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Research Paper

The Radioactive Iodine I-131 Efficiency in Thyroid Cancer Treatment At Al-Ahli Hospital, West Bank-Palestine.

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ABSTRACT
Radioactive Iodine131 (RAI131) has been used as a treatment for Thyroid Cancer (TC) after thyroidectomy. The aim of this study was to evaluate the efficacy of RAI-131 therapy after using high accumulated doses of I131 at Al-Ahli Hospital - Hebron. This study included a retrospective review of 141patients with histologically proven TC in the post-operation stage. After thyroid tissue remnants were eliminated with I131 therapy. Patients with TC status was confirmed by Tc99m thyroid scan and I131 whole body scan regarding metastasis. Patients were treated with I131as appropriate. All the patients underwent thyroidectomy in 2018 and 2019. Among the total 141 TC patients, 114 TC patients were females (80.15%) and 27 patients were males (19.85%). The total effective rate of I131therapy of the current study was 87.9%. The non-effective rate (recurrence rate) was 12.1%. Recurrences were more common in female patients with TC than in male patients with TC (17.55 vs. 11.11%, respectively). However, the middle age (30-40) patients had significantly worse than the other groups; although the least affected age group was fifth group (60-70). I131 provided an effective therapeutic modality for TC patients with distant metastasis. Postoperative serum Thyroglobulin (Tg) level is a sensible and reliable marker in terms of the presence of TC in remnant thyroid tissue. Tc99m pertechnetate thyroid scintigraphy may be helpful to determinate the remnant carcinogenic cells in thyroid tissue of patients who underwent surgery for TC.

KEY WORDS: *Radioactive Iodine, Thyroid Cancer, Iodine -131, Disease-Specific Mortality, Fine Needle Aspiration Biopsy, Triiodothyronine, Thyroxin.*

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I. INTRODUCTION AND LITERATURE REVIEW

The thyroid gland descends from its place of origin, the foramen cecum at the base of the tongue, to its final destination in the anterior lower neck. The line of descent is represented by the remnant thyroglossal duct, along which residual thyroid tissue may be found. Cases of descent beyond the normal distance result to a mediastinal thyroid component. The thyroid gland is normally located in the anterior lower neck. It consists of right and left lobes which are joined at the midline by a thin bridge of thyroid tissue called the isthmus. The isthmus drapes over the anterior trachea at the junction of middle and lower third of the gland. The thyroid is anterior to the longus colli and paraspinal musculature and deep to the strap muscles. An accessory lobe, referred to as the pyramidal lobe, may be present in up to 50 percent of people, which usually arises from the isthmus of the gland and extends superiorly.

The thyroid gland has a rich vascular supply. There are paired superior and inferior thyroidal arteries which are branches of the external carotid arteries and thyrocervical trunks, respectively. The thyroidea ima is an inconstant vessel, arising directly from the aortic arch and helps to supply the inferior thyroid, when present. The thyroid is drained by superior and middle thyroidal veins that empty into the internal jugular vein, and by an inferior vein that drains into the innominate vein. Thyroid carcinoma arises from both follicular and para-

follicular C cells. The potential of malignancy range from low grades (papillary/follicular carcinoma) to aggressive (anaplastic carcinoma).

The major histological classification of thyroid carcinoma includes papillary, follicular, medullary, and anaplastic. The majority of carcinomas are papillary, followed by follicular, medullary and anaplastic types [1]. The thyroid gland is critical in regulating various metabolic functions; thus, patients with hormonally active thyroid gland present with wide-ranging symptoms. Radiological imaging assesses the pathological effects of abnormal thyroid function as well as important morphological features. The thyroid gland can be imaged with multiple modalities for example, nuclear medicine, high resolution ultrasound (US), thin section computed tomography (CT) and magnetic resonance imaging (MRI). However, the initial methods to evaluate the thyroid disease remains clinical history, physical examination, and laboratory values, potentially augmented by palpation-guided fine needle aspiration biopsy (FNAB) [2]. The endocrine aspects of thyroid diseases rarely require imaging for diagnosis. However, the non-endocrinal aspects produce many radiological signs and these may influence clinical management. Nuclear scintigraphy provides functional information because of the ability of the radio-nuclides to be taken up by functioning thyroid tissue. Thin section CT and MRI can demonstrate the tissue nature and enhancement characteristics of a large neck mass, especially if it extends into the mediastinum. High resolution US demonstrates clearly the anatomy and morphology of the neck soft tissues and pathological processes involving the thyroid gland and cervical lymph nodes. Sonography can also be used to guide interventional procedures, including fine needle aspiration cytology and biopsy.

