

# Treatment of Hyperthyroidism With Iodine-131

Pages with reference to book, From 29 To 33

Sbeeda Asghar, Mumtaz-ul-Haq, Maqbool Ahmad Shahid ( Atomic Energy Nuclear Medicine Centre, Mayo Hospital, Lahore. )

## Abstract

A retrospective study of radiolodine therapy for thyrotoxicosis was done in 402 patients over a period of 10 years from 1963 to 1972. The patients were classified as follows:

- (1) Age
- (2) Sex
- (3) Size of the gland estimated by physical examination
- (4) Type of goitre (diffuse, nodular)
- (5) Ocular signs
- (6) Number of doses and
- (7) Total dose of I-131 administered.

The usual age for the treatment was 30 to 60 years with a mean ( $\pm 1$  s.d.) of  $42.7 \pm 8.6$ . Female patients were 73% and male 27%. The most common age group for female patients was from 31 to 40 years and for males from 41 to 50 years. The end results were euthyroid, hypothyroid and hyperthyroid states. About 6% of the cases developed permanent hypothyroidism, very few cases stopped treatment while they were still hyperthyroid and rest of them became euthyroid. The ocular symptoms associated with hyperthyroidism were relieved in 64.2%, not relieved in 31.3% and aggravated in 4.5% after I-131 treatment (JPMA 32:29, 1982).

## Introduction

The major function of the thyroid gland is to concentrate iodide from the circulation and convert it along with the aminoacid tyrosine to the hormones thyroxin and triiodothyronine. Significant advances in understanding basic physiology and biochemistry of the thyroid gland have resulted from wide spread experimental and clinical use of radioactive iodine. Iodine-131 metabolically duplicates the pattern of normally occurring stable iodine (Iodine-127) Iodine-131 has been exploited in getting diagnostic information I-131 uptake and thyroid scan and in therapy of the patients with hyperthyroidism and thyroid cancer. This isotope is the most useful tool for the investigation and treatment of thyroid disease (Blaht, 1971).

We studied the effects of iodine-131 treatment in 402 patients of hyperthyroidism, over a period of 10 years from 1963 to 1972 in the Atomic Energy Nuclear Medicine Centre, at Lahore.

## Material and Methods

A retrospective study of iodine-131 therapy of thyrotoxicosis was done in 402 patients over a period of 10 years. The patients were classified by the following (1) Sex (2) Age (3) Weight of gland estimated on the basis of physical findings (4) Type of goitre- diffuse, nodular (5) Ocular signs (6) Number of doses and (7) Total dose of I-131 administered. The findings obtained are discussed with special reference to the response and complications of radioiodine treatment. Age of the patients ranged from 30 to 60 years with mean age of  $42.7 \pm 8.6$ . Few cases were below 20 and none below the age of 10 years. 91.2% of the patients received from 1 to 20 mci with mean ( $\pm 1$  s.d.) of  $6.8 \pm 4.7$  and the dose given to all patients was 80 u curie retained/ gram which delivered a total dose of 7239 rads to the

thyroid gland. For patients requiring a second treatment, three months after the first, the new dose was calculated to deliver half of the first dose or modified according to the response of the patient. Each patient was followed closely at regular intervals of one and a half month. Each is evaluated, on the basis of history, physical examination,  $^{131}\text{I}$  uptake (1 hour, 3rd hour and 24th hour readings), thyroid scan and in some of the cases by PBI test (protein bound iodine test). Where all these factors were in the same direction, the final diagnosis was easy; when this was not the case, the final evaluation was based upon the consistent majority.  $T_4$  and  $T_3$  values were not being done in this Centre during 1963-72 period so these values were not estimated in the patients.

