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# Radioiodine I-131 Therapy for Graves' Disease

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***Abstract:*** **Graves' Disease is an autoimmune disease that affects the thyroid and is the most common cause of hyperthyroidism Signs and symptoms of hyperthyroidism may include exophthalmos irritability, muscle weakness, palpitations, diarrhea, and weight loss**

**The diagnosis may be suspected based on symptoms and confirmed with blood tests and radioiodin euptake. Typically blood tests show a raised $T_3$ and $T_4$, and serum thyroglobulin, low TSH, increased radioiodine uptake in all areas of the thyroid, and TSI antibodies. There are three treatment options: anti-thyroid medications such as methimazole , radioiodine therapy and thyroid surgery (Thyroidectomy). This review will focus on the approach to RAI therapy; discussing dose selection, patient preparation, and consideration before and after administering RAI, examining aspects of pre-treatment . Follow-up is lifelong with the aim of ensuring the patient remains euthyroid or on replacement therapy if there is evidence of hypothyroidism.**

***Keywords:*** **Radioactive Iodine, Graves' disease, Thyroid, Treatment, Medical Sciences.**

## 1. INTRODUCTION

Radioactive iodine (I-131) or RAI is an important radioisotope of iodine discovered by Glenn Seaborg and John Livingood in 1938 at the University of California, Berkeley has been commonly used for the treatment of both benign and malignant thyroid conditions since the 1940s Iodine-131 is also one of the most commonly used radioisotopes with both gamma rays emitting as well as beta particles production so it helps in diagnosis as well as treatment of Graves' disease. It has a radioactive decay half-life of about eight days. It is associated with nuclear energy, medical diagnostic and treatment procedures, and natural gas production.it is absorbed into the bloodstream and concentrated by the thyroid gland, where it destroying sufficient thyroid tissue to render the patient either euthyroid or hypothyroid .

## 2. GOAL OF THERAPY

The goal of therapy for Graves ' disease is to achieve an euthyroid state but if hypothyroidism happened as a sequence of the treatment, oral levothyroxine will be used as a replacement therapy to achieve the euthyroid state .

**When the Radioiodine I-131 is indicated to graves' disease**

Second line treatment when an over-active thyroid gland due to graves disease fails to settle after antithyroid medication.

**Patient preparation for the RAI:**

Patient preparation is the most factor role that play to reduces the potential complications. Important issues like the consent procedure, pregnancy issues and timing of stopping medication, restarting therapy and possible complications of therapy should be discussed with the patient and. Certain medications and other substances such as radiographic contrast materials can interfere with RAI uptake and should be taken in consideration before treatment.

## 3. WHAT IS THE OPTIMAL DOSE OF RADIOIODINE I-131 FOR THE THERAPY OF GRAVES' DISEASE

1- Imperial dose technique: The imperial dose ranges from 5-15 mC

2- Calculated dose technique: It is determined either by using various formulas that take into account the estimated thyroid weight and radioiodine uptake or by using fixed dosages of iodine I 131; it is effective and safe and does not require hospitalization in the fast majority of cases. Radioactive iodine is administered orally as a single dose capsule or liquid form in the fast majority of cases.

**How is it work:**

The thyroid gland's natural need for iodine to make thyroid hormone. The thyroid is taking significant percentage of RAI-131, collects and retains iodine. In hyperthyroidism, the thyroid cells are over-stimulated and make larger amounts of thyroid hormone. The excess amounts of hormones are secreted into the blood, and produce the symptoms of hyperthyroidism. When radioiodine is given, the thyroid gland cannot tell if the iodine is radioactive or not, and collects it in the normal way in proportion to the activity of the thyroid. Radioiodine thus accumulates in the cells that make thyroid hormone and remains there long enough to radiate the gland and to slow thyroid production. Radioiodine that is not retained by the thyroid gland is secreted rapidly by the body (within two or three days), primarily through the kidneys into the urine

**Contra-indications for Radioiodine I- 131 therapy:**

**A-Absolute contraindication:**

1. Pregnancy, Radioactive iodine should never be administered to pregnant women, because it can cross the placenta and ablate the fetus's thyroid, resulting in hypothyroidism.

