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A 5 Year Retrospective Study of 131I Therapy for Thyroid Cancer Practice in King Abdulaziz University Hospital

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Abstract Since 1940s, intake of Iodine 131 is a deeprooted postoperative therapy for malignant thyroid. However, clinical practice does differ significantly between hospitals. This paper presents a retrospective study of a clinical practice for patients diagnosed with thyroid cancer at King Abdulaziz University Hospital (KAUH). The aim of this study was to benchmark KAUH practice patterns against international guidelines. A total of 100 patients with thyroid cancer were included, 70% females and 30% males with median age of 42.5 and 43.5 years respectively. Cases were patients, diagnosed with thyroid cancer and treated with radioactive iodine at KAUH in Saudi Arabia between 2005 and 2011. Some additional patient's data were excluded from the study because of missing information or lost to follow-up. Medical records included patient's gender, age, clinical diagnoses, iodine dose, and the recurrence. Where, thirty-three percent (33%) of the patients had papillary carcinoma, (3%) had follicular carcinoma and (1%) had Hurtle cell tumors. All patients had their total/partial thyroidectomy at KAUH. Dose administered ranged from (50 to 300) mCi with the 61% receiving a dose of 100mCi. A statistical test, Chisquare test, were used to allow us to test for deviations of observed frequencies from expected frequencies. The medical record showed that 3% of the patient had died and 4% had a recurrence that was successfully treated by the time of the study. Moreover, the 5-year survival rates for patients with thyroid cancers was 93%. The thyroid cancer incidence and the I-131 practice in KAUH is consistent with international data and standards.

Keywords: *radioactive iodine, thyroid cancer, nuclear medicine*

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1. Introduction

Therapeutic Nuclear Medicine is a medical imaging branch that involves the usage of small amounts of radioactive material to treat many diseases; including cancer. Radioactive Iodine 131 is a β-emitting radionuclide with a physical half-life of 8.1 d; a principal γ-ray 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 is an isotope of iodine used in the treatment of residual of thyroid after a complete or a partial thyroidectomy [1]. The purpose of the treatment is usually to distort the normal and cancerous thyroid tissue. Oral administration of I-131 has been a commonly accepted procedure for treatment of conditions of the thyroid since the 1940s [1].

Thyroid malignancies vary in incidence worldwide with a rising trend over the last 20 years. According to the Saudi Cancer Registry report of 2007, thyroid cancer comprised 9.9% of female malignancies ranking second to breast. Males, however, had a lower incidence at 6.4% making it the 4th most common cancer. Regarding age, thyroid cancer ranked the 1st among patients aged 15-29. The mean age for diagnosis was 43 years among males and 37 years among females [2].

Types of thyroid cancer are classified according to cell of origin into follicular and para-follicular. Follicular malignancies include papillary (which is the most common) followed by follicular and anaplastic cancers. Para-follicular malignancies include medullary thyroid cancer, which is a rare subtype [3].

The most widely used modality for treatment of differentiated thyroid cancers, include subtotal thyroidectomy followed by radioactive ablation of the gland remnants or any metastatic foci [4,5].

The 1st published use of radioactive iodine was in 1948, and since then, it has been increasing dramatically. However, there are no clear guidelines pertaining to the optimum dose used for treatment [6].

Selection of doses can be either empirically or by dosimetry [7,8]. The efficacy of therapy is directly related to tumor uptake, which depends on cell differentiation and inversely related to tumor stage and grade [9].

Activities between 50 mCi- 200 mCi are the most commonly used [7]. However, a meta-analysis revealed that the dose does not change efficacy on the condition

that the tumor cells are well differentiated, making a lower dose more favorable to decrease toxicity [10].

Activity of the radioactive iodine dose administrated varies; the common method is according to the estimated size of the thyroid gland and the result of the radioactive iodine uptake RAIU. The purpose of the treatment also plays a role in the selection of the activity of radioiodine administrated; for the postoperative ablation of thyroid 75-150 mCi are typically used, for the treatment of presumed thyroid cancer in the neck or mediastinal lymph nodes activity of 150-200 mCi is administrated, for the treatment of distant metastasis administration of radioactive iodine of activity more than 200 mCi [1].

This paper audits the records of 100 cases with histologically proven thyroid cancer during 2005-2010 at King Abdulaziz University Hospital (KAUH) Jeddah. Age, sex, and referring department have also been presented. We also report the doses of radioactive Iodine used for the treatment and relate it to the type of thyroid cancer.

