Detection at Public Facilities of ^{131}I in Patients Treated for Differentiated Thyroid Cancer: Frequency, Sites, Management by Security Agents, and Physician Documentation Recommended for Patients

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Patients treated with ^{131}I may be identified at security checkpoints at various public facilities. The objective of this survey was to determine the frequency of detection, the spectrum of public facilities, the various methods of management of the situation by security agents, and the spectrum of physician documentation for patients regarding their ^{131}I therapy. **Methods:** Data were tabulated from a Thyroid Cancer Survivors' Association, Inc., survey emailed to approximately 15,000 associates and available online from December 2013 to December 2014. Responses were tabulated from respondents who reported that they were 18 y old or older, had received at least 1 ^{131}I treatment for differentiated thyroid cancer, and were responding regarding their last ^{131}I treatment. **Results:** Of 621 respondents, 595 reported an attempt to pass through a public facility security checkpoint. Of these 595 patients, approximately 10% (57) were identified as being radioactive. The facility reported by 43 respondents was an airport for 35% (15), border crossing for 33% (14), government building for 19% (8), shopping mall for 7% (3), train station for 5% (2), and steel recycling plant for 2% (1). The security agent's management of the situation reported by 47 respondents included questioning for 81% (38), allowing them to proceed without a change in travel plans for 57% (27), requesting documentation of the therapy for 55% (26), rescanning for 55% (26), calling a member of the treating team for validation for 17% (8), "strip" searching for 4% (2), detaining such that a change in travel plans was required for 6% (3), and prohibiting continued travel for 4% (2). The period of detainment reported by these 47 respondents was less than 30 min for 57% (27), 30 to less than 60 min for 21% (10), 1 to less than 1.5 h for 15% (7), 1.5 to less than 2 h for 2% (1), 2–4 h for 0% (0), and greater than 4 h for 4% (2). Data regarding physician documentation are presented. **Conclusion:** The detection of radioactivity at a variety of security checkpoints at public facilities after^{131}I therapy occurred in approximately 10% of respondents. Travel inconvenience is not infrequent and may require alteration of travel plans. Physicians should take steps to ensure that patients not only have appropriate documentation of their ^{131}I therapy with them but also have instructions regarding how security agents may verify their ^{131}I therapy.

Key Words: ^{131}I therapy; differentiated thyroid cancer; security checkpoint; documentation

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Radioactive iodine (^{131}I) is important in diagnosis and therapy for many patients with differentiated thyroid cancer. Multiple articles have reported on the detection at airports, border crossings, and other public facilities of patients who have been administered diagnostic and therapeutic activities of radioactive agents (*1–15*). Of note, the security personnel are trying to prevent the criminal use of radiologic devices and are not trying to monitor or restrict the movement of patients emitting radiation from nuclear medicine procedures, but the detection of those patients is a well-documented phenomenon.

However, the frequency of detection at government and public facilities of patients who have been administered therapeutic activities of ^{131}I for differentiated thyroid cancer has not been reported. In 2007, the U.S. Nuclear Regulatory Commission (NRC) reported on how frequently written documentation and counseling were provided to patients who were administered diagnostic and therapeutic activities of radioisotopes. The inspectors interviewed 11 radiation safety officers, 9 authorized users (physicians), 12 physicists, 43 nuclear medicine technologists, and 14 managerial staff. However, no patients were interviewed (*16*). Siegel and Marcus (*10*) raised the concerns that this survey was an exploratory survey and that physicians and other professionals may overestimate the frequency with which appropriate instructions and documentation of the administration of a radioisotope are given. Hence, it was suggested that surveys of patients rather than of physicians or other professionals should be performed.

The objective of this study was to determine through a national survey of patients the overall frequency of detection at U.S. public facilities of patients who had been administered ^{131}I for the therapy

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of differentiated thyroid cancer, the types of public facilities, the frequency per public facility, the various methods of management of the situation by security agents, and the spectrum of physician documentation of ^{131}I therapy for patients.

MATERIALS AND METHODS

Survey Design

The survey was developed by a team involving 2 nuclear medicine physicians, 3 endocrinologists, 3 patients who were treated with ^{131}I, 1 statistician, and 1 professional survey developer. Five patients with differentiated thyroid cancer that had been previously treated with ^{131}I completed a trial survey, and modifications to the survey were made on the basis of their comments. The survey was administered via a web-based, commercial survey management service (SurveyMonkey).The survey was composed of questions regarding multiple baseline demographic characteristics, the type of public facility that the patient attempted to cross, whether the patient was detained for detected radioactivity, the management of the situation by security agents, and the documentation that the patient had received after ^{131}I therapy. The survey questions are available in Supplemental Table 1 (supplemental materials are available at http://jnm.snmjournals.org).

