

Isolation period of ^{131}I administered patients at nimra jamshoro Pakistan

Abstract

Objectives: Since 1940s, the clinical use of unsealed radioisotopes has been in practice and after that the radioiodine's oral administration became a gold standard for treating thyroid cancers. To protect the patients' family members/caregivers and general public from unacceptably high radiation exposures, the therapeutic dosage of ^{131}I administered patients are mandatory hospitalized in special isolation room until the exposure rate at one meter meets international and national limits. The current study was focused to measure the isolation duration of inpatients treated with radioiodine.

Material and methods: The current study presents the duration of hospitalization of patients treated with ^{131}I therapeutic dosages at Nuclear Institute of Medicine & Radiotherapy (NIMRA) Jamshoro, Pakistan from 2011 to 2013. Thirty Five patients (age range from 18 to 70years) with cancer of thyroid administered with different activities (50 to 200mCi (milliCurie)) of ^{131}I admitted in special isolated room at different times were included in this study.

Results: The results indicated that only one (2.86%) of total patients discharged from hospital within first 24hours of ^{131}I administration whereas 17(48.57%), 11(31.43%) and 3(8.57%) patients were hospitalized in isolation room for 48, 72 and 96hours after the administration of activity. Eleven percent of total isolated patients (n=4) stayed for 120 to 144hours at the hospital.

Conclusion: The stay duration of ^{131}I administered patients at NIMRA shows wide-ranging pattern. Due to rapid clearance of radioiodine from their bodies, more than half of patients stayed only 48hours.

Keywords: exposure, hospitalization, isolation room, radioiodine, stay duration

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Introduction

After the radioiodine production by neutrons bombardment on stable iodine by Enrico Fermi in the Ernest O. Lawrence's constructed cyclotron in 1930s,¹ the first usage of radioiodine for treating hyperthyroidism was done by Saul Hertz and Arthur Roberts in 1940s² since then it became the milestone for treatment of thyroid cancer. ^{131}I primarily emits 610keV β particle which initiate the emission of 364keV γ ray.³ As ^{131}I administered patients may likely be potential sources of adverse high radiation exposure to close family members/caregivers,⁴ so for protection of family members/caregivers and general public, the patients are discharged when the exposure rate level at one meter from the patients' body falls to tolerable levels.⁵⁻⁷ To regulate the discharge of hospitalized ^{131}I administered patients, numerous standards and policies have been established.⁴ The patients' releasing criteria is set to ensure that no family member/caregiver or general public receives exposures above the regulatory dose limits.^{3,5,8-11} This study was initiated to discuss the isolation period of inpatients treated with radioiodine.

Material and methods

The stay period of radioiodine administered patients solely depends upon the exposure rate measurement⁴ by which the dose to others may be minimized.^{12,13} If the administered radioiodine to the patient is more than 30mCi, isolated hospitalization is necessary until the reduction of residual activity to 30mCi or decline of the exposure rate to 50 $\mu\text{Sv/hr}$ (micro Sievert) at one meter from patient.^{14,15} Total 35, 71.43% (n=25) females and 28.57% (n=10) males treated with radioiodine at

Nuclear Institute of Medicine and Radiotherapy (NIMRA) Jamshoro from 2011 to 2013 were included in the current study. The ages of patients were from 18 to 70years and the administered activities of ^{131}I were from 50mCi to 200mCi. Data of patients (age, sex, activity administered, date and time of ^{131}I administration) were recorded.^{4,16} Exposures rates at one meter from patients' bodies on the first day (at the time of activity administration), then consecutive days until the patients' hospital discharging day^{3,9,17} were done with calibrated RM1001-RD LAMSE survey meter. Oral and written instructions about patients' isolation at hospital and at home were given for minimization of dose to others.^{4,5,9,16,18-20} The instructions were

- During hospital stay, the patient will be alone in the isolated room;
- Family members/caregivers will be allowed for very short span of time for providing meals and water to the isolated patient;
- Ensuring increased liquids intake;
- Lemon/orange candies chewing to minimizing salivary glands dose;
- Lactating mothers advised to complete cessation of breast milk to their babies to prevent radioiodine excreted to the babies;
- Pregnancy avoidance for 4-6months period after radioiodine administration;
- Keeping maximum distance from family members/caregivers and general public, separate sleeping arrangements, avoiding of public transport travel and visiting public places (grocery stores, shopping centers, restaurants and theatres);

h. Instructing the patients and their caregivers to follow the instructions at home as maintained in isolation after discharge for one to two weeks for reduction of caregivers’/family members’ dose.

