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Original Research Article

To Assess the Prevalence, Severity, and Long-Term Impact of Thyroid Dysfunction Following Intensity-Modulated Radiotherapy (IMRT) in Patients with Non-Thyroidal Head and Neck Cancers and to Evaluate the Potential Need for Routine Thyroid Function Monitoring in This Patient Population

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Conflict of interest: Nil

Abstract

Background: To Assess The Prevalence, Severity, And Long-Term Impact Of Thyroid Dysfunction Following Intensity-Modulated Radiotherapy (Imrt) In Patients With Non-Thyroidal Head And Neck Cancers And To Evaluate The Potential Need For Routine Thyroid Function Monitoring In This Patient Population.

Methodology: This study is a prospective cohort study conducted at a single tertiary care institute, specifically the Radiotherapy Department of Government General Hospital (GGH), Guntur. The primary aim of this study is to assess the incidence and pattern of thyroid dysfunction following Intensity-Modulated Radiotherapy (IMRT) in patients with non- thyroid head and neck cancers. A total of 70 patients with non-thyroid head and neck squamous cell carcinoma (HNSCC) were prospectively evaluated for thyroid dysfunction following radiation treatment.

Results: In this prospective study 70 patients with non-thyroid head and neck squamous cell carcinoma (HNSCC) were recruited. Of these 70 patients, 8 patients (11.4%) developed subclinical hypothyroidism following treatment, whereas 62 (88.6%) retained normal thyroid function during the follow-up period. Median period for the development of the subclinical hypothyroidism is 3 months. Results were observed.

Conclusion: In conclusion, the study strongly advocates for early and sustained thyroid function monitoring post-radiotherapy, even in asymptomatic patients. Detecting subclinical hypothyroidism early opens a window for potential intervention before clinical symptoms arise. Future research should aim to explore long-term outcomes with larger sample sizes, integrate autoimmune and endocrine markers, and optimize radiation planning to mitigate risks. Such efforts are essential for improving survivorship quality and reducing the burden of preventable late effects in cancer care.

Keywords: Thyroid Gland, Subclinical hypothyroidism, Intensity-Modulated Radiotherapy, Head and neck cancers.

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Introduction

Head and neck cancers (HNC) represent a diverse group of malignancies [3] that originate in the upper aerodigestive tract, including the oral cavity, pharynx, larynx, nasal cavity, paranasal sinuses, and salivary glands.

These cancers account for a significant proportion of the global cancer [1] burden, particularly in low- and middle- income countries, due to risk factors such as tobacco use, alcohol consumption, and human papillomavirus (HPV) infection, Radiotherapy (RT) remains a cornerstone in the management of head and neck cancers (HNC).

Establishing uniform diagnostic benchmarks and incorporating routine thyroid monitoring into survivorship care plans would enhance the accuracy of incidence estimates and ultimately improve patient outcomes. Radiation-induced hypothyroidism (RIH) is a recognized sequela in patients receiving radiotherapy for head and neck cancers (HNC), presenting either as subclinical or overt hypothyroidism. Subclinical hypothyroidism is biochemically defined by elevated thyroid-stimulating hormone (TSH) levels while maintaining normal circulating levels of free thyroxine (T4) and free triiodothyronine (T3).

Clinically, it is often underdiagnosed due to its insidious and non-specific symptomatology, which includes fatigue, constipation, cold intolerance, and unintentional weight gain. Failure to detect and manage subclinical hypothyroidism in a timely manner may result in progression to overt hypothyroidism, marked by low levels of free triiodothyronine (T3) and free thyroxine (T4), & elevated TSH. Overt hypothyroidism carries more serious clinical consequences, including increased cardiovascular risk, dyslipidaemia, cognitive impairment, and deterioration in health-related quality of life. These outcomes highlight the importance of early biochemical detection and clinical awareness among healthcare providers involved in the long-term care of HNC survivors.