Question Design

Most of the questions required the selection of a single best response from multiple choices. The option "Select all that apply" was included when more than 1 answer could be provided. Several questions allowed additional free text comments. To encourage survey participation and completion, the survey was designed to be brief and easily comprehensible; it consisted of 15 questions and was designed to be completed in less than 10 min.

Target Cohort and Response Collection

The web link to the survey was emailed to approximately 15,000 Thyroid Cancer Survivors' Association, Inc., members. Survey responses were anonymously collected and stored electronically by the online survey service and were accessible in a password-protected manner. Repeat submissions from the same internet protocol address were automatically blocked by the survey service. Each patient was asked to respond only for the last ^{131}I therapy, and the response "don't remember" was excluded from the analysis. The survey website was open to respondents from December 2013 to December 2014. This study was approved by the Institutional Review Board at MedStar Health, and a waiver for informed consent was obtained because the data were anonymously collected and deidentified.

Statistical Analysis

Summary statistics were prepared for responses to each question. Because not all participants responded to all of the questions, the percentage of respondents providing a specific answer was calculated individually for each question, using the number of respondents to that specific question as the denominator.

RESULTS

Baseline Characteristics

The median age of the 621 participants who responded to the survey was 47 y (Fig. 1A). Eleven percent of the respondents (69/608) were male, and 89% (539/608) were female. All respondents (621/621) had been treated with ^{131}I. Forty-seven participants provided the prescribed activity of ^{131}I that they received for their therapy (Fig. 1B).

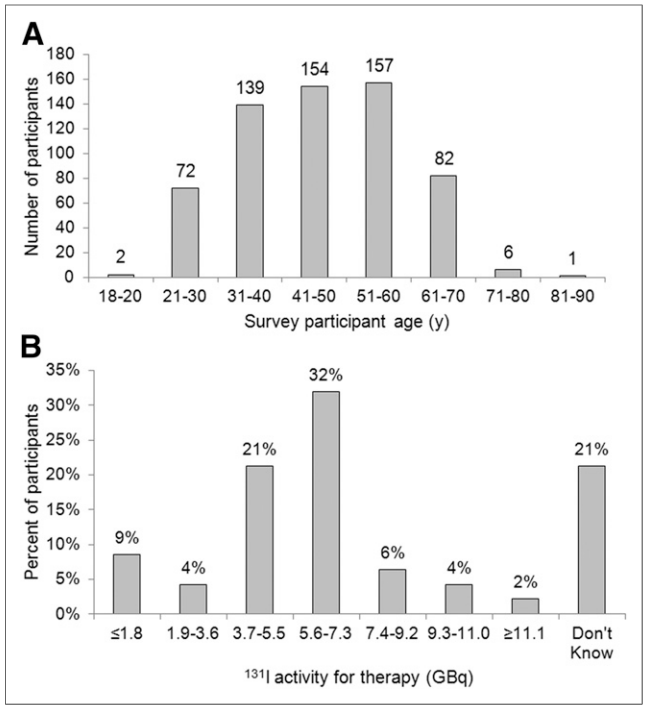

FIGURE 1. Baseline characteristic of survey participants. (A) Age of participants. (B) ^{131}I activity, as reported by participants.

Security Checkpoints

Ninety-six percent (595/621) of the respondents reported that they attempted to pass through a public facility checkpoint. Of these 595 patients, approximately 10% (57/595) were detected as being radioactive and were detained for that reason at a facility checkpoint. These 57 respondents replied that they attempted to pass through a security checkpoint a total of 117 times (Fig. 2A) within 4 mo of their most recent ^{131}I therapy. Moreover, of the 57 respondents, 47 replied that they were stopped a total of 65 times at a security checkpoint because radioactivity was detected (Fig. 2B). Thus, patients who reported that they attempted to pass through a security checkpoint more than once were stopped at least 55.6% (65/117) of the time.

Types of Security Checkpoints

The complete list of public facilities and the number of respondents who were stopped because of the detection of radioactivity at security checkpoints are shown in Table 1. Approximately 10% (57/595) of the respondents who attempted to pass through a public facility checkpoint were identified as being radioactive; for the 43 respondents who reported the type of facility at which they were stopped, the facilities were as follows: airport for 35% (15/43), border crossing for 33% (14/43), government building for 19% (8/43), shopping mall for 7% (3/43), train station for 5% (2/43), and steel recycling plant for 2% (1/43).

