چکیده
هدف: سرطان‌های تیروئید ۱/۵ تا ۱/۲ درصد بیماران ناشی از خونریزی‌های گوارشی یا انسداد وریدی به سنجیده شده‌اند. بیمارانی که مبتلا به سرطان تیروئید هستند، سال‌ها یا سال‌ها را در آینده مشاهده می‌کنند. هدف این مطالعه بررسی تاثیر متغیرهای سن، جنس، نوع پاتولوژی و باقیمانده بیماری بر نیمه عمر بیولوژیک تیروئید در بیماران مبتلا به سرطان تیروئید است.

روش: در این مطالعه، تعداد ۱۳۱ بیمار مبتلا به سرطان تیروئید در بیمارستان تهران که به دو دسته تقسیم شده بودند. در تیپ اول، بیماران با سن بالا و درجه‌بندی سنی بالا بودند. در دسته دوم، بیماران با سن پایین و درجه‌بندی سنی پایین بودند. در هر دو دسته، تعداد بیماران با پاتولوژی داده بود و تعدادی دیگر با پاتولوژی غیرفعال بودند. در هر دو دسته، بیماران به دو دسته تقسیم شدند: یک دسته بیمارانی که به دو دوز اولترا پتوکاربات (پاتولوژی غیرفعال) و دیگر دسته بیمارانی که به دو دوز اولترا پتوکاربات (پاتولوژی فعال) درمان شدند.

نتیجه‌گیری: بر اساس نتایج بدست‌آمده، به دو دسته تقسیم شده بیماران، نیمه عمر بیولوژیک در بیماران مبتلا به سرطان تیروئید بخصوص انسداد وریدی بیشتر از انسداد وریدی بیماران مبتلا به سرطان تیروئید بدون انسداد وریدی بود.

کلمات کلیدی: سرطان تیروئید، بیماران مبتلا به سرطان، نیمه عمر.
Biologic half-life of 131I in thyroid cancer patients

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Background: Thyroid cancer comprises about 1% of all malignancies and accounts for up to 1% of all cancer deaths. Radioactive iodine is utilized to treat some papillary, mixed papillary-follicular and follicular carcinomas. In these patients, because of the absence of thyroid tissue, the range of absorption of iodine and time of decreasing the exposure rate to standard limits differs from other patients with extra pathologies. In this study we tried to measure the biologic half-life of 131I in patients with thyroid cancer and the effects of different variables like age, sex, histological subtypes, and residual disease on the biologic half-life of 131I.

Methods: We evaluated 29 patients with differentiated thyroid cancer who referred to radiation oncology department of Jorjani hospital, Tehran, Iran. Patients were treated with 131I dosing between 100-150 mci and the exposure rate in patients, just after prescribing 131I, were regularly estimated by portable dose rate meter.

Results: We observed wide range of biologic half-life of 131I in patients and no variable had significant effects on biologic half-life of 131I.

Conclusion: It seems that all patients should repeatedly undergo dosimetry until the range of radiation reaches to normal.

Keywords: Thyroid cancer, 131I, Half-life
Thyroid cancer comprises about 1% of all malignancies and is responsible to up 1% of all cancer deaths (1). Differentiated thyroid cancers consist of papillary, mixed papillary-follicular and follicular carcinomas. These tumors arise from thyroid follicular cells. Treatment modalities of thyroid cancer include: surgery, thyroid hormone therapy, 131I therapy, external irradiation and chemotherapy (1). Radioactive iodine is utilized to treat some papillary, mixed papillary-follicular and follicular carcinomas. The indications for 131I therapy are: tumor size greater than 1-1.5 cm, thyroid capsule invasion, vascular invasion, multifocal disease, soft tissue invasion, post operative residual disease, cervical or mediastinal nodal metastasis and distant metastasis or recurrent disease. The ablation dose which is administered after thyroidectomy, may vary from 30 to 100 mci, but the appropriate doses of 131I for the ablation therapy remain controversial (2). In these patients, because of the absence of thyroid tissue, the range of absorption of iodine and time of decreasing the exposure rate to standard limits differs from other patients with extra pathologies (1). 131I delivers high doses of radiation to both normal and cancerous thyroid tissue (4). In this study we tried to measure the biologic half-life of 131I in patients with thyroid cancer and the effects of different variables like age, sex, tumor histology, the extent of tumor resection, stage of the disease, presence of any residual pathology after surgery and the history of treatment with 131I were extracted from patients’ files.

We evaluated 29 patients with differentiated thyroid cancer who treated with 131I and referred to radiation oncology department of Jorjani hospital.