The most common and practical method for thyroid scintigraphy is gamma camera planar imaging using 99mTc. The mechanism of uptake is trapping 3-4% of the administered activity, usually 75 MBq (2mCi) which produces good quality images. 99mTc undergoes no further metabolic degradation in the thyroid cells. A more physiological approach to thyroid imaging would involve a radioisotope of iodine that is both trapped and organified by follicular cells, commonly Iodine-123 (I123) and Iodine-131(I131). Gamma camera imaging produces good quality 2-dimentional representation of the radiopharmaceutical distribution that can be greatly improved with pin-hole collimator. To differentiate between salivary excretion and activity in thyroid bed, amount of water should be drink before thyroid scan. Certain medications that interfere with trapping mechanisms such as thyroxin, tertroxine, amiodarone and potassium perchlorate need to be stopped for variable intervals. Iodinated contrast agents produce undesirable saturation of sodium-iodide symporter that may persist for weeks particularly lipid soluble agents. Anterior views are obtained 20 minutes after intravenous injection of 99mTc supplemented by oblique and lateral views and occasionally single photon emission tomography (SPECT). Although rectilinear scanners are still in common use, they are time consuming and less reliable than gamma camera with overall accuracy of 77% compared to 94% for pin-hole imaging [3].

Oral administration of I131 has been a commonly accepted procedure for treatment of benign and malignant conditions of the thyroid since the 1940s. Physicians responsible for treating such patients should have an understanding of the clinical pathophysiology and natural history of the disease processes, should be familiar with alternate forms of therapy, and should be able to collaborate closely with other physicians involved in the management of the patient's condition [4]. RAI (I-131) has been used as an adjuvant treatment for high-risk, well-differentiated Thyroid Cancer (DTC) after thyroidectomy for residual or recurrent TC. Decreasing the use of I-131 for the treatment of low-risk TC may be necessary owing to the controversial effects of this treatment on well-differentiated TC [5]. Three stages of treatment of DTC have been suggested as optimal treatment strategies: the total or subtotal ablation of thyroid tissues, the postoperative ablation of thyroid remnants with I-131 therapy, and the administration of thyroid hormone suppression treatment [6]. Most patients with DTC have good prognosis following appropriate treatment. A 90% remission rate can be achieved after receiving treatments that include thyroidectomies and postoperative I131 therapies [2].

With reference to the significance, the aims of this study were to investigate the treatment efficacy of RAI therapy on patients after total thyroidectomy and its effect on the quality of life.

Thyroid Cancer Types

TC is a common endocrine malignant tumor in clinic. In recent years, due to changes in the living environment, its incidence has been increasing year by year, with females higher than males. Most of the tumor cells of TC are derived from follicular epithelial cells. According to pathological type, which are classified into papillary adenocarcinoma and follicular adenocarcinoma which make up about 95% of all TC, medullary carcinoma 3% of all TCs, anaplastic TC accounting for about 1% of TC and undifferentiated carcinoma. Among them, the incidence of papillary adenocarcinoma is the highest, up to 80%[7].

Laboratory Tests

Before starting the treatment session in radiotherapy using radio-active iodine, it should take some laboratory tests. These tests consist of; Thyroid Stimulating Hormone (TSH) which must be more than 30 μLU/mL. If TSH level is decreased, then it should be measured free thyroxin and total or free triiodothyronine

(T3). However, if the TSH level is increased, free thyroxin and thyroid peroxidase antibodies should be measured. Another testing for antithyroglobulin antibodies should be restricted to patients with ultrasound and clinical findings suggestive of chronic lymphocytic thyroiditis when serum levels of thyroid peroxidase are normal. In addition, assessment of serum thyroglobulin is not recommended in the diagnosis of thyroid nodules. In patients undergoing surgery for malignancy, serum thyroglobulin measurement is useful to detect potential false-negative results. In fact, the TSH-receptor antibody measurement should be performed in patients with TSH levels below the reference range. The laboratory tests is more important in patients with a family history or clinical suspicion of medullary thyroid carcinoma or multiple endocrine neoplasia type 2 [8].

Radioactive Iodine-131 (I131)

I131 decays by beta emission and has physical half-life of 8.04 days with main gamma energy of 364 keV and a principal β-particle 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 delivers higher radiation dose to thyroid as compared to Tc99m pertechnetate (5mCi) and I123 (100-300 μCi), Tc99m pertechnetate has a short half-life of 6 h and main gamma energy of 140 keV, I123 has a half-life of 13 h, and its main gamma energy is 159 keV. I131 has low cost and is readily available. It is widely used for imaging and ablation/treatment purposes in patients with differentiated TC.[9]

Radioactive Iodine Whole Body Scan

Whole body scan with RAI (I131 or I123) is used to determine the presence and extent of residual functioning thyroid tissue after total thyroidectomy and after I131 ablation and detect functioning differentiated TC residues, recurrences, or metastases. The physician should obtain and record a pertinent, standard history and examination findings as well as results of laboratory tests (Tg, anti-Tg, and TSH). A measurement of serum TSH prior to the study is used to ensure maximum stimulation of any functional thyroid tissue.