The patients’ releasing criteria from hospital’s isolation room was based on international and national regulatory agencies,^{4,5,10,11,16} that indicate that the patients may be discharged from hospital as exposure rate drops below 50µSv/hr at one meter²¹ and this limit is PNRA’s regulatory requirements;⁵ however, to avoid radiation dose to family members/caregivers, most patients were discharged from the hospital at exposure rate around 20-30µSv/hr.

Results

Amongst 35 patients who have administered ¹³¹I, 2.86% (n=1) stayed for just 24hours in isolation room whereas 48.57% (n=17), 31.43% (n=11) and 8.57% (n=3) patients were stayed in isolation room at NIMRA for 48, 72 and 96hours after the administration of radioiodine respectively. Remaining 4 patients (11.43%) stayed for 120 to 144hours at the hospital as shown in Figure 1.

Continuous reduction in exposure rate shows the radioiodine excretion from the patients and we observed a mixed pattern of patients’ exposure rates. The exposure rate of radioiodine patients dropped to around initial exposure rate’s 50% within first 24hours, and after each succeeding 24 hour period, the exposure rates dropped to 16.35%, 11.70% and 9.77% as expressed in Figure 2.

Overall, more than 80% fall in the initial exposure rate was recorded during patients’ stay at the hospital in all patients. From daily exposure rate measurements, the doses of caregivers during patients’ stay (providing meals and water to patients in a minute time span) were estimated from 0.0517 to 0.2125mSv (average 0.132mSv) and the majority of caregivers (more than 80%) received doses between 0.03mSv and 0.09mSv.

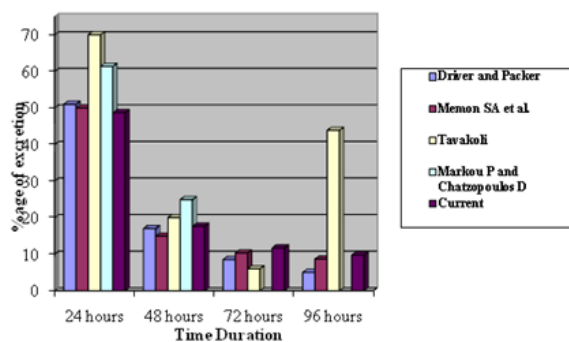


Figure 1 % age of excretion of ¹³¹I activity from patients as studied in different studies including current.

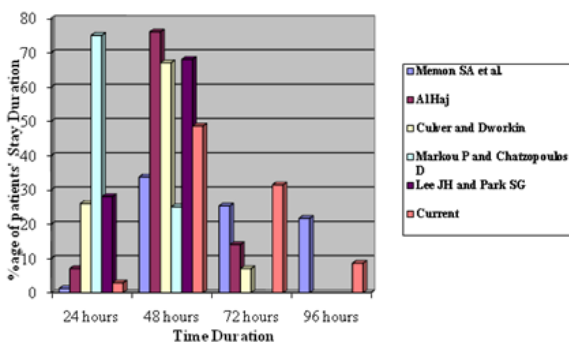


Figure 2 % age of ¹³¹I administered patients’ stay duration from different studies including current.

Discussion

The stay of patient in isolation room at the institute depends on many factors⁴

- a. Activity administered,
- b. Removal of activity from the patient,
- c. Behavior of exposure rate.

The hospitalization of patient in isolation room for a 1-3days or more till fall of the radioactivity in their bodies or the exposure rate at one meter to acceptable levels play major role to avoid unsuitable high radiation exposure to patients’ family members/caregivers.^{9,22} The radioiodine uptake and exposure rate differs from patient to patient so their stay at hospital may differ also. The exposure rate, patients’ socioeconomic conditions and institution’s available resources must be considered as the majority of patients are financially poor and the institution has limited resources.^{4,23} The studies^{3,4,15,24-38} on