2. Methodology

The medical records of patients diagnosed with thyroid cancer in king Abdulaziz university hospital between January 2005 and December 2010 were reviewed retrospectively. All in-patients were included in the study. One hundred (100) cases were admitted during this time period. Data comprised of type of thyroid cancer along with age, gender, referring department and dose of RAI received to patients. Data analysis was done using SPSS version 20.0. Chi-square test was applied for categorical data represented as frequencies and percentages. P-value < 0.05 was used as a significance level.

3. Results

One hundred (100) medical records were reviewed. Of these, 70% patients were females and 30% were males with a female to male ratio of 2.3:1. Median age for the females was 42.5 years, and for males 43.5 years. Thirty-three (33%) patients had a papillary carcinoma, three (3%) had follicular carcinoma, (1%) had Hurtle cell tumors, twenty-five (25%) patients had tumors with non-specified histology, 22 (22%) patients had other types, as medullary thyroid carcinoma and lymphoma, and 16 (16%) patients had undifferentiated neoplasms. The pediatric age group comprised 5% of the sample population.

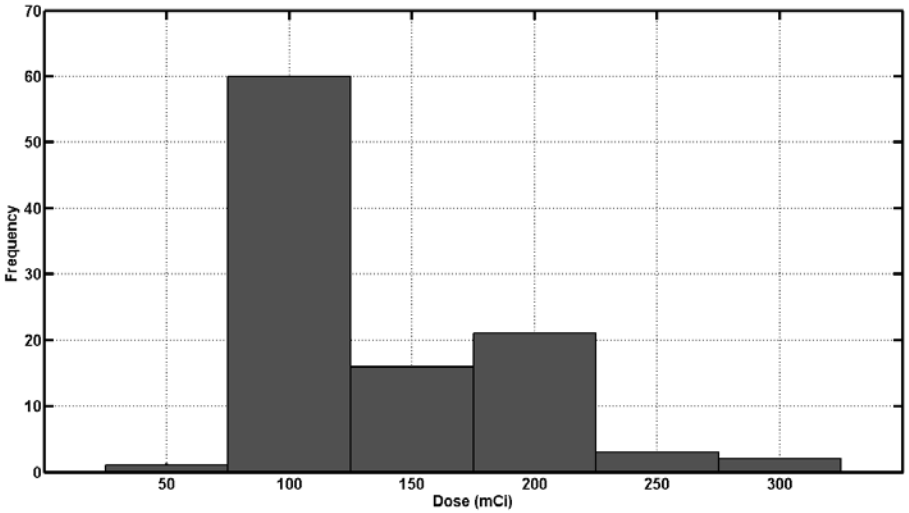

Figure 1. Activity range used

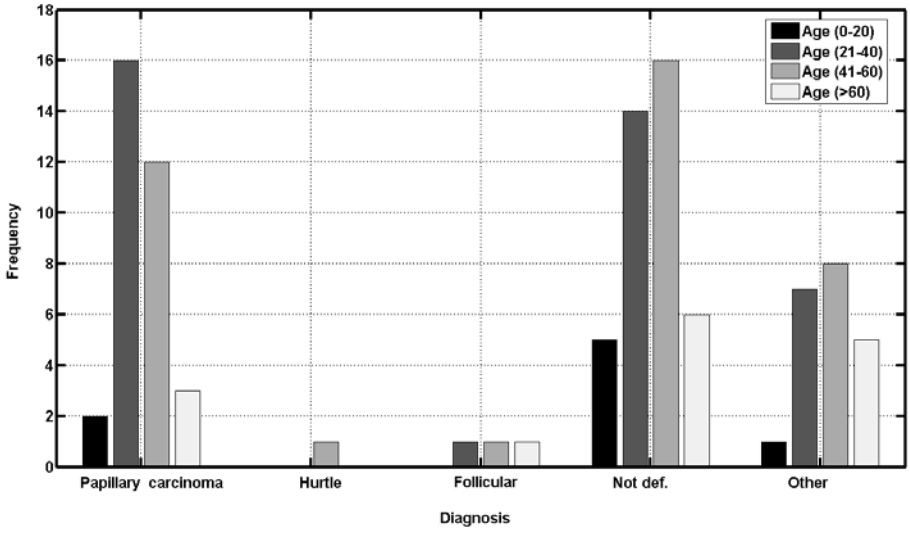

Figure 2. Diagnosis according to age

Activities administered ranged from 50 to 300 mCi with the majority (61%) receiving a dose of 100 (Figure 1) regardless of their age group, gender, or diagnosis. A dose of 300 was only used in papillary cancers. For follicular and hurtle cell tumors, only a dose of 100 was administered. Patients less than 20 years did not receive doses that exceeded 200, and patients aged 60 years and older were more likely to receive a dose of 200 than their younger counterparts.