None of the Patients had any important abnormality in their gastrointestinal or urinary tract systems. Patients were treated with 131I doses between 100-150 mci and the exposure rate in patients just after prescription of 131I and in regular times were estimated by portable dose rate meter, type PDR2 from nuclear enterprises LTD, in a distance of 1 meter from the patient neck, which has the best relation with the patients activity (according to Kovalic et al. study) (3) and the parameters were transmitted to the diagram. From the diagram, the effective half-life of 131I in patients, (equivalent time of which the exposure rate in patients reaches to the half) were derived and according to $1/tE=1/tB+1/tP$, the biological half-life calculated.

RESULTS

The median of biological half-life in patients was 719.61 minutes (approximately 12 hours). SD (761.07)

The maximum half-life was 4259.73 (71 hours) and minimum was 80.5 minutes (1.3 hours).

In this study, 10 males (34%) and 19 females (66%) were recruited which the median half-life in males was 750.08 minutes and in females 703.57 minutes. Thirty patients were under 40 years old and 16 above 40. The median half-life in patients under 40 years was 533.3 minutes (9.2 hours) and in the other group was 873.87 minutes.

The histopathological type of tumors in patients included: 23 patients with papillary carcinoma and 6 patients with follicular carcinoma. The half-life in patients with papillary carcinoma and follicular carcinoma were 801.91 and 404.09 minutes, respectively. Twenty one patients had total and sub-total resection of thy-
roid, 5 patients, lobectomy or tissue biopsy only, and in 3 patients there was no information about the extent of resection.

The median of biologic half-life in patients who had undergone total or sub-total resection was 608.05 minutes (10.1 hours) whereas, in patients who had lobectomy or biopsy, the value was 1299.6 minutes (21.6 hours). In 12 patients, disease was limited to thyroid and in 17 there were lymphadenopathy, invasion to soft tissue of neck and/or distant metastasis.

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In our study, the minimum and maximum biological half-lives of 131I were 80.5 and 4259.73 minutes, respectively.

DISCUSSION

All the data were evaluated by student t-test and compared together.

Median half-life of 131I had no significant difference in genders, furthermore, in under and over 40 years old age groups, and different histopathological sub-types (P>0.05).

Although the median biological half-life in two groups of surgical methods (total or sub-total thyroidectomy, and lobectomy or biopsy) showed difference, but were not statistically significant which may be explained with small sample size in lobectomy or biopsy group, so warrants more consideration in further studies. We did not observe significant difference in biological half-life of iodine in comparing two groups of disease dissemination (limited to thyroid tissue and extra-thyroid invasion), moreover, in comparing two groups of presence or absence of gross residue after surgery. Biological half-life in patients who had total or subtotal thyroidectomy was significantly lower than in euthyroid or hyperthyroid patients.

Biological half-life of 131I in patients with hyperthyroidism has been reported 33 days and in euthyroid patients 80-100 days (5).

But in this study, biological half-life of 131I in patients with thyroid cancer, which most of them had thyroidectomy, was 719 minutes (12 hours). This result can be attributed to the thyroidectomy and absence of any absorbent tissue of 131I in the body, but in patients who had been referred for thyroid cancer and were treated, different variables such as sex, age, pathology sub-type, extent of resection, stage of disease, presence of any gross residue and history of treatment with 131I, revealed no significant correlation with biological half-life of 131I.

There are some reports considered effects of lithium on increasing biological half-life of 131I about 25-50% (5); but, because of the toxic effects and narrow therapeutic window of this agent, it is not considered as a routine treatment modality in patients (2).

It is known that increasing in TSH levels in patients with thyroid cancer results in decrease biological half-life. So, in some centers, patients are treated with full-dose of T3 for decreasing TSH, 24 hours before treatment with 131I. In our study, all of the drugs were discontinued 1 month before the beginning of 131I therapy and so, TSH rose to maximum levels, nonetheless; this had no effects on our results. In our study, median biological half-life was significantly higher in patients who had undergone lobectomy or biopsy than in patients who had total or sub-total thyroidectomy, however; it did not show statistically significant difference.
In this study, the number of patients in lobectomy or biopsy group (5 patients) was lower than total or sub-total thyroidectomy group (21 patients) which can be explained with small sample size.

Conclusion:
Biological half-life of 131I, which is affected by internal metabolism, is different in people. In our study, the minimum of biological half-life of 131I was 80.5 minutes and the maximum was 4259.73 minutes. Varied iodine metabolism can justify this wide range of biological half-life.
In a sense, discharge criterion for radiation safety purposes should individually be calculated.
According to the results, wide range of biological half-life of 131I in patients and the absence of any effective variable on biological half-life of 131I, it seems that all patients should undergo repeated dosimetry until the range of radiation reaches to normal.

REFERENCES