Management of Detained Patients by Security Agents

More than half of the respondents stopped at security checkpoints (57.4%; 27/47) were detained for less than 30 min. A total of 21.3% (10/47) of the respondents were detained for 30 min to less than 60 min, 14.9% (7/47) were detained for 60 min to less than 90 min, 2.1% (1/47) were detained for 90 min to less than 120 min, and 4.3% (2/47) were detained for more than 4 h. Security personnel questioned 81% (38/47) of the respondents,

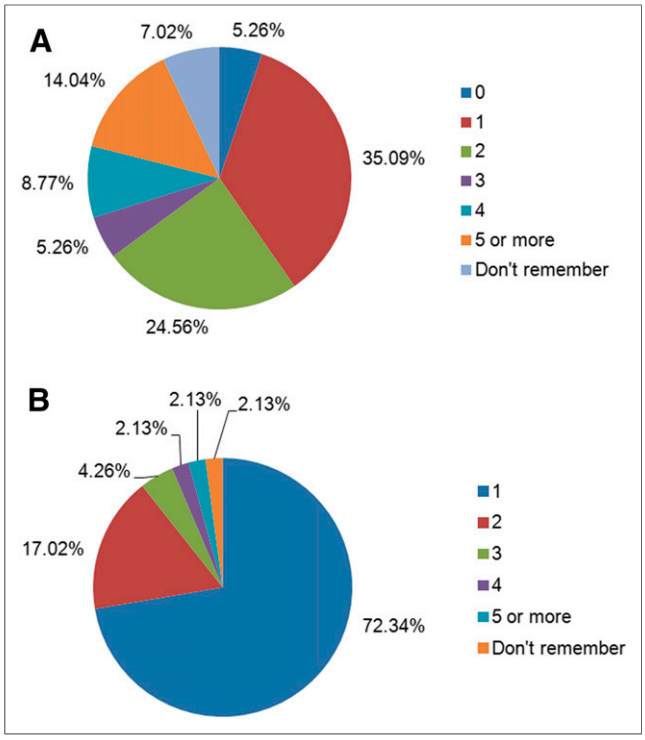

FIGURE 2. Distribution of attempts to pass through and being stopped at security checkpoint. (A) Number of attempts (from total of 117 attempts) to pass through security checkpoint within 4 mo of most recent ^{131}I therapy, as reported by 57 respondents. Of those 57 respondents, 47 replied that they were stopped 65 times at security checkpoint because of detection of radioactivity. (B) Exact times 47 participants were stopped.

allowed 57% (27/47) to proceed without a change in travel plans, requested documentation of the therapy from 55% (26/47), rescanned 55% (26/47), verified the therapy for 17% (8/47), initiated a "strip" search for 4% (2/47), detained 6% (3/47) (leading to a change in travel plans), or prohibited continuation of travel for 4% (2/47). Most of the 47 respondents thought that the security personnel interacted with them politely, professionally, and with complete respect for their privacy (Table 2). However, 9%–19% of the respondents did not agree that the security personnel interacted with them politely (11%), professionally (9%), or with complete respect (19%).

The security agents used various methods to verify that a detained individual was treated with ^{131}I. The security agents asked for official documentation from the detained individual's treating physician for 56% (24/43) of the respondents, called the treating facility for 7% (3/43), and called the physician's office/radiation safety office for 2% (1/43). On the contrary, in 28% (12/43) of the cases, the security agents did not verify the ^{131}I therapy in any reported way.

Patients' Receipt of Documentation of ^{131}I Therapy

Most participants (71.8%; 440/613) responded that their physician provided them with a document stating that they had received ^{131}I therapy. However, 20.9% (128/613) of the respondents reported that their physician did not provide any kind of documentation, and 7.3% (45/613) did not remember whether they received documentation. When provided, this document included the patient's name for 84.0% (356/424) of the respondents, the treating physician's name for 71.5% (303/424), the treating physician's telephone number for 64.9% (275/424), the type of radioactive iodine administered for 76.7% (325/424), the prescribed activity of ^{131}I administered for 66.0% (280/424), and the date on which the ^{131}I was administered for 79.2% (336/424). A total of 15.1% (64/424) of the respondents did not remember, and 8.0% (34/424) responded that some other information was included but did not specify further.

DISCUSSION

Multiple publications have reported that patients who were administered a radioisotope were subsequently detected and detained for triggering radiation alarms in various government and other public and private locations (*1–15*). As a result, many of the authors suggested that patients not only should be educated about the potential for being stopped at security checkpoints but also should receive documentation helping to verify the administration of a diagnostic or therapeutic quantity of a radioisotope.