The study is performed 4–8 weeks post near total thyroidectomy. . Alternately the patient will have intramuscular Thyrogen injections (0.9 mg) for 2 days prior to dosing especially when the TSH in patient cannot be increase [10]. Thyrogen helps to increase the sensitivity of testing while allowing patients to avoid the potentially debilitating symptoms associated with thyroid hormone withdrawal. If the patient had intravenous iodinated contrast agents (intravenous pyelogram, CT with contrast, or angiogram), the study should be delayed for 4 weeks. For intrathecal contrast (myelogram), this duration is 8 weeks. However, the adverse effect on the study may last as long as a year. The patient should be fasting overnight or at least 3 h before oral administration of the RAI and for 3 h afterward. Low iodine diet is preferred starting 10 days before the test and continued throughout the period of imaging and for 1–2 days after treatment. The following foods and ingredients should be avoided: iodized salt, sea salt, seafood and sea products, dairy products, egg yolks or whole eggs, red dye (erythrosine or E127), soybeans, foods containing high salt, iodine-containing vitamins and food supplements, and iodine-containing medications (e.g., iodinated contrast, amiodarone, and betadine). A pertinent menstrual history and pregnancy test as well as nursing and lactation history should be obtained. TSH, serum Tg, and anti-Tg antibody levels should be obtained before RAI administration as well as 72 h after Thyrogen administration. For I-131, 74–185 MBq (2–5 mCi) of activity is administered orally. A large field-of-view gamma camera with 3/8 in. or greater crystal thickness equipped with high-energy, parallel- hole collimator and pinhole collimator with 10 mm insert is used with 20% energy window centered at 364 keV. For I-123 study, 14.8–185 MBq (0.4–5.0mCi) of activity is administered orally. A large field-of-view camera equipped with a low- energy collimator with 20% energy window centered at 159 keV is used. Whole body and neck images are obtained at 48 h for I-131 and 24 h for I-123. Using pinhole collimator, an anterior image of the neck is obtained for 10 min. Anterior and posterior whole-body images are obtained from top of the head to the knees, 1024 × 256 matrix, 5–6 cm/min scan speed for I-131 and 10 cm/min for I-123. Delayed images may be acquired if necessary. SPECT or SPECT/CT images improve tumor localization and are optional. Thyroid uptake measurement may be used to determine the mass of remaining thyroid tissue or tumor (anterior image of the neck at 24 h using parallel-hole collimator). Three milliliters of blood samples before ingestion of the radiopharmaceutical and at 24, 48, and 72 h after administration may be collected for dosimetric calculations. In post-ablation/therapy patients, whole body images should be performed 7 days following I-131 administration[11].

Patient Preparation

Thyroid hormone medications must be with-held for a time sufficient to permit an adequate rise in TSH (>30 μLU/mL). This is at least 2 weeks for T3 and 4 to 6 weeks for T4. TSH may not rise to this level if a large volume of functioning tissue remains. For patients receiving an ablative dose or treatment dose of radioiodine following a partial or complete thyroidectomy for TC, the results from a recent measurement of TSH and the operative and histology reports should be available and reviewed. A baseline serum thyroglobulin should be obtained in the hypothyroid state. A complete blood count before treatment may be useful. Other

laboratory tests such as serum calcium (to exclude hyperparathyroidism post-thyroidectomy) may be helpful. Many experts recommend a low iodide diet for 7–10 d before administration of therapy to improve iodine uptake. Since iodized salt is a major dietary source of iodide, compliance with a low iodide diet may be difficult, especially if restaurant food is eaten. The presence of iodine accumulating thyroid tissue is routinely documented by uptake measurement and imaging. In selected patients, an uptake measurement and/or imaging may not be necessary. In the absence of anti-Tg antibodies, an elevated or rising serum Tg may also be a useful indicator of residual or recurrent TC and may be an indication for radioiodine therapy even in the absence of discernible activity following a diagnostic dose of I131. An elevated serum thyroglobulin does not guarantee iodine avidity of the tumor.

A written informed consent form must be obtained and could include the following items specific for the therapy of TC; the purpose of the treatment is to destroy normal and cancerous thyroid tissue. Other normal tissues may also be affected; More than one I131 treatment may be necessary; Early side effects may include nausea, occasional vomiting, pain and tenderness in the salivary glands, loss of saliva or taste, neck pain and swelling if a sizeable thyroid remnant remains after surgery, and decreased white blood cells that may result in increased susceptibility for infection. Generally, these side effects are temporary; Late side effects may include temporary infertility (in men this can be permanent as dosages progressively exceed 11.1 GBq [300 mCi]). Rarely, permanent damage to the salivary glands resulting in loss of saliva or stones; excessive dental caries; reduced taste; and the very rare development of other cancers, including those of the stomach, bladder, colon, and salivary glands, and leukemia (only with very high cumulative doses);and These late side effects are rarely seen and should not deter a patient from taking I131 for treatment of TC[4].

Patient Dose

A variety of approaches have been used to select the amount of administered activity. General guidelines are; for postoperative ablation of thyroid bed remnants, activity in the range of 2.75– 5.5 GBq (75–150 mCi) is typically administered, depending on the Radioactive Iodine uptake (RAIU) and amount of residual functioning tissue present; For treatment of presumed TC in the neck or mediastinal lymph nodes, activity in the range of 5.55–7.4 GBq (150–200 mCi) is typically administered; For treatment of distant metastases, activity of >7.4 GBq (200 mCi) is often given. The radiation dose to the bone marrow is typically the limiting factor. Most experts recommend that the estimated radiation dose to the bone marrow be less than 200 rad. Detailed dosimetry may be indicated in patients who are treated with large amounts of RAI to determine how much I-131 can be safely administered. Retention of radioiodine in the body at 48 h should be <4.44 GBq (120 mCi), or <2.96 GBq (80 mCi) if diffuse lung metastases are present, to reduce toxicity. Oral administration of lithium carbonate prolongs the biological half-life of administered I131 and occasionally may be useful in patients who have a rapid turnover of RAI. A short effective I131 half-life can be a source of failure of I131 therapy in metastatic lesions. Side effects may occur and are generally dose related. Hydration of the patient, with instructions urging frequent urination for several days and efforts to increase salivary flow may reduce radiation exposure to the bladder and salivary glands. Antiemetics may be helpful. The patient should have at least 1 bowel movement a day to reduce colon exposure. Laxatives may be necessary. Patients should have extended scintigraphy approximately 1 week after treatment for staging purposes.

