

Additional Radiation Safety Concerns Involving Sodium Iodide-131 Capsules

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Objective: We studied the extent of ^{131}I contamination within absorbent packets of activated carbon that are enclosed in one manufacturer's packaging of ^{131}I therapeutic capsules.

Methods: Iodine-131 activity within the absorbent packets of ten ^{131}I capsules was measured 3–5 min after opening each container and over a one workday period.

Results: Initial ^{131}I activity of the absorbent packets ranged from 0.1% to 1.0% of the activity of the respective ^{131}I capsules. Follow-up measurements demonstrated rapid release of ^{131}I .

Conclusion: Absorbent packets used in the packaging of ^{131}I capsules are a source of ^{131}I contamination. They must be handled and stored properly to minimize potential internal exposure to the nuclear medicine staff.

Key Words: radiation safety; iodine-131; contamination

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Sodium iodide-131 has been shown to be volatile in both of its commercially available forms (1–6), solution and capsule. Iodine-131 capsules involve less handling and manipulating by nuclear medicine personnel, therefore, they are thought of as a lesser hazard when compared to ^{131}I in solution. We have studied the extent of ^{131}I contamination of the absorbent packets of activated carbon that are used in one manufacturer's packaging of ^{131}I therapeutic capsules (Fig. 1).

MATERIALS AND METHODS

Ten individually packaged ^{131}I therapeutic capsules and their absorbent packets were evaluated. Prior to the administration of the ^{131}I capsule(s) to the patient, the container that housed the ^{131}I capsule and the absorbent packet were opened under a fume hood. The container remained open in its shielding for 3–5 min. The absorbent packet was then removed and assayed in a dose calibrator on the ^{131}I setting. Then, the ^{131}I capsule was assayed. Additional assays of the absorbent packet were obtained over a

one workday period. Between assays, the absorbent packet was stored in a shielded, but not air-tight container in a fume hood.

RESULTS

Initial activity of the absorbent packets ranged from 0.07–18.8 MBq (2–507 μCi), while the ^{131}I capsules ranged from 57–3108 MBq (1.5–84 mCi), respectively (Table 1). The initial activity of the absorbent packet, expressed as a percentage of its associated ^{131}I capsule, ranged from 0.1%–1.0% (Table 1). The initial absorbent packet activity proportionally increased as the capsule activity increased, at a rate of 0.0064 MBq/MBq (6.4 $\mu\text{Ci}/\text{mCi}$) (Fig. 2). Follow-up assays demonstrated rapid release of ^{131}I from the absorbent packet within the first 20–30 min (Fig. 3, 4). After this time there was no appreciable loss of activity.

DISCUSSION

Sodium iodide-131 in solution has been reported as a source of internal intake by the staff handling volatile ^{131}I (2,7).

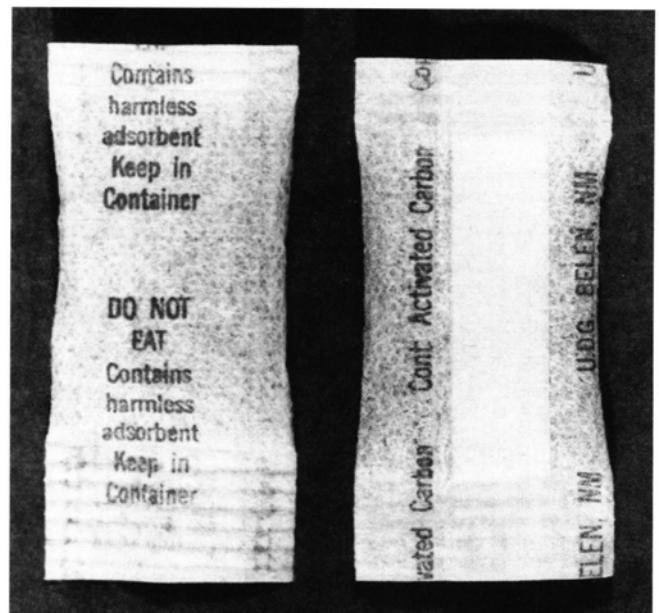


FIGURE 1. Absorbent packets (~16 × 34 mm) used in packaging of one manufacturer's ^{131}I capsules.