A series of publications have been issued to provide regulation, guidance, and recommendations for the medical use of radioisotopes. In 2002, the NRC further expanded federal regulations and guidelines regarding licensed health care facilities releasing patients who have been treated with unsealed byproduct material (*17*). In 2003, the NRC published a notice emphasizing that patients who have received medical administrations of radioisotopes should be aware of the likelihood that they may trigger radiation alarms (*18*). The NRC recommended voluntary actions that licensees could take with every released patient who contained detectable amounts of radiation after receiving diagnostic or therapeutic quantities of radiopharmaceuticals or brachytherapy implants. These actions included explaining to patients the potential for triggering radiation monitoring alarms and providing them with written information for law enforcement agents. In November 2006, the Society of Nuclear Medicine (now the Society of Nuclear Medicine and Molecular Imaging) also recommended that patients obtain a letter from their health care providers explaining that they have undergone a nuclear medicine procedure; the Society also outlined the information that such a document should contain (*19*).

TABLE 1
Facilities at Which Participants Were Stopped Because of Detection of Radioactivity

Facility	% of participants	No. of participants
Airport	35	15
Border crossing	33	14
Government building	19	8
Shopping mall	7	3
Train station	5	2
Nongovernment building	2	1
Bus station	0	0
Tunnel	0	0
Ferry dock	0	0
Stadium	0	0
Total		43

TABLE 2
How Security Personnel Interacted with Participants During Their Detainment

How security personnel interacted with participants	Rating by participants										Total no. of responses
	Strongly agree		Agree		Neutral		Disagree		Strongly disagree		
	%	No.	%	No.	%	No.	%	No.	%	No.	
Politely	53.2	25	23.4	11	12.8	6	8.5	4	2.1	1	47
With complete respect for my privacy	44.7	21	23.4	11	12.8	6	8.5	4	10.6	5	47
Professionally	50	23	26.1	12	15.2	7	4.3	2	4.3	2	46

In 2007, Katz and Ansari (*16*) reported the results of a survey of licensees regarding "the process of patient education related to radiopharmaceutical administration, including consent procedures, pre- and postadministration counseling, and any other relevant verbal written communication." The survey was performed by NRC inspectors, and as Katz and Ansari (*16*) noted, "... respondents may have been inclined to present their facilities in the best possible light because of concerns that a 'wrong' answer might adversely affect the inspection results." Of 66 facilities interviewed, 65% (43/66) provided some form of documentation to patients and 32% (21/66) were prepared to provide it on request.

Our survey evaluated the responses from patients, and 71.8% (440/613) responded that their physicians provided them with a document stating that they had received ^{131}I therapy. The 65% reported by Katz and Ansari (*16*) and the percentage that we report seem comparable; there may be a trend suggesting slightly improved compliance of licensed physicians or their representatives in giving patients documentation of the therapeutic administration of ^{131}I. However, this response represents only approximately 72% of the total number of patients who were administered ^{131}I and responded to the survey and does not address the frequency of documentation of administrations of other therapeutic or diagnostic radioisotopes.

Our study has several strengths. First, the fact that the responses were from patients eliminates the response bias of licensees trying to portray their facilities in a positive light. Second, to our knowledge, the number of responses is from the largest number of patient participants to date. Third, the survey assessed not only the frequency and location of detection of patients treated with ^{131}I but also the contents of the ^{131}I therapy documentation and the management of the situation by security agents. Despite the slightly elevated female-to-male ratio of the respondents relative to the ratios typically found in treatment, we believe that the sample was representative and did not contribute to any bias regarding the results of the study or bias on the part of the security guards.

However, our study also has several limitations. As with any survey, a limitation is recollection bias. In addition, it is possible that patients who were detected and detained would be more likely to complete the survey than those who were not detected and detained. This scenario could lead to the bias of a falsely elevated frequency of detection. However, since this survey was completed, we speculate that the number of facilities screening for radioactivity and the frequency of patients being detected and detained have increased, potentially reducing the magnitude of such bias. Despite the fact that the survey provided data regarding the activity of ^{131}I administered to the respondents as well as the recent administration (within 4 mo of the detection of radioactivity), no further relationship (dose–time) analysis of the outcomes of the survey could be performed.

Another limitation was the small number of questions because of the objective of minimizing survey fatigue—an important factor affecting the number of individuals who respond to and complete a survey. Moreover, it was not feasible to study whether the quality of the documentation provided by the treating team was another factor that caused an increased number or length of delays, because the study was anonymous and the documentation was not available to the authors for review. However, the survey addressed whether key features (such as a physician's name and telephone number) were included in the documentation, when provided. Finally, and as already noted, the present study did not survey patients who received other radioisotopes—only therapies with ^{131}I. Specific locations at which the patients were detected and detained were not reported because of national security concerns.