J.lin etal in 2018, conducted a study to evaluate the long-term follow-up results after using high accumulated doses of I131(>600 mCi) for the treatment of well-differentiated TC. The study based on retrospective method to evaluate prospectively enrolled patients with well- differentiated TC who were treated and followed up in Chang Gung Memorial Hospital in Linkou and Keelung, Taiwan. All the patients underwent thyroidectomy between 1979 and 2016. For their study, 228 patients with papillary and follicular thyroid carcinoma with distant metastases were enrolled. Of the 228 patients, 71 (31.1%) received I-131 therapy with an accumulated dose of at least 600 mCi. Forty-four died because of disease-specific mortality (DSM) after a mean follow-up of 10.6 ± 6.3 years. Compared with the patients in the DSM group, which included 27 survival cases, patients who were younger, and those with a multifocal tumor, more extensive thyroidectomy, and papillary thyroid carcinoma showed better prognosis. The DSM group included a higher percentage of patients who developed a secondary primary cancer after receiving a diagnosis of TC than the survival group (18.2 vs. 3.7%). However, the difference did not reach statistical significance[12].

Y.He et.al in 2016, were conducted a study to assess the efficacy of RAI-131 therapy for lymph node metastasis of DTC and to identify influential factors using univariate and multivariate analyses to determine if identified factors influence the efficacy of treatment. This study was a retrospective review of 218 patients with histologically proven DTC in the post-operation stage. After thyroid tissue remnants were eliminated with I131 therapy, patients' lymph node status was confirmed by ultrasound and by I131 whole body scan regarding lymph node metastasis, and then patients were treated with I131 as appropriate. They found that The total effective rate of I131 therapy was 88.07% (including a cure rate of 20.64% and an improvement rate of 67.43%). The non-effective rate was 11.93%. Of the total 406 lymph nodes of 218 patients, 319 lymph nodes

(78.57%) were judged to be effectively cured, including 133 (32.75%) lymph nodes that were totally eliminated and 186 (45.82%) lymph nodes that shrank. Eighty-seven (21.43%) of the 406 lymph nodes had no obvious change. No lymph nodes were found to be in a continuously enlarging state. Distant metastasis, size of lymph node, human Tg level, and condition of thyroid remnants ablation were identified as the independent factors influencing the efficacy of treatment using univariate and multivariate analyses [6].

Y.Yang et.al in 2019, were conducted a study to investigate the treatment efficacy of RAI therapy on patients after total thyroidectomy and its effect on the quality of life. A retrospective analysis of clinical data of 120 TC patients admitted to Jiangxi Provincial People's Hospital Affiliated to Nanchang University, Nanchang, China from February 2014 to February 2017 was performed. According to different treatment methods, they were divided into observation group of 62 cases and control group of 58 cases. Both groups were treated with total thyroidectomy. The control group was treated with anti-infection and prevention of complications after operation, the observation group with RAI therapy. Treatment efficacy, quality of life score, recurrent laryngeal nerve injury and post- operative survival rate were compared between the two groups. They found that The total effective rate of treatment in the test group was 98.39%, significantly higher than 72.41% in the control group, with a statistically significant difference ($P<0.05$). Compared with the control group, the fatigue score of the test group was lower, but the score in the area of emotion function and the overall health status score were higher, with a statistically significant difference ($P<0.05$). There was no significant difference in the recurrent laryngeal nerve injury between the two groups of patients. The postoperative survival rate of the test group of patients was 96.77%, significantly higher than 86.21% of the control group.

Abbreviations

RAI: Radioactive Iodine, **TC:** Thyroid Cancer, **I131:** Iodine -131, **Tc 99m:** Tecnitium-99 metastable, **Tg :** Thyroglobulin, **US :** Ultrasound, **CT:** Computed Tomography. **MRI:** Magnetic Resonance Imaging, **FNAB:** Fine Needle Aspiration Biopsy, **Bq:** Becquerel, **Ci:** Curie, **SPECT:** Single Photon Emission Tomography, **DTC:** well-differentiated Thyroid Cancer, **TSH:** Thyroid Stimulating Hormone, **T3:** Triiodothyronine,**T4:** Thyroxin, **RAIU:** Radioactive Iodine uptake, **DSM:** Disease-Specific Mortality.