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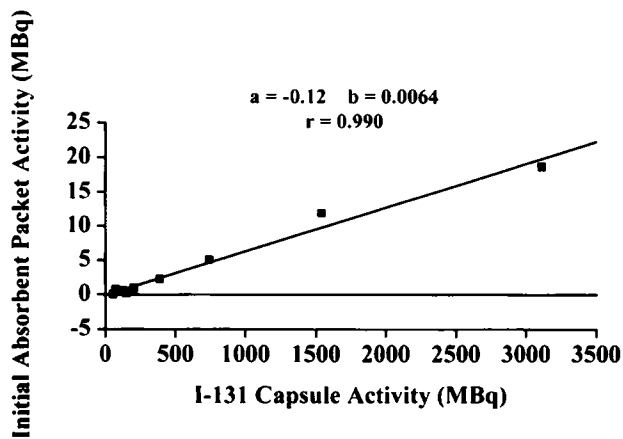


FIGURE 2. Initial ¹³¹I activity of capsules and absorbent packets.

External ¹³¹I contamination of lead and plastic or glass containers is another potential source of internal intake to the staff (8,9). Proper handling procedures for ¹³¹I and the patient should be used to minimize possible internal intake (1-3,8,10,11). Though ¹³¹I capsules are thought to be a lesser hazard than ¹³¹I in solution, they are still quite volatile (4,5).

TABLE 1
Comparison of Initial Activity of Absorbent
Packets (AP) and ¹³¹I Capsules*

Number	AP MBq (μ Ci)	Capsule MBq (mCi)	% AP/ capsule
1	0.07 (2.0)	57.0 (1.5)	0.1
2	0.8 (20.3)	74.0 (2.0)	1.0
3	0.6 (16.2)	126.5 (3.4)	0.5
4	0.2 (6.0)	152.8 (4.1)	0.1
5	0.5 (13.0)	195.4 (5.3)	0.2
6	0.9 (25.3)	202.8 (5.5)	0.5
7	2.3 (61.4)	388.5 (10.5)	0.6
8	5.1 (137.2)	740.0 (20.0)	0.7
9	12.0 (323.0)	1539.2 (41.6)	0.8
10	18.8 (507.0)	3108.0 (84.0)	0.6

*Based on actual assayed activity in μ Ci or mCi.

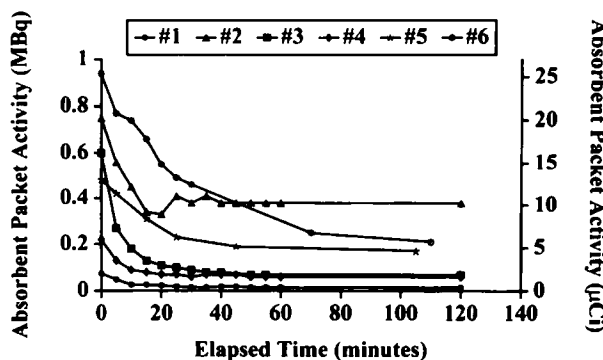


FIGURE 3. Release over time of ¹³¹I activity from absorbent packets one through six.

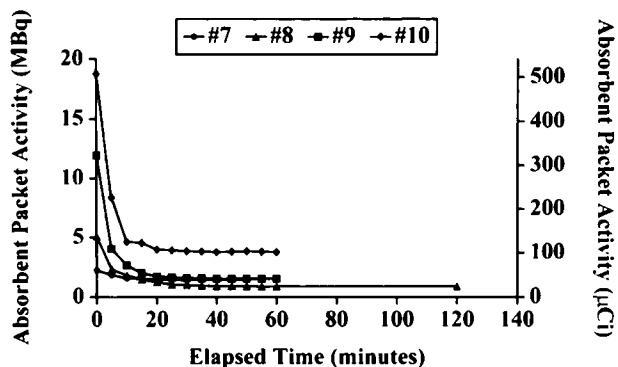


FIGURE 4. Release over time of ¹³¹I activity from absorbent packets seven through ten.

Our study demonstrated that the initial ¹³¹I activity within the absorbent packet was no greater than 1% of the activity of its associated ¹³¹I capsule. The absorbent packets were initially assayed 3-5 min after the ¹³¹I capsule containers were opened. This is our normal procedure to vent off any possible volatilized ¹³¹I in the container. Some ¹³¹I may have been released by the absorbent packets during this period since it was demonstrated that the absorbent readily releases ¹³¹I when exposed to open air. The ¹³¹I capsule and its absorbent packet should be handled carefully to limit possible internal intake by the nuclear medicine staff. Initially, all containers of ¹³¹I capsules should be opened under a fume hood and remain open for 5-10 min before assaying the ¹³¹I capsule. At this time, the absorbent packet should be removed from the container and kept shielded under the fume hood, labeled as radioactive waste.

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