Original Research

NUTRITION STATUS OF THYROID CANCER PATIENTS UNDERGOING RADIOACTIVE IODINE ABLATION THERAPY

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ABTRACT

Aims: This study aims to determine the characteristics of patients indicated for I-131 treatment following complete thyroidectomy. The findings will assist Vietnamese nutritionists in developing appropriate guidelines and intervention methods.

Methods: This cross-sectional study was conducted at Hanoi Oncology Hospital from April 2021 to December 2022. Body weight, height, arm and calf circumference were measured. Body mass index (BMI) was calculated, and Patient Generated Subjective Global Assessment (PG-SGA) was assessed. The 24-hour dietary recall was assessed in comparison to patient's energy and protein daily requirements.

Results: Based on BMI, 15.3% of patients were overweight or obese, while 9.6% were malnourished. Arm and calf circumferences were effective indicators of malnutrition risk, similar to the PG-SGA. Despite 91.1% reporting no dietary changes, 40.3% experienced weight loss. Common symptoms included difficulty swallowing, loss of appetite, and fatigue. Dietary intake met 60.6 ± 24.6% of energy and 48.8 ± 20.6% of daily protein requirements.

Conclusions: A predominant rate of overweight-obesity (33.1%) was found in the thyroid cancer patients. Their energy and protein intake were inadequate. Dietary counseling is recommended to ensure iodine restriction, adequate nutrition, and prevent weight gain after I-131 treatment.

***Keywords**: thyroid cancer, nutrition status, dietary intake, BMI, PG-SGA*

I. INTRODUCTION

The incidence of thyroid cancer has been increasing rapidly worldwide in recent years. In Vietnam, according to global cancer statistics Globocan 2022, thyroid cancer ranks the 7th most frequent cancers [1]. Patients diagnosed with thyroid cancer post total thyroidectomy are often prescribed treatment with radioactive iodine ablation therapy using I-131 to treat remaining thyroid tissue after surgery. Current guidelines in Vietnam suggest patients have a low iodine diet for 4 weeks. Meanwhile, worldwide recommendations, a low iodine diet is defined as a diet that limits iodine intake to less than 50 micrograms (mcg) per day, and common application requires 1 to 2 weeks [2].

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The American Thyroid Association recommended that an iodine-restricted diet is successful when the iodine concentration in urine is < 15 µg/dL [2]. A study of Dao Quynh Huong et al. (2013) at the 108 Central Military Hospital showed that the iodine concentration in urine of patients decreased significantly after 2 weeks of an iodine-restricted diet at 6.1 ± 3.96 µg/dL [3]. Besides, a low iodine diet causes many negative effects on the patients such as fatigue, vomiting, nausea, hyponatremia, and reduces the patient's quality of life.

Nutritional consultation enhances treatment effectiveness through personalized diets [4]. However, the limited number of hospital nutritionists in Vietnam necessitates efficient patient nutrition management. This study aims to identify characteristics of patients needing I-131 treatment post-thyroidectomy to guide Vietnamese nutritionists in creating relevant resources and interventions.

II. METHODS

2.1. Patients and study design

This cross-sectional clinical study was conducted from April 2021 to December 2022 and included selected patients from the Department of Head and Neck Surgery and Thyroid Clinic, Hanoi Oncology Hospital (HOH). The HOH located in Hanoi, Vietnam, a tertiary referral hospital of oncology treatment that receives referral cases from the surrounding Northern and Mid-northern provinces, and HOH is an educational institutional affiliated with several medical university such as Hanoi medical university, Thai Nguyen pharmacy and medical university, Hanoi university of public health.

A formulation of sample size was used to calculate sample size as follows:

$$n = Z^2_{1-\alpha/2} \frac{p\,(1-p)}{(p\varepsilon)^2}$$

In which: n is sample size; $Z_{(1-\alpha/2)}$ = 1.96 with α=0.05; p = 0.605 is the proportion of obese cancer patients according to the previous study by Avital Harari (2012) [5]; and ε = 0.15 is the relative precision. Then, n = 111 is minimum sample size.

The inclusion criteria*:* patients aged ≥ 18, diagnosed with thyroid cancer, passed at least 5 days post operative complete thyroidectomy, the wound has completely healed, and patients were indicated to have low iodine diet. Patients could answer interviews and agree to participate in the research; Qualified for treatment with I-131 after implementing a low iodine diet, received treatment by a doctor from the Department of Nuclear Medicine after performing clinical and para-clinical examinations.