- a. % age excretion of ¹³¹I activity by researchers and,
- b. Dose to caregivers/family members including current study are summarized in Table 1 & 2.
- c. The studies conducted by Driver & Memon^{3,4} and current study reveals that clearance of ¹³¹I from patients’ bodies is about 50% in first 24hours where as 30% to 75% radioiodine excretion in first 24hours observed by Tuntawiroon et al.,²⁵ Parthasarathy et al.²⁶ Tavakoli²⁷ reported that about 70% of activity cleared within first 24hours. The study conducted by Markou P et al.²⁸ indicated that more than 60% of administered activity excreted within first 24hours whereas 50-60% excretion administered activity was studied by Hamizah NMZ et al.²⁹ in the first 24hours. Table 1 concludes that in all studies the excretion rate of ¹³¹I activity from patients is more than 75% within 72hours of activity administration. Figure 1 shows the %age excretion of ¹³¹I activity from isolated patients at NIMRA Jamshoro Pakistan.

Table 1 Summary of studies including current for % age of excretion of ¹³¹I activity from patients

Study	% Age of excretion ¹³¹ I activity from patients			
	24hours	48hours	72hours	96hours
Driver et al. ³	51	17	8.5	5
Memon SA et al. ⁴	50	14.95	10.32	8.67
Thompson MA ¹⁵	80			
Massimiliano P et al. ²⁴	80			
Tuntawiroon M et al. ²⁵	30 to 75			
Parthasarathy et al. ²⁶	30 to 75			
Tavakoli ²⁷	70	20	6	
Markou P et al. ²⁸	61.37	24.9		
Hamizah NMZ et al. ²⁹	50-60			
Current	48.7	17.65	11.7	9.77

Table 2 shows the radiation dose levels to family members/caregivers of radioiodine patient which pointed out that the doses to

masses in various studies^{4,30–38} including current report were in the magnitude of annual limit to general public (1mSv) which wrapping up that the patients treated with ¹³¹I do not share a significant radiation dose to the public.^{4,16,39} Table 3 presents the data of patients' stay at hospital including current study. Memon SA et al.⁴ studied that stay duration of only 1.2% patients was 24hours and 33.73%, 25.3% & 21.67% were discharged from hospital after 48, 72 & 96hours. Al Haj⁹ revealed that only 7% of the total patients were stayed just for 24hours where as 76% and 14% of patients stayed for 48 and 72hours. Culver et al.²¹ reported that 26% of the treated patients were released after 24hours from hospital whereas 67% and 7% were stayed for 48 and 72hours respectively, Markou P et al.,²⁸ studied that 75% of patients stayed for 48hours and only 25% discharged from hospital within 72hours. The study commenced by Lee JH et al.⁴⁰ reveals that 28% of patients discharged from hospital within 24hours whereas stay of 68% patients in hospital was 48hours. This study expressed that the patients' stay at the hospital were in the magnitude of 2.86% for 24hours whereas 48.57%, 31.43% and 8.57% of patients discharged after 48, 72 and 96hours respectively. Figure 2 indicates the data of patients' stay duration at NIMRA Jamshoro Pakistan.

Table 2 Different studies for dose to caregivers/family members of ¹³¹I administered patients

Study	Average dose to caregivers/ family members msv
Memon SA et al. ⁴	0.134
Grigsby et al. ³⁰	0.55
Willegaignon J et al. ³¹	<1
AlMaskery et al. ³²	<1
Rutar et al. ³³	2.13
Tonnonchiang et al. ³⁴	<1
Marriott et al. ³⁵	0.283
Sapienza MT et al. ³⁶	<1
Reiners C et al. ³⁷	<1
Cappelen T et al. ³⁸	<1
Current	0.132

Table 3 Studies regarding % age of stay duration of ¹³¹I administered patients

Study	% age of patients' stay duration			
	24hours	48hours	72hours	96hours
Memon SA et al. ⁴	1.2	33.73	25.3	21.67
Al Haj ⁹	7	76	14	
Culver et al. ²¹	26	67	7	
Markou P et al. ²⁸	75	25		
Lee JH et al. ⁴⁰	28	68		
Current	2.86	48.57	31.43	8.57

Conclusion

Like other studies,^{4,9,21,28,40} the present study as well shows the mixed behaviour for stay of radioiodine administered patients concluding that more than 50% of hospitalized patients discharged within first 48hours of administration of radioiodine.

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Conflict of interest

Author declares that there is no conflict of interest.

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