Effectiveness Dose of I-131 Fixed Dose for Hypertyroidism (Bandung Experience)

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Abstract

*Background*: The dose of $^{131}$I for hyperthyroidism treatment is still controversy. The dose of $^{131}$I can be given as fixed dose based on empirical experience or using calculated dose. The aim of this study was to compare the effectiveness between fixed dose and calculated dose of $^{131}$I for hyperthyroidism treatment.

*Material and Method*: Retrospective study was done to 46 patients with hyperthyroidism. Fixed dose of $^{131}$I is 8 mCi, and < 8 mCi and > 8 mCi consider as calculated dose. Following up was done in 3 and 6 months.

*Result*: Euthyroid was observed in 3 months on 72% of patient using 8 mCi, 4% with < 8 mCi, and 9% with > 8 mCi. Euthyroidism observed in 83% using 8 mCi in 6 months and 13% using calculated dose.

*Conclusion*: Fixed dose of $^{131}$I more effective for hyperthyroidism treatment compare to calculated dose.

Key words: Fixed Doses, Calculated doses, Hypertyroidism, Radioiodine, I-131

*Introduction*:

Radioiodine has been used in the treatment of thyrotoxicosis since 1942 when it was first reported by Herz & Roberts (1942) and Hamilton & Lawrence (1942). Radioactive iodine (I-131) or RAI as it shall now be referred to, has been commonly used for the treatment of both
benign and malignant thyroid conditions since the 1940s. The aim of therapy is to treat hyperthyroidism by destroying sufficient thyroid tissue to render the patient either euthyroidism or hypothyroidism.\(^3\) That patients can be treated effectively merely by their having a drink of radioactive iodine on a single occasion remains a major achievement in medicine. The ideal treatment should render the patient permanently euthyroidism by a single noninvasive procedure without any serious side effects. Radioiodine fulfils most of these criteria, but against this one has to balance the delay in achieving control and the incidence of hypothyroidism necessitating life-long replacement therapy.\(^2\)

Iodine-131 is a beta-emitting radionuclide with a maximum energy of 0.61 MeV, an average energy of 0.192 MeV, and a range in tissue of 0.8 mm. It remains the radionuclide of choice for therapy because of its long half-life of just over 8 days. The mechanism of action of RAI is physiological. Iodine is the precursor of thyroxine. The radioactive form of iodine is taken up by iodidetransporter of the thyroid the same way as natural iodine and is similarly processed. The b particle destroys the follicular cell, gradually leading to volume reduction and control of the thyrotoxicosis.\(^3\)

Dose of \(^{131}\)I for hyperthyroidism treatment is still controversy. The dose of \(^{131}\)I can be given fixed dose based on empirical experience or use calculated dose. However there is no agreement on the regime or the dose of RAI used and success rate is quite variable \(^1\)

Whilst several large series analyzed the number of euthyroidism patients after radioiodine treatment, There was a limited data on the time and doses taken for patients to become euthyroid\(^2\)

The aim of this study was to compare the effectiveness between fixed dose and calculated dose of \(^{131}\)I for hyperthyroidism treatment.

**Method:**

Retrospective study was done to 46 patients ( 10 men, 36 women ) with hyperthyroidism. Fixed dose of \(^{131}\)I is 8 mCi, and \(< 8 \text{ mCi and } > 8 \text{ mCi consider as “calculated dose” treated at Hasan Sadikin Hospital between January 2011 and December 2013. The randomly selected. Following up was done in 3 and 6 months. All subjects were investigated by thyroid scintigraphy**
and thyroid function test. Subject was considered to be euthyroidism if no clinical symptom and sign, and biochemicals finding are within normal limit.

**Result:**

A total of 46 subject, 10 (22%) men and 36 (78%) women met inclusion criteria were included in this study. Subject’s characteristic related to age and sex are shown on figure 1,2

![Sex](image)

**Figure 1. Subject’s characteristic related to sex**

![Age](image)

**Figure 2. Patients characteristic related age**

There were 11 (24%) subjects with range age 20-29 year old, 9 (20%) subjects with 30-39 years old, 16 (35%) subjects with range age 40-49 years old, 10 (22%) subjects with range 50-59 years old.
Euthyroidism was observed in 3 months on 72% of subjects treated by 8 mCi, 4% with < 8 mCi, and 9% with > 8 mCi. Euthyroidism observed in 83% using 8 mCi in 6 months and 13% using calculated dose. (Figure 3).

**Discussion**:

RAI is widely used for the treatment of patients with thyroid disorders, particularly in hyperthyroidism. However, the outcomes of patients who have received RAI are differed from study to study. In our study, 72% patient had become euthyroidism at 3 month treated with 8 mCi. These periods are slightly faster compared to other study. Other study done by Kendall-Taylor et al in 1984 found that after a single dose of 15 mCi, 64% of patients became hypothyroid within the first year and 27% became euthyroidism.

The optimal method for determining the appropriate dose of iodine-131 is remains controversial. Techniques have varied from fixed doses to more elaborate calculations based upon gland size (estimated either by palpation or imaging), iodine uptake, and sometimes from iodine turnover.
Taylor et al studied 225 patients who were treated with 555 MBq (15 mCi) RAI for hyperthyroidism to ablate the thyroid and induce early hypothyroidism. Using fixed dose regimen, only 5.6% failed to become euthyroidism within one year of treatment. Leslie et al. studied 88 patients with Graves’ hyperthyroidism who had not previously been treated with radioactive iodine. The patients were randomized to one of four dose-calculation methods: low-fixed, 235 MBq; high-fixed, 350 MBq; low-adjusted, 2.96 MBq (80-Ci)/g thyroid adjusted for 24 hours RAI uptake; and high-adjusted, 4.44 MBq(120-Ci)/g thyroid adjusted for 24-hour RAI uptake. Subjects were followed for a mean of 63 months to assess clinical outcomes. Mean treatment doses were similar in the different outcome groups. Leslie et al. could not demonstrate any advantage to using adjusted dose method. Survival analysis did not demonstrate any difference in the time to outcome between fixed and adjusted dose methods. A. de Rooij in meta-regression showed no effect of follow-up duration on the difference in euthyroidism between estimated and calculated activity.

In this study there was not observe a significant association between cure rate and sex. This result is consistent with the outcome of many other studies that did not show gender to be a significant prognostic factor in patients’ responses to RAI treatment. But, in contrast, Allahabadia et all. found that males had a significantly lower cure rate than females after one dose of RAI. We also did not observe association between age, etiology and the use of anti-thyroid medication prior to RAI and the outcome following RAI. Y Khalid et.all found that there was no statistically significant correlation between age, gender, aetiology and the use of anti-thyroid medication prior to RAI and the outcome following RAI therapy although a high free thyroxine level at diagnosis predicted a failure of the first dose to achieve a cure of hyperthyroidism. There were several conflicting reports in the literature on the correlation
between these factors and the response to RAI therapy. In our study, a good result was seen in euthyroidism was observed in 3 months on 72% of patient using 8 mCi, and euthyroid observed in 83% using 8 mCi in 6 months after treatment.

**Conclusion:**

Fixed dose of 8 mCi $^{131}$I is more effective for hyperthyroidism treatment compare to calculated dose.

**References:**

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