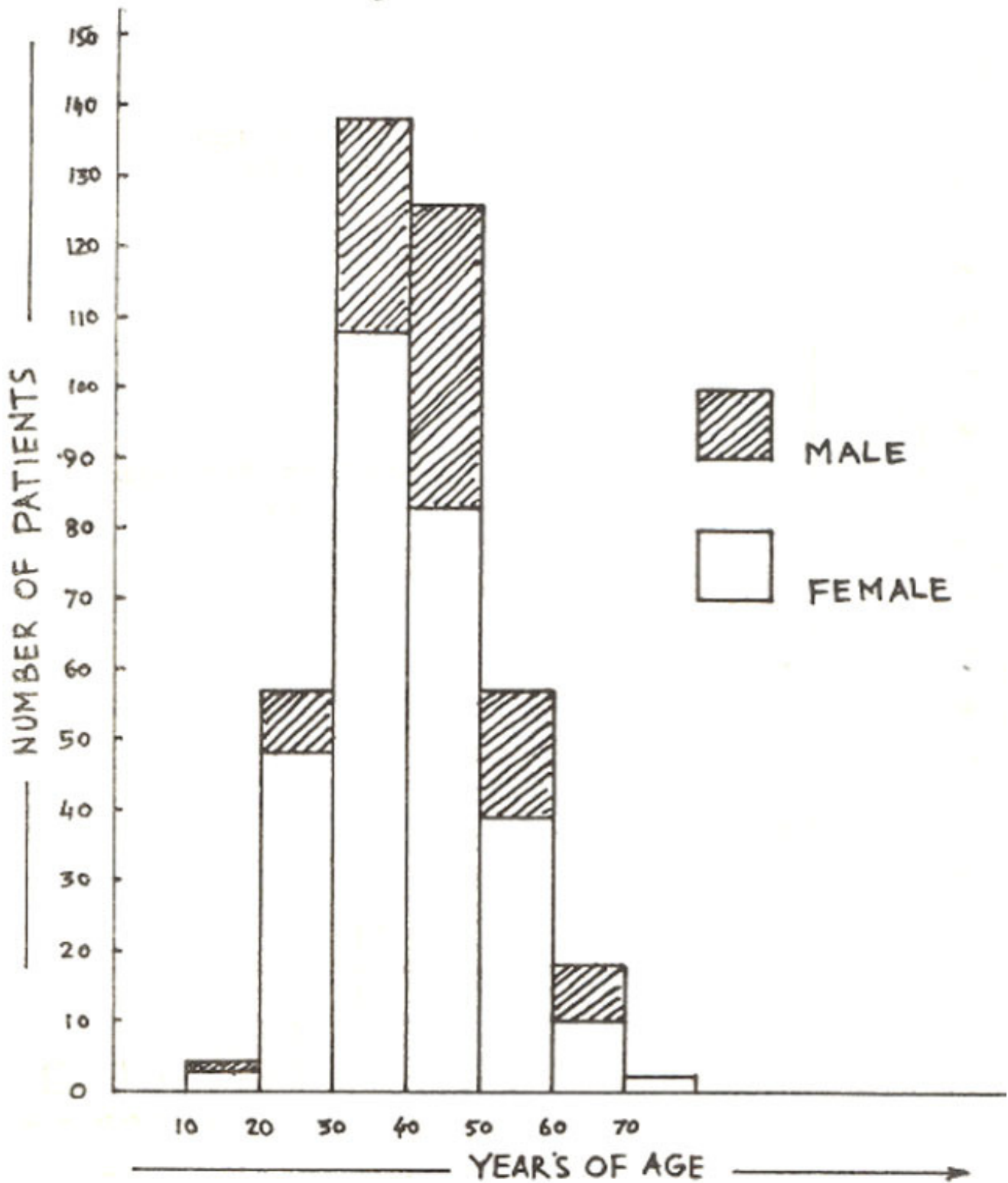
Five important factors enter into the pretreatment estimation of the therapeutic dose, but not all of these are measurable. First is the percentage of uptake of a tracer dose; second, the effective half life of the retained tracer dose radioactivity; third, the distribution of radioactivity within the gland; fourth, the weight and shape of the thyroid; and fifth the radiosensitivity of the thyroid cells. The effective or observed half-life is the time necessary for one-half of the radioactive - iodine to leave the thyroid. This variability in the turn over of labelled iodide in the thyroid could not be related directly to the severity or intensity of the patients illness. In addition, shifting biological factors, such as the distribution of radioactivity within the thyroid and the variable sensitivity of the thyroid cells of the individual patient, defeated any exact formulation of the dose.

## **Results**

Four hundred and two patients were treated with  $^{131}\text{I}$ . Their ages ranged from 30 to 60 years (Fig. 1).

