Iodine-131 Therapy of Thyroid Cancer: Extensive Contamination of the Hospital Room in a Patient with Tracheostomy

TO THE EDITOR: Radiation safety precautions for hospitalized patients receiving ^{131}I therapy are well established (*1–3*). Contamination generally is related to excreted radioiodine in the urine, sweat and saliva (*4*). Routine measures to minimize contamination include proper toilet use to avoid spilling of urine, frequent showers and handwashing to decrease skin activity, segregation of eating utensils and cups and the covering of telephones for activity in the saliva. Contamination of the floor and other surfaces in the room is common, secondary to radioiodine in the saliva and skin, but generally is not significant enough to pose a radiation safety problem. Herein we describe the effects of tracheostomy and the added contribution of tracheobronchial secretions on room surface contamination following radioiodine therapy for thyroid cancer.

A 62-yr-old female underwent thyroidectomy for locally invasive thyroid cancer, shown by histopathological examination to be a follicular variant of papillary carcinoma. Subsequently, rapid regrowth of the tumor necessitated tracheostomy and a second thyroid resection approximately 4 mo after the first. Because of the aggressive nature of the tumor, the second resection was followed by radioiodine treatment.

The patient was admitted to a private room 2 days prior to radioiodine treatment. She had excessive tracheobronchial secretions which required periodic suctioning and caused her to cough and clear her throat frequently. Instructions on radiation precautions were given to the patient and the nursing staff and, prior to the administration of the therapeutic radioiodine dose, all areas of potential contact were covered with absorbent material. These included the night table, the meal server, the toilet seat and areas of the floor around the toilet. She did not have a telephone. After posting the required radioactivity symbols and emergency procedures and obtaining baseline thyroid counts of the physicist and physician involved in administering the dose, 7400 MBq (200 mCi) of sodium ^{131}I in a single capsule was administered to the patient.

Soon after administration, it became apparent that there was significant floor contamination and steps, including the use of shoe covers, were taken to prevent the spread of radioactive contamination outside of the room. The patient's medical condition necessitated extension of her hospital stay to a total of 11 days.

After the patient's discharge from the hospital, the staff and the room were monitored for contamination. There was significant removable activity (350–2000 dpm) on the floor as measured by counting wipes taken with cotton swabs in a multi-sample NaI (Tl) well counter. The highest contamination levels were found at the bedside, entrance to the toilet room and the floor by the sink. In an attempt to remove the floor contamination, the room was thoroughly mopped using bleach and stock floor cleaning solution, but wipes taken after the moppings still showed removable contamination of 1000 dpm/100 cm^2, well above the recommended 200 dpm/100 cm^2 maximum (*5*). However, since the exposure using an ionization chamber (0.2 mR/hr) was significantly less than the 2 mR/hr limit (*6*), a decision was made to "lock in" the contamination by waxing the floor. This was done with several coats of wax and subsequent wipes showed no removable contamination. Other contaminated items, including the suction machine, night stand, dining table, chair, mop and waste basket, were placed in red bags and removed for decay to the nuclear medicine department for 12 wk (10 half-lives).

Treatment of thyroid carcinoma with ^{131}I is a very common procedure and over 10,000 such treatments are performed annually in the United States. Regulations and safety guidelines are outlined in a number of publications (*1–3,5,6*). While excretion of radioiodine via the urine, saliva and skin is well accepted (*4,7*), excretion in bronchial mucous secretions is not generally appreciated. That tracheobronchial secretion of radioiodine in the mucus does occur is suggested by the mucolytic effect of therapeutically administered (stable) iodides and an increase in lung uptake of ^{131}I in inflammatory conditions, presumably associated with increased bronchopulmonary secretions (*8*).

This case illustrates the potential for radioiodine contamination from tracheobronchial secretions in patients with a tracheostomy. The simple act of clearing the throat may expel radioactive droplets of sputum directly into the air. The particles then settle on the floor and other surfaces around the patient and may be difficult to remove, as illustrated in our case, rendering the room unusable for a period of time. It is conceivable that the contamination associated with our patient would be less severe if radioiodine therapy were given after the resolution of her pulmonary condition. However, even in retrospect, this would not have been possible because of the aggressive nature of her tumor and the added risk of tumor growth from prolonged endogenous TSH stimulation (resulting from withdrawal of exogenous thyroid hormone in preparation for radioiodine therapy) (*9*).

