (n = 8). Participants had the option to leave any question unanswered.

Demographics

Oncologists were asked to state their subspecialties, describe their practice types, state the sizes of their divisions and hospitals, indicate whether their institutions are solely devoted to oncology patients, and indicate what portions of their efforts were spent in clinical patient care and what malignancies they routinely follow.

Concerns Regarding Radiation From Medical Imaging and Current Practices in Imaging Oncology Patients

Oncologists were asked rate their agreement with the statement "I am concerned about the risks of cumulative radiation dose from medical imaging in oncology patients" on a 5-answer spectrum and whether patients or their families had raised concerns regarding the risks of radiation exposure from medical imaging.

Oncologists were asked whether their radiology departments use dose reduction techniques for CT imaging in oncology patients and whether they were concerned that small lesions might be missed with low-dose CT imaging. Respondents were asked if they could support an effort to reduce CT dose in oncology patients with known disease if the protocol preserved image quality necessary for lesion detection and in which subset of patients. Oncologists were also asked whether MRI should be considered in consensus guidelines for oncologic imaging and, if so, in which patient population.

Long-Term Imaging Surveillance

Respondents were asked what guidelines they follow for surveillance imaging and at what time point they consider a patient cured from an oncology perspective. They were asked whether they follow patients with surveillance imaging after being disease free for $\geq$3 years and, if so, at what time interval. Oncologists were asked what their imaging test of choice is for surveillance imaging and what specific malignancies warrant long-term surveillance. Finally, respondents were asked whether they treat pediatric malignancies and, if so, which tumors require long-term surveillance after "cure."

Statistical Analysis

The data were collected and tabulated by the online survey program. The standard error of each percentage value can be estimated using the following formula: $100 \times [\sqrt{p(1-p)/n}]$, where p is the proportion of respondents with a specific characteristic and n is the unweighted number of respondents [7].

RESULTS

Four hundred fifteen of 2,725 oncologists responded to the survey, corresponding to a 15% response rate. Of those responders, 354 (85%) completed the entire survey.

Demographics

Respondents primarily work in academic teaching hospitals (99% [409 of 415]). The distribution of subspecialties is described in Figure 1. Only 14% of all respondents (59 of 415) practice in institutions solely devoted to oncologic care, while the remainder of institutions serve both oncology and non-oncology populations. Surveyed oncologists spend anywhere from 20% to 100% of their time in direct patient care. When asked about which specific malignancies the respondents treat, there was a wide spectrum of responses, with breast malignancies being the most common (26% [106 of 409]). Response rates were similar for the remainder of the malignancies, with approximately 10% to 20% of respondents treating each malignancy (head and neck, urothelial, renal, testicular, small bowel and/or colorectal, pancreatic, liver, hepatobiliary, lung, prostate, gynecologic, melanoma, sarcoma, lymphoma, leukemia, intracranial, and pediatric malignancies), except for orthopedic malignancies, of which only 4% of respondents actively treat.

Current Practices and Opinions in Radiation Dose and Imaging Oncology Patients

Sixty percent of oncologists (240 of 402) agreed with the statement "I am concerned about the risks of cumulative radiation dose from medical imaging in oncology patients," with 17% disagreeing, 6% strongly disagreeing, and 18% neutral. Eighty-two percent of respondents (331 of 402) stated that patients or their families had raised concerns regarding the risks of cumulative radiation dose from medical imaging.

Although approximately half (48% [184 of 386]) of oncologists were unsure whether their radiology departments used dose reduction techniques, only 25% of oncology respondents (98 of 402) were concerned that