Fig. 1

Distribution of Ages at the Time of Treatment of All Patients

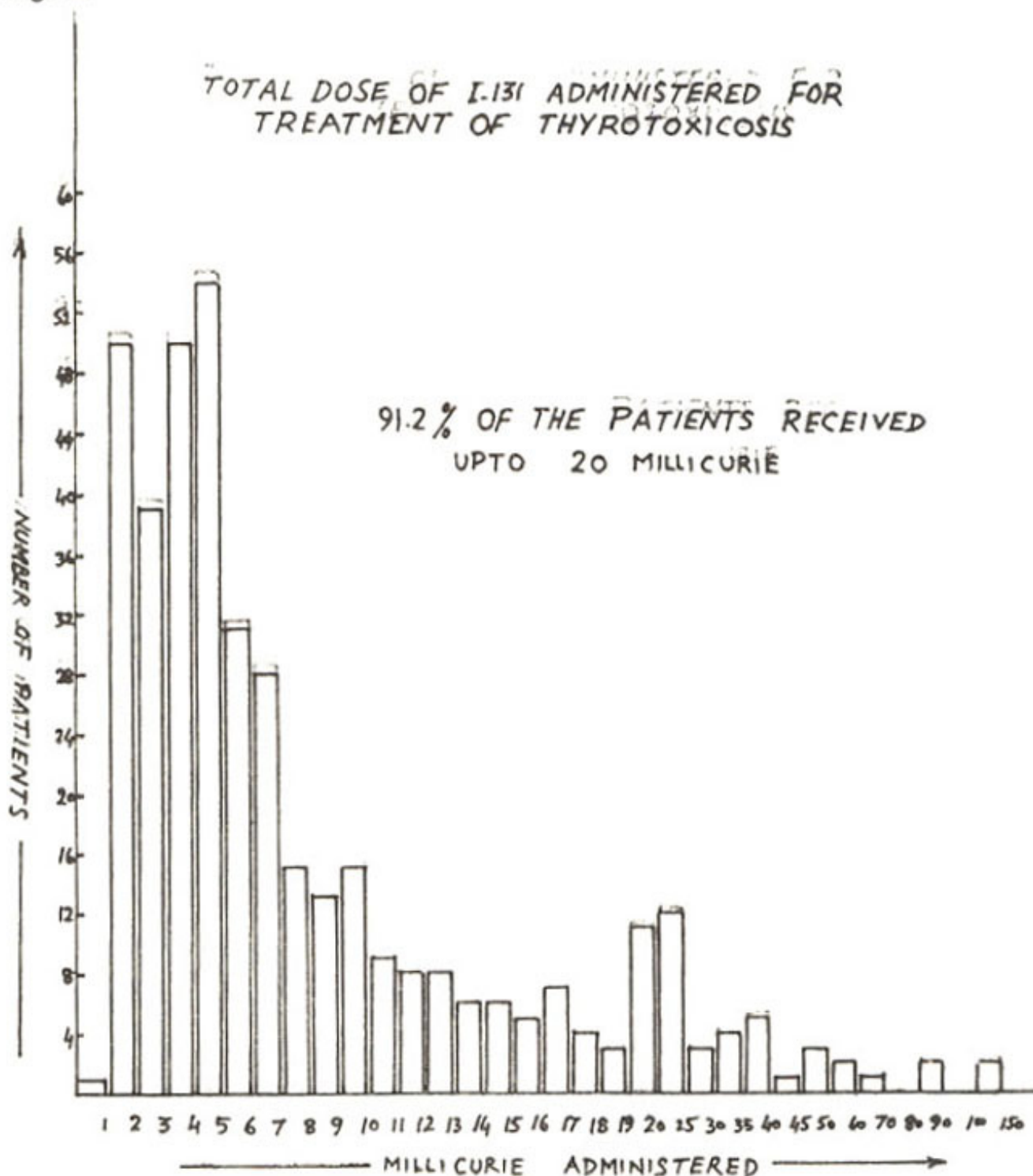


Few cases were below 20 years of age and none below 10. The female patients were 293 i.e. 73% and the male patients were 109 i.e. 27%. Maximum number of female patients belonged to the third decade and males to fourth decade. The weight of thyroid gland ranged from 20 grams to 130 grams with the mean weight ( $\pm 1$  s.d.) of  $48.2 \pm 18.7$  before treatment which became  $31.7 \pm 10.8$  after treatment with 1-

131. 13.5% cases had nodular goitres; 78.00% had diffuse goitres and 8.5% showed no enlargement of the thyroid gland. 13 cases represented post operative recurrences.

192 patients were successfully treated with one dose, 69 patients required a second dose treatment, 39 required 3 treatments and in 52 cases more than three doses were needed. 91.2% of the patients received upto 20 mci, with mean ( $\pm 1$  s.d.) of  $6.8 \pm 4.7$  mci (Fig. 2).

Fig. 2



The dose was 80 u curie retained/gram which delivered a total dose of 7239 rads. 39.3% of the patients

with diffuse goitre became euthyroid with single dose whereas only 3.7% with the nodular goitre became euthyroid with one dose. 119 patients needed an associated medical treatment (antithyroid medication). 80.2% patients were followed for 36 months. The range of follow up was from 1 month to 138 months. At 6 months period of follow up 82% were euthyroid, 8% remained hyperthyroid and 6% became hypothyroid. Fourteen cases became hypothyroid in this study of which 4 had temporary hypothyroidism and 10 permanent hypothyroidism.

Out of the total patients (402) 72 patients had ocular symptoms at one time or the other. 67 patients had ocular symptoms before treatment of which 64.2% were relieved after treatment, 31.3% were not relieved and 4.5% were aggravated. 5 cases developed ocular symptoms after treatment.

## Discussion

The criteria for ideal treatment of hyperthyroidism are restoration of the patient to health and normal thyroid function in a reasonable length of time with the least economic loss and minimum hazard.