To maintain national security while minimizing inconveniences to patients–travelers as much as possible, we believe that treating teams, patients, and security teams each have a role. First, and at a minimum, a treating team should educate patients regarding security checkpoints, and all patients should receive a certificate documenting their ^{131}I therapy (Table 3). We suggest that this certificate should include the following: cautioning patients about the potential to be detained at security checkpoints and that detainment can occur many months after ^{131}I therapy, educating patients about the wide spectrum of security checkpoints, and preparing patients to be better able to address such detainment. We also recommend that the document contain the following statement: "Radiation received by the patient presents no immediate danger to the public, and therefore the patient is allowed in public spaces without restrictions per the Nuclear Regulatory Commission medical use regulations." In addition, the treating team should establish a mechanism by which any security agent can contact the treating facility at any time to help validate the legitimate claim of ^{131}I therapy. All documentation should be on the therapy facility's official letterhead. Finally, all physicians should ask patients to sign a Health Insurance Portability and Accountability Act release form allowing the staff of the treating facility to validate

TABLE 3
Suggested Content of Patient Documentation

Included categories	Specific points in each category
Patient	Name
	Date of birth
	Age
	Sex
Therapy	Name of nuclear medicine procedure/therapy
	Date of procedure/therapy
	Radioisotope that was used
	Half-life of radioisotope
	Amount of activity administered
Treatment physician and facility	Name of treating physician
	Name and address of treating facility
Instructions for how security agent may confirm patient's ^{131}I therapy	24-h contact number of member or representative of treating team

their ^{131}I therapy in response to any telephone inquiry by a security agent.

Patients can help reduce inconvenience and possibly reduce significant detainment by doing the following. First, they should allow enough time for potential detection and detainment. They should ensure that the information in Table 3 is in their documentation, which should also include a contact person for verification. They should carry documentation of ^{131}I therapy everywhere they go—not just for traveling on public transportation or crossing borders but also for entering government, public, and private buildings. Although no precise time can be given for how long patients should carry documentation, the longer the better—perhaps 4–6 mo. Patients have been detected as being radioactive for up to 95 d after their ^{131}I therapy (*3*). Conversely, patients should be advised not to present such documentation and information unless requested by security personnel to avoid raising undue concern.

Security agents should be aware of medical use radioisotopes triggering alarms in radiation detection systems, have the ability to determine the spectrum of isotopes to identify which radioisotope is being detected, and have the ability to determine whether the spectrum is consistent with the documented nuclear medicine procedure. Security agents should ask for documentation and, when necessary, should validate the history with the therapy team. Although none of these steps is foolproof, they can help facilitate the process and can help differentiate the legitimate use of medical radioisotopes from radioisotopes that might be used with criminal intent. Finally, security agents should also be aware that an individual who did not have therapy with ^{131}I may still trigger a radiation detection alarm. A person who resides in close proximity to someone who has had ^{131}I therapy could be contaminated. Although this contamination should not be a radiation safety risk to other individuals in the public, it may set off radiation detection alarms, as reported by Sinzinger et al. (*12*). With the information from a patient's documentation, the ability to determine the radioisotope(s) and, if necessary, validation of the radioisotope therapy with the treating team, the security agent should be able to help verify that a patient has received a medical diagnostic or therapeutic radioisotope that has no potential harm for the public. However, further additional methods to improve the validation of an individual's claim of recent ^{131}I therapy or the administration of any other diagnostic or therapeutic radioisotope(s) are warranted.

CONCLUSION

Many public and private facilities may have security checkpoints that may screen for radioactivity; these security checkpoints can be in airports, border crossings, train stations, government buildings, factories, landfills, theaters, concert halls, and many other locations. A significant percentage of patients treated with ^{131}I (as high as 10% of the respondents in our survey) may be detected as being radioactive and stopped at any of the aforementioned checkpoints.

Although most physicians give their patients a signed document stating that the patients have been treated with ^{131}I, some facilities and physicians still do not. Further improvement is necessary; perhaps a statement signed by a patient acknowledging that he or she has received such a document should be kept in the patient's medical record. Although some physicians designate a contact person with whom a security agent may verify that the patient has been treated with ^{131}I, some do not. If a patient plans to travel on public transportation, cross country borders, enter government buildings or other facilities, the patient and his or her physician should take steps to ensure that the patient carries appropriate documentation and has alternative methods for the verification of ^{131}I therapy.

DISCLOSURE

Douglas Van Nostrand is a speaker and consultant for Jubilant DraxImage. No other potential conflict of interest relevant to this article was reported.

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