The exclusion criteria: Those who had congenital diseases that affect absorption and metabolism of nutrients (type 1 diabetes, acute kidney injury and chronic kidney disease) or a history of thyroid cancer treatment, mental disorders or intellectual disabilities, were excluded. The study was approved by the Human Research Ethics Committee of the National Institute of Nutrition in Vietnam. The study was conducted in accordance with the Declaration of Helsinki. All patients voluntarily signed the informed consent form.

2.2. Data collection

General information (name, age, gender, address) was interviewed and recorded on the survey form.

Anthropometric measurements (weight, height, arm-, calf- circumference were performed according to the standard of practice of the National Institute of Nutrition. Weight was measured in supine position with 100kg standard scale (Tanita BC-541N, made in China) with a precision of 0.1kg and with shoe removal and minimal clothes. Actual height was measured in standing position using sliding head SECA 217 height scale (SECA Germany, made in China). The subjects were wearing no shoes, hair coverings or hair bands and with hair smoothed down; stand erect on the floor or horizontal platform, with back against the vertical Stadiometer, heels against the wall, and feet or knees together whichever come together first. The participant looked straight ahead, with head in the Frankfort horizontal plane. Measurements were recorded at the nearest 1 mm. The 60 centimeters non-elastic measuring tape (The Abbott Laboratories Purchase Order) was used to measure circumference of the non-dominant mid-upper arm (mid-arm circumference – MAC) and calf circumference (CC), in centimeters, with a precision of 1 mm. MAC was measured with participants' standing positions and their non-dominant arm that was bent to 90 degrees. The midpoint between the accordion and the colcannon was marked with a pen. With the arm hanging straight down, a MAC tape was wrapped around the arm at the midpoint mark. Sitting calf was measured while the participant sat on a chair and held his/her bare foot down, holding the leg folded to 90 degrees. The circumference of the calf in this position was at its widest point that helped two professional dietitians laying the tape on the skin without tightening.

Body mass index (BMI) was calculated as on weight in kilogram divided by height in meters squared (kg/m^2). The patients were classified as underweight (BMI < 18.5), normal weight ($18.5 \leq BMI \leq 24.99$), overweight ($25.0 \leq BMI \leq 29.99$), and obese ($BMI \geq 30$) according to the World health organization (WHO) criteria.

For MAC, cut-off points of 22 cm and 23 cm were used for women and men, respectively [6]. Cut-off values for moderately and severely low CC were 34 cm and 32 cm (males), and 33 cm and 31 cm (females), respectively [7].

Dietary intake was measured by a dietitian based on a 24-hour dietary recall standard of practice of the National Institute of Nutrition, using food portion size models with images to help patients imagine and understand the estimation. Both oral and tube feeding were noted. Parenteral nutrition was calculated according to information from medical records. Results of the sum of the 24-hour dietary recall and total parenteral nutrition (if available) were calculated as kilo calorie energy and gram protein intake within 24-hour using the software of Vietnam National Institute of Nutrition based on local food composition and the nutritional content from parenteral nutrition commercial products. Cut-off points for energy intake were > 35 kcal/kg/d, 25-35 kcal/kg/d, and < 25 kcal/kg/d for malnutrition, normal or obesity, respectively while thresholds of protein intake were 1.5-2 g/kg/d, based on ESPEN guideline [8].

Patient-generated subjective global assessment score

PG-SGA scores were assessed for all patients. This tool comprised 2 sections that were completed by a patient or a clinician accordingly. Four medical components, namely weight loss, nutrition impact symptoms, intakes, and functional capacity, were assessed in a check box format, which was completed by the patient. Later, the physician scored the disease status and its relationship with nutritional requirements, metabolic demands, and physical examinations. PG-SGA scores were classified according to the standard scoring system: 0-1 (no intervention), 2-3 (nutrition education and counseling), 4-8 (dietitian intervention), and ≥ 9 (critical intervention). PG-SGA was also classified as (A) well-nourished, (B) moderately (or suspected of being) malnourished, and (C) severely malnourished [9].