PROBLEM STATEMENT AND SIGNIFICANCE OF STUDY

Cancer treatment can be performed in several ways such as chemotherapy, hormone therapy, surgery, and radiotherapy. TC is one of the most common cancers in the world among different age groups. This cancer is treated using the above-mentioned methods. The treatment begins by performing a surgical procedure (Thyroidectomy) and then exposing the patient to a RAI dose. Some patients need more than one treatment dose using RAI, depending on their condition. In order to know the number of doses that should be given to the patient, it is necessary to know the efficiency of the previous dose that has been given to the patient. The efficacy of treatment can be evaluated through the patient condition after the follow-up session. Thus the problem of statement in this study consists to evaluate the efficiency of RAI-131 for eliminating the remnant tissue after complete thyroidectomy.

RESEARCH OBJECTIVES AND INQUIRIES

The main purpose of this study is to evaluate the efficiency of RAI I-131 in TC treatment. The secondary objectives are:

- To demonstrate the most age group at risk for TC.
- To demonstrate which gender is most affected by TC.
- To investigate the amount recurrence of TC.
- To evaluate the long-term follow-up results after using high accumulated doses of I131 for the treatment of well-differentiated TC.

The study addresses the following questions:

1. Is RAI effective in treating TC remnant tissue?
2. Is a single dose sufficient to treat TC remnant tissue?
3. Are the laboratory tests important in TC treatment?
4. Is the patient fasting for thyroxin tablet affecting on ablation treatment?

II. MATERIALS AND METHODS

MATERIALS:

Gamma camera

I131 with different activities were used for treatments depending on the patient conditions as motioned before. The e.cam Single-Head Gamma Camera; Siemens was used to acquired patient images. A large field of view gamma camera with 3/8 inch or greater crystal thickness equipped with high-energy, parallel hole collimator and pinhole collimator with 10 mm insert is used with 20% energy window centered at 364 keV.

Geiger Muller
A radiation monitors AT6310, AT6130A and AT6130D was used to measure the activity of patients after finish the ablation period in the hospital.
Well Counter
The amount of iodine activity which determined by nuclear medicine specialist, it was measured using CRC® - 712M Dose Calibrator Item# 5130-3054. This activity measured before given to the patient.
Shielding
The thyroid shielding, and lead apron were used during giving the iodine dose to the patient.

III. METHODOLOGY

Study Design
A cross sectional retrospective descriptive design was selected for this study since this type of researches are used to obtain information concerning the current status of the situation and to describe what exists with respect to variables or conditions in a situation[13].
Study Setting
The study was conducted in nuclear medicine department at Al-Ahli Hospital at West Bank Palestine. The data were collected between January 2018 and November 2019. The study was included all of TC cases who are take RAI treatment after thyroidectomy; the dealing with patients where followed as; firstly, whole body iodine was obtained before iodine ablation to determine the amount activity for each patient; secondary patient was given iodine ablation; after six days the whole body images where acquired for the patient; and finally the whole body follow up after six months was taken.
Data Collection
The efficiency of RAI in TC treatment was retrospective study on total of 141 patients over 22 months at a period between January 2018 and November 2019 in the Al Ahli hospital. In the addition, all of the following data were obtained age, dose activity ablation, lab tests, number of doses for each patient, gender, and image after ablation.
Data Analysis
The data was analyzed using SPSS version 25. The significance level was, mean, standard deviation; tables were used to present the sociodemographic data. Pie chart, and bar chart were used to present the data in graphical form.

IV. RESULTS AND DISCUSSION

The gender distribution in the sample
The table1 shown that the most affected gender was females with 80.15% and the lowest percentage was in males with 19.15%. These results are consistent with previous studies, such as a study of He, Ying et.al [6] which estimated the percentage of TC in females with 70.64% compared to the incidence of TC in males with 29.36%.

Gender	Frequency	Percent	Valid Percent	Cumulative Percent
Male	27	19.1%	19.1%	19.1%
Female	114	80.9%	80.9%	100.0%
Total	141	100.0%	100.0%	

Table1: The Distribution of Gender in the Sample.

The study shows the age distributions in the sample in male and female group. The age were sorted in sixth groups; first group (between 20-30 years), second group (between 30-40 years), third group (between 40-50 years), fourth group (between 50-60 years), fifth group (between 60-70 years), and sixth group (between 70-80 years). The table 2 shows the gender distributions with percentage of each age group.

Variables	*Age group*					
Gender	20-30	30-40	40-50	50-60	60-70	70-80
Male	19.0%	10.3%	17.65%	25%	40%	23.08%
Female	81.0%	89.7%	82.35%	75%	60%	76.92%

Table 2: The gender Distribution in the Age Groups.

Table 3 shows that the most age group affected by TC is second group with percentage of 27.7% then the third group with a percentage 24.1%. While, the lowest percentage was in the fifth group with percentage of 7.1%.

Age group	Frequency	Percent	Valid Percent	Cumulative Percent
20-30	21	14.9%	14.9%	14.9%
30-40	39	27.7%	27.7%	42.6%
40-50	34	24.1%	24.1%	66.7%
50-60	24	17.0%	17.0%	83.7%
60-70	10	7.1%	7.1%	90.8%
70-80	13	9.2%	9.2%	100.0%
Total	141	100.0%	100.0%	

Table 3: Distribution of Each Age Group in the Sample.

The most affected age group in the study was found in second group (30-40) with a percentage of 27.66% while the lowest percentage was found in fifth group (60-70) with a percentage of 7.09%.