Papillary carcinoma occurred most frequently between the ages 21-40 (Figure 2). It was also the commonest in both males and females (Figure 3).

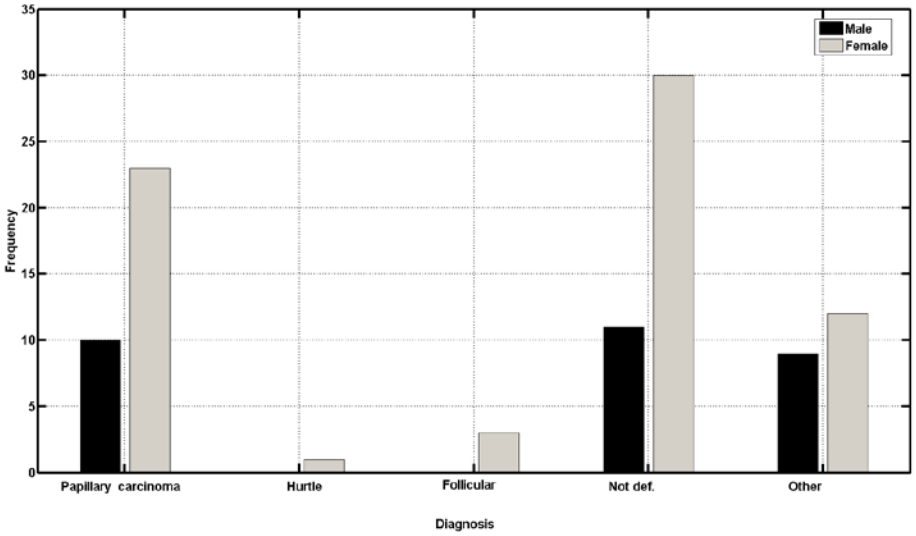

Figure 3. Diagnosis according to gender

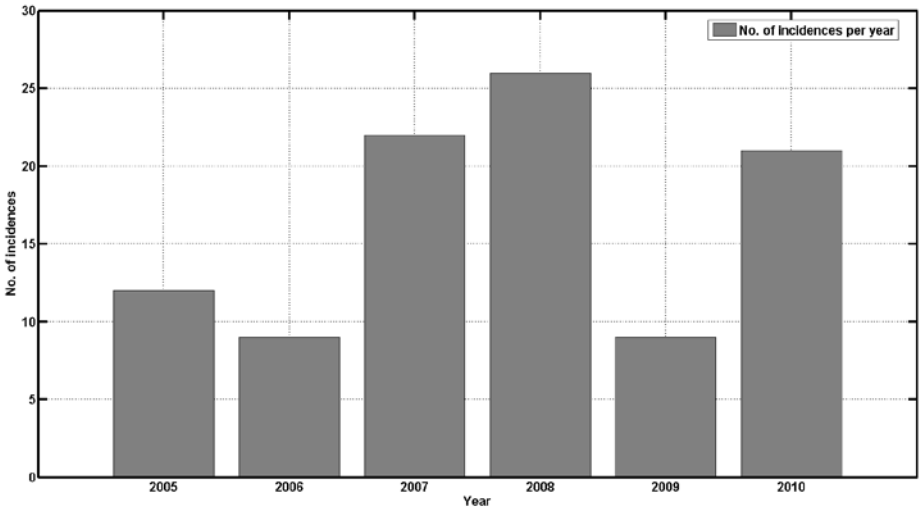

Figure 4. Disease incidences 2005-2010

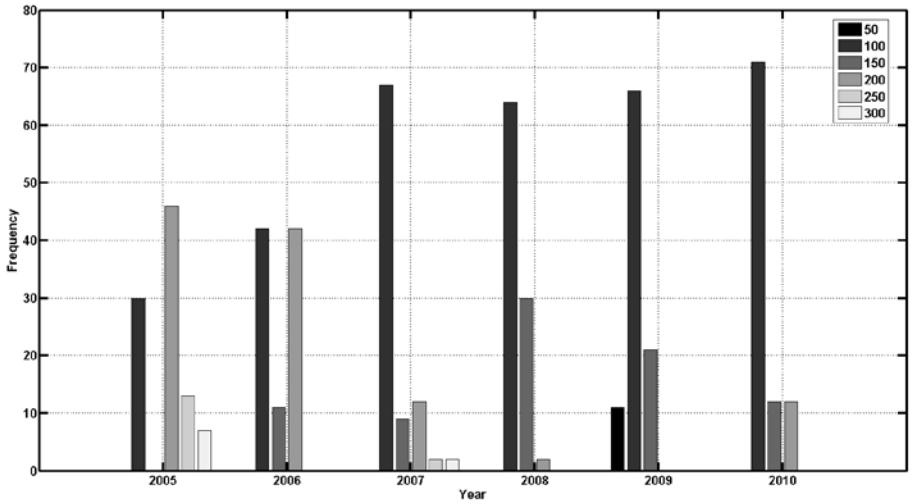

Figure 5. Activities throughout the years 2005-2010

The patterns of thyroid cancers throughout the five years of study shows that the incidence did not change drastically except for the years 2007 and 2009 (Figure 4).

During those years only 9 patients were diagnosed. Doses of 250 and more were not used beyond the year of 2007 (Figure 5).

The outcome of the treatment was that 3% of patients died, 4% had a recurrence, and 93% were alive and well. Those who died were all females with neoplasms of non-specified histology and no recurrence. All patients that died received a dose of 200. Their tumor type was not specified. All were females and none were recurrences.

Those who had a recurrence were also all females with papillary tumors. All were successfully treated by the time of the study with a second dose of RAI that exceeded their first by 50 mCi.

4. Discussion

Our study population demographics coincide with the expected distribution of thyroid malignancies; Being more common in females with a median age of 42.5 in females and 43.5 in males [11,12,13,14]. Our male: female ratio was 1:2.3 in concordance with other populations. However, male: female ratios as high as 1:7 has been reported [11]. In addition, a peak of 60-70 years for the incidence of these malignancies has been reported in male patients [15]. Studies that related gender and age to prognosis report that males tend to have a worse prognosis than women and that the pediatric age group tend to have recurrent cancers but better long-term survival [15,16]. In contrast, our study revealed that all patients who died as well as all those who had a recurrence were adult females. Similar