2.3. Statistical analysis

All input data were statistically analyzed using the Statistical Package for the Social Sciences (SPSS Inc, Chicago. IL, USA) for Windows. Continuous data with a normal distribution were expressed as mean ± SD; when continuous data were not normally distributed, they were expressed as median (25^{th} percentile to 75^{th} percentile). Categorical variables were presented as number and percentage values (*n*, %). Between-group comparisons were made using the chi-square test, Fisher's Exact test, student's t-test, or Wilcoxon-Mann-Whitney test, as appropriate.

III. RESULTS

The study included 119 participants (92.4% female) aged 18-63 years (mean age 43.6 ± 12.0, median 44). The majority of participants had a high school education (42.5%), while the smallest group had only primary education (4.4%). Intermediate/college and university/postgraduate education levels accounted for 6.3% and 11.9% of participants, respectively. Farmers were the largest occupational group (47.1%), with freelancers (22.7%) and workers (21%) representing a relatively even distribution of the remaining participants.

Anthropometric classification

In this study, approximately three-quarters of participants had a normal BMI. Overweight and obesity affected 14.1% of women and 26.7% of men.

Arm and calf circumference classification was similar between sexes. Most subjects had normal arm circumference (82.7% of women, 93.3% of men). Fewer individuals were in the malnutrition risk range (17.3% of women, 6.7% of men). The patients with normal calf circumference accounted for the highest proportion in both men and women, with 60% of men and 60.4% of women falling into this category. The proportion of subjects with high-risk calf circumference measurements was 33.3% in men and 24.5% in women. The smallest group comprised those with calf circumference measurements at moderate risk, with 6.7% of men and 15.1% of women (Table 1).

Table 1. *Anthropometric classification of the subjects*

Classification	Total (*n* = 119)	Women (*n* = 110)	Men (*n* = 9)
Body mass index			
Malnutrition	9 (7.6)	9 (8.2)	0
Normal	95 (79.8)	88 (80.0)	7 (77.8)
Overweight/Obesity	15 (12.6)	13 (11.8)	2 (22.2)
Mid-arm circumference			
Malnutrition	6 (5.0)	6 (5.5)	0
Normal	113 (95.0)	104 (94.5)	9 (100)
Calf circumference			
High risk	26 (21.8)	24 (21.8)	2 (22.2)
Moderate risk	38 (31.9)	36 (32.7)	2 (22.2)
Normal	55 (46.2)	50 (45.5)	5 (55.6)

Assessment of nutritional status in patients according to PG-SGA

The study found that 44.5% of subjects had lost weight in the two weeks prior. The largest group, at 52.1%, maintained their weight, while only 3.4% experienced weight gain. Most of them had their dietary intake unchanged prior 1 month (91.6%); 2 patients had a dietary intake more than usual and the rest 8 patients (6.7%) eaten less. The most common symptoms among patients were loss of appetite and difficult swallowing (both with 13.4%) Other symptoms included constipation (3.4%), dry mouth (4.2%), and fatigue (5.0%). Symptoms such as nausea, vomiting, diarrhea, mouth pain, taste changes or loss of taste, pain, and other signs were very rare, each accounting for less than 3%. There were no reported cases of unpleasant odor or early satiety.

According to functional status, most subjects (99.2%) had normal functional activities, with only 0.8% being able to perform light work and requiring frequent rest. The proportion of subjects with suspected or mild malnutrition (SGA-B) was 22.7%. The largest group, 76.5%, had a normal nutritional status (SGA-A), while the smallest group, at just 0.8%, suffered from severe malnutrition (SGA-C).

Table 2. *Nutritional assessment of patients according to PG-SGA*

Categories	*n* (%)
Weight change	
Lost weight	53 (44.5)
Unchangeed	62 (52.1)
Increase	4 (3.4)
Changes in dietary intake one month before operation	
Less than usual	8 (6.7)

Categories	*n* (%)
Unchanged	109 (91.6)
More than usual	2 (1.7)
Symptoms affect nutrition status in two weeks before operation	
Loss of appetite	16 (13.4)
Nausea	1 (0.8)
Vomiting	1 (0.8)
Constipation	4 (3.4)
Diarrhea	1 (0.8)
Sore mouth	1 (0.8)
Dry mouth	5 (4.2)
Taste changes	1 (0.8)
Bad smell	0
Difficult swallowing	16 (13.4)
Feel full quickly	0
Tired	6 (5.0)
Pain	1 (0.8)
Others	1 (0.8)
Activities and function	
Normal	118 (99.2)
Able to be little activity	1 (0.8)
PG-SGA classification	
Level A	91 (76.5)
Level B	27 (22.7)
Level C	1 (0.8)