The study also examined the number of doses were given to patients who suffer from TC in order to be able to determine the effectiveness of iodine treatment from the first, second, third, and the fourth dose. Note that the cases who took four doses are considered untreated using RAI. Table fourth shows these results with its own percentage.

	Age group						
Number of dose	20-30	30-40	40-50	50-60	60-70	70-80	Total
0*	0.7%	0.7%	2.1%	-	0.7%	0.7%	4.9%
1	12.8%	24.9%	15.6%	14.9%	6.4%	7.1%	81.7%
2	0.7%	0.7%	6.4%	1.4%	-	1.4%	10.6%
3	-	1.4%	-	0.7%	-	-	2.1%
4	0.7%	-	-	-	-	-	0.7%

Table 4: The Relationship Between Number of Doses and Age Groups

*: Patients who underwent RAI in different hospital and made the follow up at Al-Ahli Hospital.

Table 4 above shows that the highest number of patients were taken a single dose as the percentage was estimated at 81.7%, while the patients who taken a double dose was 10.6%, while 2.1% of patients were taken triple doses, and finally the patients who were not treated were 0.7%, which represents patients who were given four time of doses as we can see in the following chart (Figure 1).

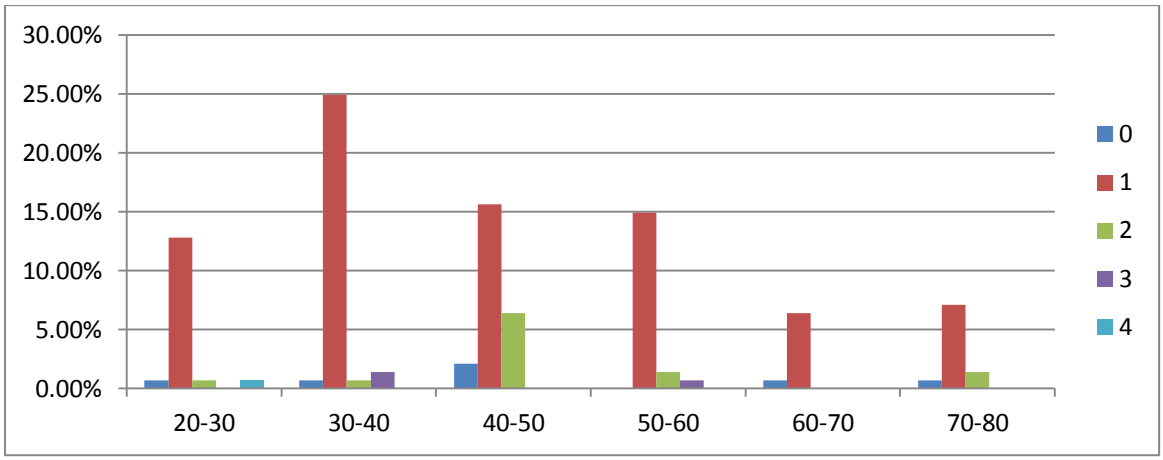

Figure 1: The Relationship between Number of Doses and Age Groups.

Figure 1 shows that the highest age group taking a single dose was the second age group (30-40) while the fifth age group (60-70) was the lowest group taking a single dose. It also appears from the figure that the

third age group (40-50) was exposed to a double dose at a greater percentage than other age groups. Finally, the first age group (20-30) is the only group who has been exposed to four doses.

The relationship between number of doses and age groups within males

Table 4 and figure 1 explain that the percentage of a single dose which is given to the patients was the highest percentage among the number of other doses in male group. In addition to that no cases have been exposed to more than two therapeutic doses.

	Age group						
Number of doses	20-30	30-40	40-50	50-60	60-70	70-80	Total
0*	-	-	3.7%	-	-	3.7%	7.4%
1	14.8%	14.8%	14.8%	22.3%	14.8%	7.4%	88.9%
2	-	-	3.7%	-	-	-	3.7%