2. Breast feeding, that the radioisotope is secreted in breast milk. Women will continue to receive increased radiation to the breast from radioactive iodine for a few months after ceasing lactation; accordingly, initiation of this therapy should be delayed.

**B-Relative contraindication:**

1. Uncontrolled thyrotoxicosis

2. Cardiac disease (arrhythmia**)**

**Follow Up of Patients who have received RAI:**

Follow-up after radioactive iodine treatment is essential. There is no single correct dose and about 10% of patients need a further dose. There are no additional problems associated with having more than one dose. Some of those for whom the first dose is effective will need treatment with antithyroid medication until the over-activity is fully settled

Over two-thirds of those who have radioactive iodine treatment will develop hypothyroidism (an under-active thyroid). This can occur anytime from one month after the treatment and is most common within the first 12 months after treatment but can occur later. You should have a blood test about four weeks after treatment, and should then be checked every one to three months in the first year - usually by your hospital clinic. It is very important not to miss these checks even if you feel well, as they can pick up an under-active thyroid before it has time to have effects on you. After that you should see your GP for an annual blood test, or at any time beforehand, if symptoms of hypothyroidism develop. It is straightforward to treat an under-active thyroid gland. Levothyroxine, which is thyroxine in tablet form, is used to replace the thyroxine that your thyroid gland is unable to produce and it is a physiological drug with no side effects or/ and contraindications like other chemical drugs as long as the dose is properly adjuste .

**Table 1: Important practical issues prior to administration of RAI Adapted from The Society Nuclear Medicine Guidelines**

| **Informed consent must be obtained after adequate discussion of the issues outlined below** | |
|---|---|
| **Adequate explanation: Written information should be provided to the patient** | Pre-treatment issues<br>Fasting prior to therapy<br>How the iodine will be administered (liquid vs. capsules)<br>Possible complications and side effects<br>Alternative treatment options: antithyroid medication and surgery<br>Expected outcome to the patient: aims of therapy<br>The risk of hypothyriodism and lifelong L-thyroxine replacement<br>In women: Issues about delaying pregnancy for 4-6 months after the last dose of iodine<br>In men: avoid fathering a child for a similar period of time<br>The necessity of lifelong follow up must be made clear |
| **Written notification** | Date of stopping antithyroid medication<br>Date of resuming antithyroid medication<br>Date and time of therapy<br>Date of follow up visit |
| **Radiation protection issues** | Patients must adhere to instructions<br>Precautions to avoid unnecessary exposure to family and co-workers, children and pregnant women<br>Mandatory urine pregnancy test performed <72 hours prior to RAI therapy |

**Incidence of hypothyroidism after radioactive iodine therapy for thyrotoxicosis:**

The available statistically significant study was done on 1396 Chinese patients in Hong Kong treated for hyperthyroidism with 131I therapy is presented using the life-table method of analysis. One year after therapy only 6% of patients were hypothyroid, but the subsequent annual incidence was 3.5%, emphasising the need for life-time surveillance of these patients. A higher incidence of subsequent hypothyroidism was found in patients with diffuse surgical treatment, the total dose or number of doses of 131I, the severity of thyrotoxicosis and the age of the patient did not influence the rate of onset of hypothyroidism. The data suggest that in order to minimise the occurrence of hypothyroidism a lower dose of 131I per gram of thyroid mass should be used for patients with small diffuse glands.

**Radioiodine Side Effects:**

There are no immediate side effects from radioiodine treatment. Like all other oral medications there is risk of nausea epigastric discomfort, unlikely vomiting, hair loss, Rarely, the thyroid gland may develop a slight tenderness which may last for a day or two.

## 4. CONCLUSION

The RAI is the Second line treatment for graves' disease, with failure of medical treatment or development of complications to medical treatment. it is effective and safe and does not require hospitalization in majority of cases. Radioactive iodine should never be administered to pregnant women and breastfeeding. Lifelong follow-up is important to ensure that recurrence of disease or hypothyroidism can be treated.

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