From the foregoing, it is clear that standard radiation safety precautions are inadequate in a patient with tracheostomy. Of particular concern is the contamination of the floor, and a number of measures may help minimize this problem. Some type of floor cover is obviously required. Plastic sheets may be effective, but may be difficult to walk on without slipping. Absorbent pads taped over all floor surfaces near the patient, including those by the bed, toilet and shower, probably are a superior alternative. Disposable shoe covers worn by all persons entering the room and discarded into a bag by the door upon leaving should help contain the activity within the room. Visitors probably should not be allowed to enter the room, especially during the first days after therapy. Additionally, measures aimed at reducing the droplet spread of radioactivity from the tracheostomy should be undertaken. Frequent suction can decrease the amount of secretions that are subsequently expelled into the air. Continuous use of an oxygenated humidification mask or tent placed over the tracheostomy, if feasible, may help localize the contamination. Lastly, covering the tracheostomy with gauze, particularly when coughing, may be an additional aid.

Previous studies have shown contamination of the room air, particularly in the first 24 hr after radioiodine therapy for thyroid cancer (*4*). We did not measure radioactivity levels in room air, although it is quite likely, because of the droplet spread of radioactivity, that room air contamination is higher in patients with a tracheostomy. While such levels of activity are not considered a health hazard, it may be prudent for hospital staff entering the room to wear disposable masks, in keeping with ALARA (as low as reasonably achievable) principles.

This case suggests an association between thyroid cancer treatment with radioiodine and a dramatic increase in room surface contamination due to a tracheostomy. Such contamination should be anticipated in advance and steps should be taken both to protect the floor and other objects in the room and to limit the release of radioactive droplets of sputum into the air.

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Strontium-89 for the Palliation of Bone Pain due to Metastatic Disease

TO THE EDITOR: There is a lack of data regarding the utility of strontium-89 (^{89}Sr) in relieving bone pain due to bony metastases from tumors other than prostate, breast and lung. Similarly, there are no data regarding the benefit of administering a second dose of ^{89}Sr to patients who failed to receive any significant pain relief from their initial therapy. To address these issues, a survey was mailed to all 136 members of the Therapy Council. There were 49 responses. Of the 49 physicians completing the questionnaire, 22 had treated patients with tumors other than prostate, breast and bone. They listed the tumor type and classified the response to therapy as none, partial and dramatic. The results are presented in Table 1. Seven of the 49 respondents had also administered a second dose of ^{89}Sr to patients who had failed to respond to the first dose. The tumor types and responses are presented in Table 2.

TABLE 1
Pain Palliation Following Strontium-89 Therapy in Patients with Tumors Other Than Breast, Lung and Prostate

Tumor type	Response		
	None	Partial	Dramatic
Bladder	–	1	–
Cholangiocarcinoma (Klatskin's tumor)	–	–	1
Colon	1	2	3
Eosinophilic granuloma	–	1	–
Esophageal	–	1	1
Liver	1	–	–
Lung	1	3	1
Lymphoma	2	–	–
Melanoma	1	–	–
Multiple myeloma	–	4	–
Neuroblastoma	1	1	–
Paget's disease of vagina	–	1	–
Renal Cell	2	3	–
Salivary	–	2	–
Sarcoma	2	1	–
Thyroid	–	2	2
Unknown primary	–	2	2

TABLE 2
Pain Palliation Following a Second Dose of Strontium-89 in Patients Who Failed to Respond to the Initial Treatment

Tumor type	Response		
	None	Partial	Dramatic
Breast	1	4	1
Lung	–	1	1
Prostate	2	11	–

Although the survey consists of retrospective and uncontrolled data, the results seem to indicate that bone pain from tumors other than breast, prostate and lung can be alleviated by ^{89}Sr and that patients who fail to respond to an initial dose may benefit from a second treatment.

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Formulas to Estimate Renal Depth in Adults

TO THE EDITOR: I recently received a call pointing out that the coefficient for weight/height in the equation for the right renal depth as reported in the abstract of my recently published manuscript (*1*) was slightly different from the coefficient as reported in the results. When I reviewed the original data to determine the correct coefficient, I also discovered that the constant had an incorrect sign. The correct equation is the following: right renal depth (mm) = 151.3 weight/height + 0.22 age − 0.77 with weight in kg and height in cm. I apologize for the error. Fortunately, both formulas fit the data equally well, and there is no statistically significant difference between them.