to other populations, papillary carcinoma was the most common type with no variation with regard to age and sex (Figure 2 and Figure 3) [11,12,13,14]. Some of our patients had anaplastic tumors and still received RAI. The American Thyroid Association (ATA) does not recommend the unnecessary use of RAI in anaplastic tumors [17]. There is insufficient data that explains the use of RAI in our hospital for this type of tumor.

Activities administered were mostly 100 mCi, commonly used in other countries, with a range of 50-300 mCi (Figure 1) [4,5,9,11,12,13,14]. It has been suggested that for low risk malignancies, no or low doses of RAI are sufficient as it does not affect overall survival with the benefit of having lower or no toxicity [9,18-24]. In fact, doses as low as 30 mCi have been shown to be as effective as doses of 100mCi [25]. There is a trend towards lower doses and even outpatient use with regimens consisting of two 20-mCi doses [26]. In our hospital, doses of 250 and more were not used beyond the year of 2007. (Figure 5)

It has been proposed that success of treatment depends on adequate surgical removal and thyroid hormone suppression rather than RAI dose [20,21,22,23,24].

Our study did not reveal any change of dose in relation to age as reported elsewhere which can be attributed to the scarcity of studies relating the younger age groups to doses higher than 100 mCi due to ethical considerations [27]. Thyroid malignancies in the pediatric age group are in general better differentiated. The ATA recommends that doses given be adjusted to weight or surface area [25].

In conclusion our study did not reveal major changes in thyroid cancer incidence through 2005-2010 (Figure 4). Other studies have shown an increase incidence of thyroid cancers. It has been suggested that this is not a true increase but rather an increase in the discovery of asymptomatic papillary thyroid cancers due to better access to health care systems [28].

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