Table 5: The Relationship between Number of Doses and Age Groups within Males

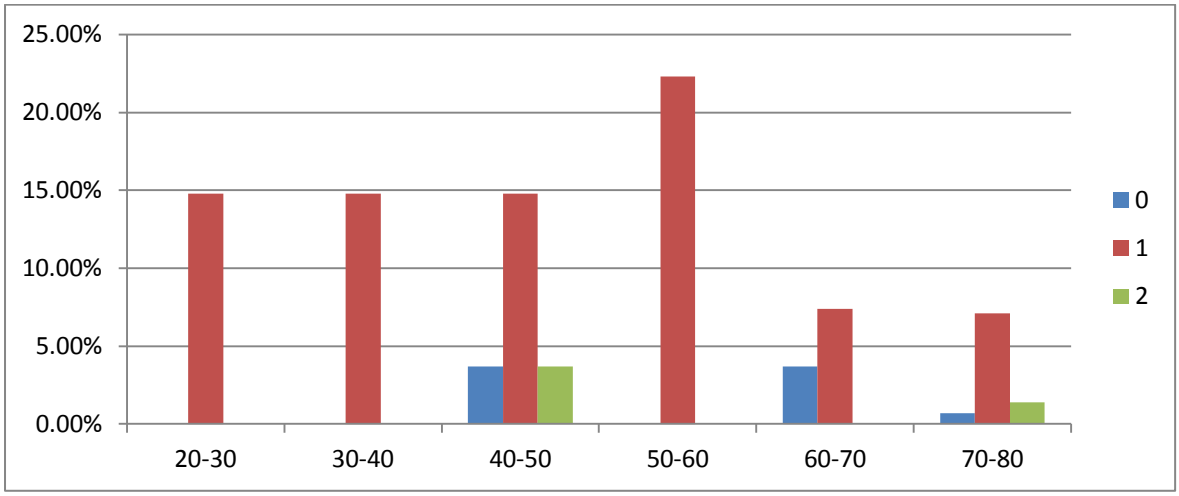

Figure 2: The Relationship between Number of Doses and Age Groups within Males

The relationship between number of doses and age groups within females

Table 6 explained that the percentage of a single dose which is given to the patients was the highest percentage among the number of other doses in female group.

	Age group						
Number of dose	**20-30**	**30-40**	**40-50**	**50-60**	**60-70**	**70-80**	**Total**
0*	0.87%	0.87%	1.7%	-	0.87%	-	4.31%
1	12.3%	27.1%	15.7%	13.1%	4.3%	7%	79.5%
2	0.87%	0.87%	7%	1.7%	-	1.7%	12.15%
3	-	1.7%	-	0.87%	-	-	2.57%
4	0.87	-	-	-	-	-	0.87%

Table 6: The Relationship between Number of Doses and Age Groups within Females

Figure 3 shows the highest percentage who exposed a single dose in female was second group (30-40) with percentage of 27.1%. It also shows that the second dose was prominent comparing to the male group and the highest percentage in second dose was found in third group (40-50). Moreover, the lowest percentage of doses was noticed in fifth group (60-70).

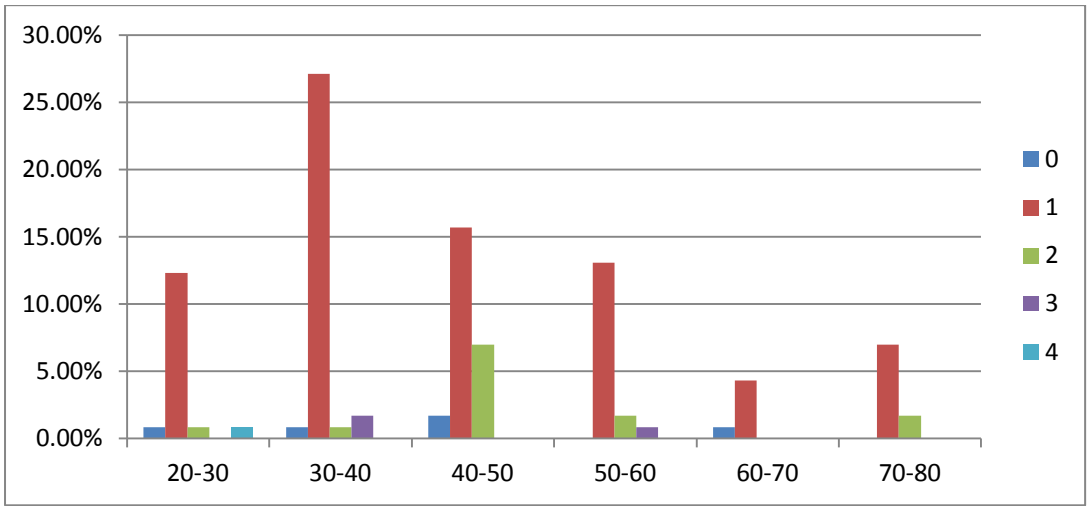

Figure 3: The relationship between Number of Doses and Age Groups within Females

Figures 1, 2 and 3 show that the percentage of patients who were exposed to a single dose was the highest among the other doses, and this is consistent with previous studies such as a study Lee, Stephanie L.[14] He found that 63.2% of the patients need a single dose for treatment, 28.1% required a second treatment, and 8.8% required a third treatment. In addition, the number of times which is the male exposed to is less than the number of female and this gives an indication that the treatment in men is higher than in female.

The efficacy of iodine treatment for TC patients

To find out the efficacy of iodine treatment for TC patients, the project was conducted to study the relationship between the numbers of doses that given to patients and the number of follow-up for each patient. D1: Single dose, D2: Double dose, D3: Triple dose, D4: Tetra dose, F.U: Follow up, table 7 shows this relationship with percentage for each of them.

	F.U 1	F.U 2	F.U 3	F.U 4	Total %
D1	74.5%	12.7%	0.7%		87.9%
D2		5.7%	1.4%	0.7%	7.8%
D3			2.1%	1.4%	3.5%
D4				0.7%	0.7%

. Table 7: The Relationship between Number of Doses and Follow up Examinations

As shown in the figure 4 the effectiveness of RAI treatment for TC patients from the first dose was estimated at 87.9%, while the cancer recurrence percentage to the patients who underwent double, tri, and tetra dose were estimated at 12.1%.