Radioactive iodine therapy if carefully given in proper dosage and coordinated with general care procedures, now meets these criteria better than other methods of therapy. Most of the patients treated in this study were in the age range of 30 to 60 years. Over the years the age limitation for therapy with I-131 has declined and many physicians now treat patients at any age. Percentage of female patients treated was higher (73%) than the male patients (27%) probably because of the general prevalence of thyroid disease in the females. In addition the maximum number of female patients were treated at an earlier age i.e. (31-40 years) than the male patients (41-50 years).

Regarding the dosage scheme, the old method of giving small doses of I-131 at short intervals till complete clinical cure is obtained was discarded and single dose treatment became popular delivering 9000 rads to the thyroid gland. Later on this dose was reduced to about 7000 rads. We used 80 microcurie retained per gram which delivered a total dose of 7239 rads to the thyroid gland and a total dose of 1 to 20 mCi was given to 91.2% patients. Predictions about the total radiation dose to the thyroid gland is however not very accurate because of the non uniform distribution of radioactivity in the gland due to "cold spots" and "hot spots" and unavoidable error in the estimation of thyroid mass (Shahid 1965).

The goitres most commonly treated with I-131 have been diffuse with hyperthyroidism, though good results were obtained in nodular goitres as well. Crispell et al have advocated the use of I-131 as a means of lessening the degree of hyperthyroidism in preparing nodular-goitre patients for operation.

We use I-131 as a routine treatment for both diffuse and nodular goitres unless there is some particular contraindication. Out of 402 patients 158 patients (39.3%) became euthyroid with single dose who had diffuse goitre whereas only 15 patients (3.7%) became euthyroid with single dose who had nodular goitres which was an expected finding (Table 1).

**Table I**  
**Total Number of Patients with Number of Treatments and Results**

<i>No. of treatment doses</i>	1			2			3			<i>More than 3</i>		
	<i>D</i>	<i>N</i>	<i>N.G</i>	<i>D</i>	<i>N</i>	<i>N.G</i>	<i>D</i>	<i>N</i>	<i>N.G</i>	<i>D</i>	<i>N</i>	<i>N.G</i>
Euthyroid	161	15	16	49	14	6	27	7	5	38	12	2
Hypothyroid	8	1	1	2	1	1	—	—	—	7	—	—
Hyperthyroid	8	2	2	6	1	—	2	—	1	3	1	—

D=Diffuse,      N=Nodular,      N.G.=No Goitre

The selection of the treatment appropriate for any patient with hyperthyroidism requires a balance of clinical judgement tempered by the attitudes of the patient. Almost all patients prefer 1-3 treatments as it would save them from a major surgical operation. The importance of long range follow-up must however be emphasized to the patients. Most of the patients in this study were followed well except very few cases that could not be traced. The patients who do not turn up are mostly those who have been cured because partially cured or uncured patients always come back for seeking advice. The follow up period for this study was from minimum of 1 month to maximum of 138 months. 225 patients were followed above 6 months, out of these patients 82% became euthyroid, 8% remained hyperthyroid, 4% developed temporary hypothyroidism and 6% had permanent hypothyroidism. This percentage of permanent hypothyroidism is about the same as described in previous literature with conservative type of treatment.

The treatment of hyperthyroidism in patients with severe ocular signs is still controversial. Eye changes may worsen if hyperthyroidism is untreated or after any form of treatment. We give steroids to the patients with severe ophthalmopathy. This study shows improvement in 64.2%, no improvement in 31.3% and aggravation of the conditions in 4.5% (Table 2).

## Table II

### Ocular Symptoms Associated with Hyperthyroidism

<i>Ocular symptoms</i>	<i>No. of Patients</i>	<i>Results after 1-131 treatment</i>		
		<i>Relieved</i>	<i>Not Relieved</i>	<i>Aggravated</i>
Present before treatment	67	64.2%	31.3%	4.5%
Developed after treatment	5	All the cases developed ocular symptoms after treatment.		

This suggests prompt and adequate treatment of hyperthyroid patients with 1-131 who show severe ocular changes..

Mild radiation thyroiditis may occur beginning one to three days following therapy and if the gland becomes very painful and causes local compression, steroids are indicated. Serious acute complications of radioiodine therapy are extremely rare. Fears about the possible carcinogenic effects of 1-131 treatment seem unjustified since no increased incidence of thyroid carcinoma or blood dyscrasias has occurred following therapeutic doses of 1-131 for thyrotoxicosis. Since 1-131 therapy for thyrotoxicosis has been used for only approximately 30 years it remains possible that adverse radiation effects could appear after a longer interval (Wagner 1975). The major long term complication of 1-131 treatment for thyrotoxicosis is the high incidence of permanent hypothyroidism. With the dose schedule that we used, hypothyroidism was found in only 6% of the cases. This percentage will probably increase, should the cases be followed longer, though it is known that most of the patients who become hypothyroid, do so within the first year (Jackson 1975).

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