Dietary intake of thyroid cancer patients undergoing radioactive iodine ablation therapy

Table 3. *Energy and protein intake of patients undergoing high-dose radioactive iodine ablation therapy.*

Categories (n = 114)	Min-max (mean ± SD)
Energy requirement (kcal/d)	1203.0 -2193.0 (1569.4 ± 183.5)
Total energy intake (kcal/d)	286.4 – 2039.4 (944.4 ± 370.7)
Energy intake (kcal/kg/d)	5.6 – 37.6 (18.0 ± 7.3)
Protein requirement (g/d)	57.9 – 124.7 (79.6 ± 12.0)
Total protein intake (g/d)	11.1 – 84.4 (38.5 ± 16.0)
Protein intake (g/kg/d)	0.21 – 1.68 (0.73 ± 0.3)
Percentage energy intake per day (%)	18.7 – 133.5 (60.6 ± 24.6)
Percentage protein intake per day (%)	13.8 – 112.0 (48.8 ± 20.6)

Excluding 5 cases lack of information dietary intake (n = 114), the diet intake of patients after thyroid operation provided an average of 60.6 ± 24.6% of their daily energy requirements and 48,8 ± 20,6% of their daily protein requirements. The energy intake covered 18,0 ± 7,3 kcal/kg/day compared to the requirement 25-35kcal/kg/day. Similarly, protein intake was 0,73 ± 0,3 g/kg/day compared to 1-1,5g/kg/day requirement (Table 3).

IV. DISCUSSION

Nutrition status of patients undergoing high-dose radioactive iodine ablation therapy

The study found that 15.3% of patients were overweight or obese, while 9.6% were malnourished according to BMI classification. Three-quarters (75.2%) had a BMI within the normal range. Based on arm circumference, 16.2% of patients were malnourished, whereas calf circumference classification showed that 25.3% were at high risk and 14.3% were at moderate risk of malnutrition. According to the PG-SGA classification, which is a specific tool for identifying malnutrition in oncology populations, 21.4% of patients were at moderate risk (level B), and only 0.6% were malnourished. These findings indicate that arm and calf circumferences provided similar results to the PG-SGA classification in identifying patients who were at risk of malnutrition. This aligns with previous studies, likely because these measurements reflect muscle mass [10, 11].

Records generated by patients indicated that nearly half (40.3%) experienced weight loss in the two weeks before the interview, suggesting weight loss occurred both before and after surgery, despite 91.1% of patients reporting no change in dietary intake. The most frequent symptoms affecting patients' nutritional status in the two weeks prior to surgery were difficulty swallowing (29.4%), loss of appetite (27.9%), and fatigue (11.8%). These findings suggest that hospital dietitians should develop strategies to prevent weight loss starting from the preparation phase for thyroid surgery and continuing through the postoperative period.

Energy and protein intake of patients undergoing high-dose radioactive iodine ablation therapy

The results of this study showed most subjects did not meet their energy needs. Specifically, the dietary met 60,6 ± 24,6 % of their daily energy and 48,8 ± 20,06% of their daily protein requirements. These findings were consistent with those of general postoperative patients in our study in 2019. Therefore, the role of dietary counseling is crucial not only to ensure iodine restriction but also to provide adequate energy and protein for postoperative recovery, support health for I-131 treatment intervention after two weeks and prevent weight gain in subjects at risk of overweight and obesity.

V. CONCLUSION

The rate of malnutrition according to BMI in thyroid cancer patients was very low at 7.6%; however, the rate of overweight-obesity was high at 12.6%. Thyroid cancer patients undergoing radioactive iodine ablation therapy exhibit similar dietary characteristics to general post-surgery patients. Their actual energy intake meets only an average of 60,6 ± 24,6% of their energy needs, while protein intake meets only an average of 48,8 ± 20,6% of their protein needs. It is recommended that dietary counseling be provided to ensure iodine restriction and to supply adequate energy and protein for postoperative recovery. This will support health during I-131 treatment intervention and help prevent weight gain in patients at risk of overweight and obesity.

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