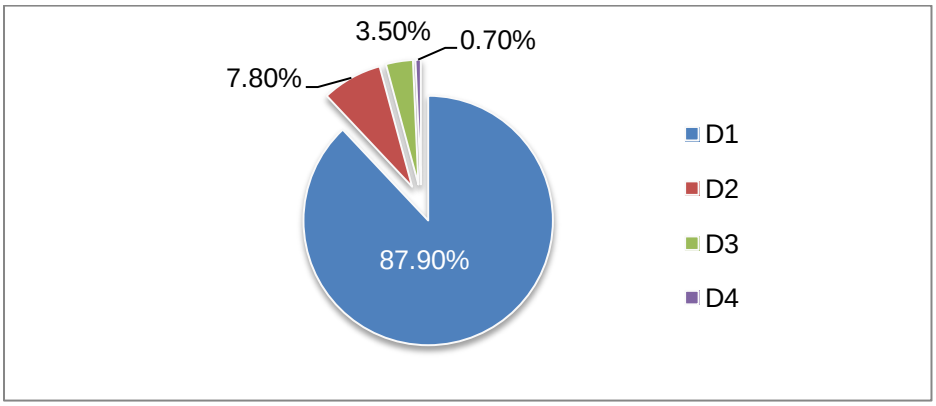

Figure 4: Treatment and Recurrence Percentage in the Sample

As mentioned in the literature review under study of Y.He et.al in 2016, they found that the total effective rate of I131 therapy was 88.07% (including a cure rate of 20.64% and an improvement rate of 67.43%). The non-effective rate was 11.93%. Another study which presented by Yong et.al [7], they found that the total effective rate of treatment in the test group was 98.39%, significantly higher than 72.41% in the control group. The table 4.8 compares the summary statistics for recovery rate in male and female.

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	F.U1	F.U2	F.U3	F.U4
Male	88.89%	11.11%	-	-
Female	82.45%	14.03%	2.63%	0.87%

Table 8: The Recovery Percentages in Each Sex

As can be seen from the figure 5, the male group reported significantly more recovery percentage than female group. It reached to 88.89% for patients who underwent a single dose and 11.11% for patients underwent double dose. However, the female recovery percentage from a single dose was reached to 82.45%. Moreover, the female patients needs for tri and tetra doses which is estimated at 2.63% and 0.87%, respectively.

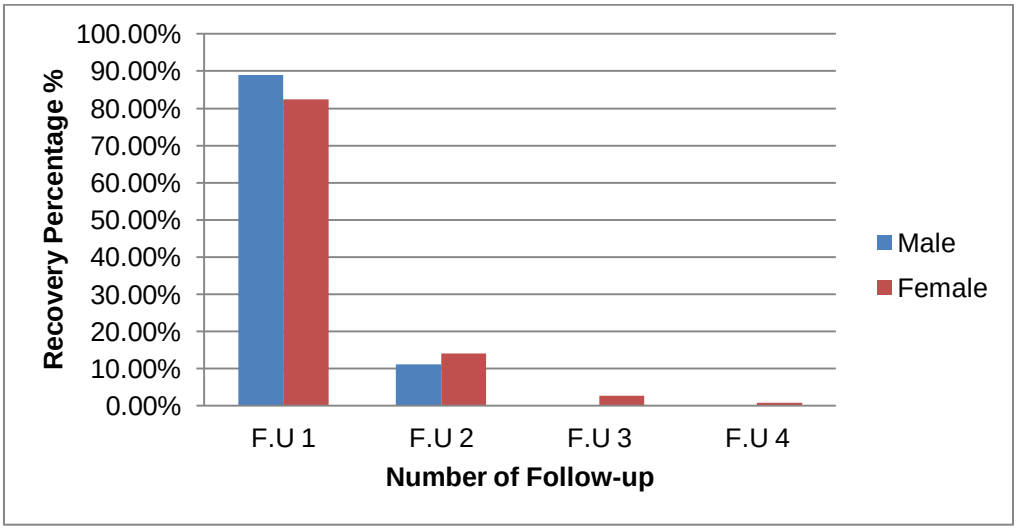

Figure 5: The Recovery Percentages in each Sex

By reviewing the literature, there are some articles were found on the association between gender and recovery rate for TC patients. They found different results than we shown like Shi et.al and Y.H Lee et.al studies. The found that Recurrence and death were more common in male patients with PTC than in female patients with thyroid carcinoma [15] and [16].

V. CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Surgery followed by radioiodine has remained the treatment of choice over the last six decades in TC with a favorable outcome. The presence of thyroid remnant tissue after thyroidectomy is a challenging problem particularly in patients with TC for RAI ablation. Postoperative serum Tg level is a sensible and reliable marker in terms of the presence of remnant thyroid tissue. Tc99m pertechnetate thyroid scintigraphy may be helpful to determinate the remnant thyroid tissue in our patients who underwent surgery for TC. According to the results of our study, female have more risk than male for TC. In addition, the prognostic value for female is lower than male. Also, the middle age group between 30-50 is more affected group. Finally, the patients with well-differentiated TC with distant metastases have poor prognoses after long-term follow-up.

Recommendations

The current study came out with several recommendations, including: doing several studies that includes a longer period of time and includes the children group in the sample. In addition, the patient history should be taken especially knowing the type of cancer, and knowing the results of laboratory tests like Tg. Also, more study should include the morality rate in the sample. Finally, the amount of dose given to the patient during the treatment period should be known.

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