ORIGINAL ARTICLE

Ionizing Radiation Knowledge Among Emergency Department Providers

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Abstract

Purpose: The aim of this study was to assess knowledge of ionizing radiation exposure from diagnostic imaging examinations among emergency department (ED) providers.

Methods: An electronic questionnaire was distributed to ED providers in a five-hospital university-affiliated health care system. Providers included attending emergency medicine (EM) physicians, EM residents, and midlevel providers (MLPs) (nurse practitioners and physicians assistants). Data were collected and analyzed.

Results: One hundred six of 210 providers (41 attending physicians, 32 residents, and 31 MLPs) completed the survey, for a response rate of 50.5%. More than two in five providers (44.6%) could not correctly identify which of six common imaging modalities used ionizing radiation. MLPs were more likely to incorrectly identify radiography (25%) and fluoroscopy (29%) as modalities that did not use ionizing radiation ($P = .01$ and $P = .25$ respectively). Fewer attending physicians (14.6%) than residents (37.5%) were not very comfortable or were uncomfortable explaining the risks of radiation to patients. Nearly half of attending physicians (47.5%) and nearly three-quarters of residents (71.9%) were not very comfortable, were uncomfortable, or were extremely uncomfortable explaining the amount of radiation in certain imaging tests to patients. MLPs were more likely to incorrectly rank a selection of imaging tests by radiation exposure ($P = .002$). MLPs were more likely to incorrectly answer a question on the effects of ionizing radiation on patients ($P = .01$).

Conclusions: Among ED providers, there are knowledge gaps regarding the presence and effect of ionizing radiation in diagnostic imaging tests. MLPs were more likely to make factual errors, while EM residents were least comfortable counseling patients about radiation risks.

Key Words: Radiology, emergency department, radiation, medical imaging

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INTRODUCTION

Despite the centrality of medical imaging to patient management, knowledge among medical professionals regarding the risks of ionizing radiation exposure is insufficient [1-6]. Ionizing radiation is a known carcinogen with cancer risk dependent on patient age, exposure time, type of radiation, and radiosensitivity of the exposed tissues [7-9]. Recent decades have seen a rapid increase in the average radiation exposure of the American population, largely from medical radiation sources such as CT and cardiac nuclear medicine examinations [10]. It has been estimated that up to 2% of future cancers may be attributable to CT [11]. Emergency department (ED) volumes continue to increase, with an increasing number of imaging examinations ordered from EDs [12]. As a result, knowledge of ionizing radiation exposure among ED ordering providers is essential to properly counsel patients and help control the medical radiation exposure of the American population.

In the ED, more than one diagnostic imaging test may be used to manage a single patient; when evaluating the risks and benefits of these various diagnostic tests, the

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presence and relative magnitude of ionizing radiation exposure may be the deciding factor regarding which imaging study to choose. This decision necessitates that ordering providers know which imaging modalities use ionizing radiation and understand relative patient exposure. Additionally, as nurse practitioners (NPs) and physician assistants (PAs) become more central in managing ED patients and order more imaging tests, their understanding of ionizing radiation needs to be evaluated. The purpose of this study was to assess the radiation knowledge of all ED providers who order diagnostic imaging and assess their comfort in counseling patients about the risks of radiation.

METHODS

Data Collection

Our institutional review board approved this project. Two radiology and one emergency medicine (EM) attending physicians created a 10-question survey (Appendix 1) to assess knowledge of ionizing radiation exposure in radiologic examinations that may be ordered from the ED. This survey was distributed in digital form (SurveyMonkey, Palo Alto, California) to all ED providers by e-mail using a departmental list server consisting of attending EM physicians, EM resident physicians, and EM mid-level providers (MLP). An MLP for the purposes of this study was either a PA or an NP. After a one-month period, a reminder was sent encouraging providers to complete the survey. Data were extracted from survey responses into a database and subsequently analyzed. Time spent on the survey was collected electronically for every respondent; three time metrics of between 90 and 208 min were excluded, as these were outliers beyond two standard deviations from the mean (the average of the remaining respondents was 4 minutes 44 seconds). These time ranges likely resulted from providers not clicking "submit" on the last page of the survey, which allowed the electronic clock to continue running.

STATISTICAL METHODS

For numeric covariates, the mean and standard deviation of the outcomes were calculated. For categorical variables, frequency and percentage were calculated. The Fisher exact test was used to test if there was any association between the providers and questions. The significance level was set at .05. SAS version 9.4 (SAS Institute, Cary, North Carolina) was used for data analyses and management.

RESULTS

There were 210 providers who received the survey, consisting of 102 attending physicians (48.6%), 62 residents (29.5%), and 46 (21.9%) MLPs. There were 106 total responses (a response rate of 50.5%), consisting of 41 attending physicians (38.6% response rate), 32 residents (51.6% response rate), and 31 MLPs (67.4% response rate). Two providers did not list their positions. All responding providers answered that they did order radiologic examinations. The average time spent on the survey was 4 min 44 seconds.

Figure 1 is a graphical representation of results to a question in which providers were asked to select from a series of imaging examinations, indicating those that entailed ionizing radiation. There were complete data in 101 cases.

The Fisher exact test was used to analyze responses by provider type. This reveals that MLPs were more likely to incorrectly identify fluoroscopy and radiography as imaging tests that did not use ionizing radiation compared with other provider types (Table 1).

Figure 2 is a graph of provider comfort in explaining the risks of radiation exposure to patients. Figure 3 is a graph of provider comfort in explaining the amount of radiation in a given imaging test to patients. Fisher exact test analysis yielded nonparametric *P* values of .18

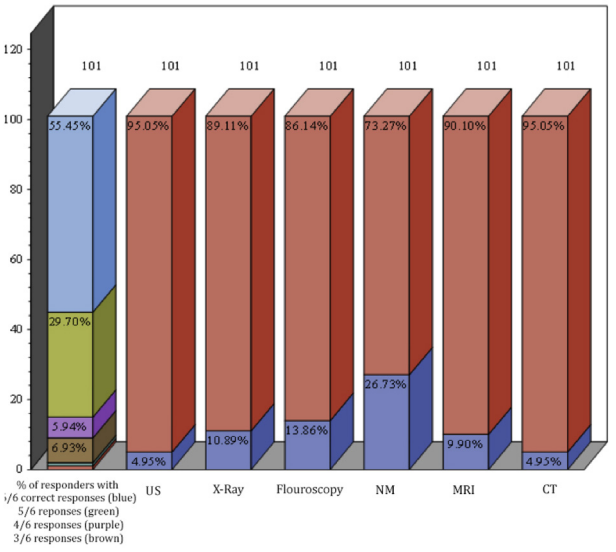

Fig 1. What imaging modalities use ionizing radiation? For the modality bars, red is the percentage of providers who correctly identified if ionizing radiation was used, while blue denotes incorrect responses. The first bar is a summation: 55.45% of providers had all six responses correct, 29.7% had five of six responses correct, 5.94% had four of six correct, and so on. NM = nuclear medicine; US = ultrasound.