When both sexes are considered, the overall incidence of HNCs in India paints a striking picture:

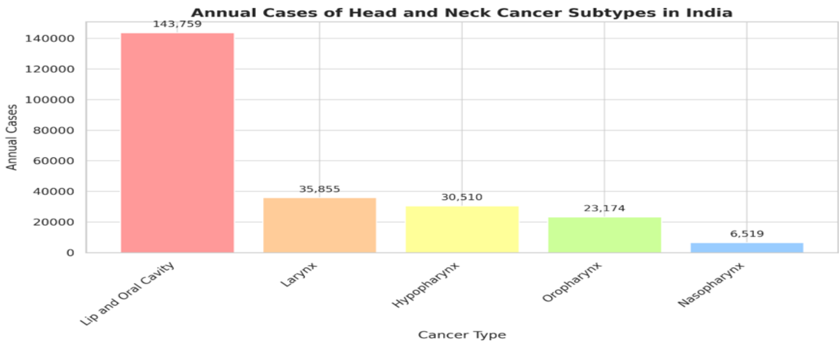

Figure 1:

Lip and oral cavity cancer: 10.2% of all cancer cases (143,759 cases annually)

Laryngeal cancer: 2.5% (35,855 cases), Hypopharyngeal cancer: 2.2% (30,510 cases), Oropharyngeal cancer: 1.6% (23,174 cases)

Nasopharyngeal cancer: 0.46% (6,519 cases)

Factors Contributing to the High Burden in India: Tobacco Use, Alcohol Consumption, HPV Infection, Poor Oral Hygiene, Decreased Nutrition and Chronic Inflammation,

Thyroid Gland:

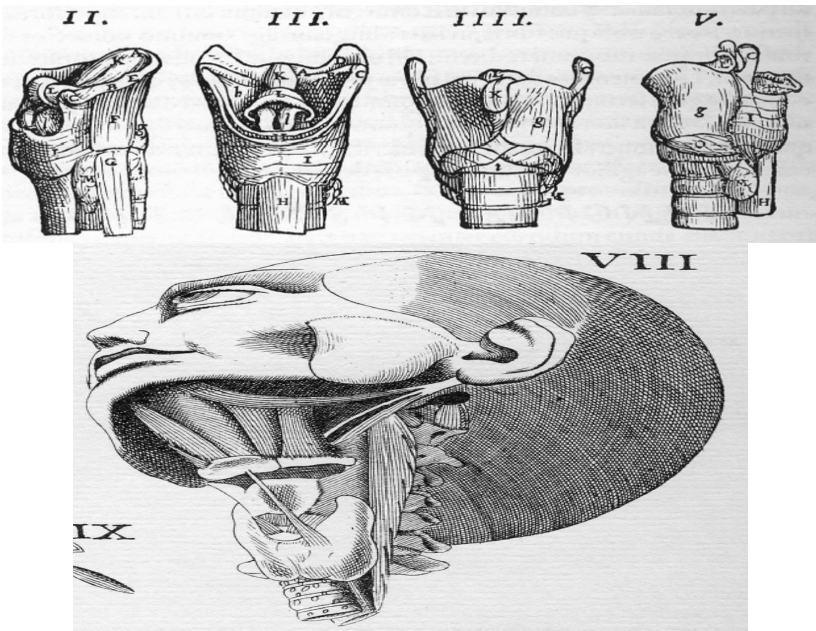

Figure 2: Thyroid gland from the plates of Eustachius, published by Lancisius in the Tabulae anatomicae, 1714 [2,5]

Intensity-modulated radiotherapy (IMRT), there has been substantial progress in reducing radiation-related toxicity to adjacent normal tissues. IMRT enables highly conformal dose distribution, allowing for precise targeting of tumours while minimizing exposure to OARs.

While radiotherapy (RT) remains a cornerstone in the management of primary malignancies and in preventing disease recurrence, it is often regarded as a “double- edged sword” due to its potential to cause significant acute and long-term toxicities.

Radiotherapy-induced malignancies (RTIMs) are late-onset complications that emerge after a latency period in patients who have undergone RT similar to RIH.

The risk is most pronounced at low to moderate radiation doses, peaking around 20 Gy, after which it declines, likely due to the cytotoxic effects of higher doses.

Aim

To assess the prevalence, severity, and long-term impact of thyroid dysfunction following intensity-modulated radiotherapy (IMRT) in patients with non-thyroidal head and neck cancers and to evaluate the potential need for routine thyroid function monitoring in this patient population.

Objectives

1. To determine the prevalence and severity of thyroid dysfunction in patients undergoing IMRT for non-thyroidal head and neck cancers.
2. To evaluate the long-term effects of IMRT on thyroid function, identifying trends in thyroid hormone alterations over time.
3. To assess the necessity of incorporating routine thyroid function tests into the standard follow-up protocol for head and neck cancer patients receiving IMRT.

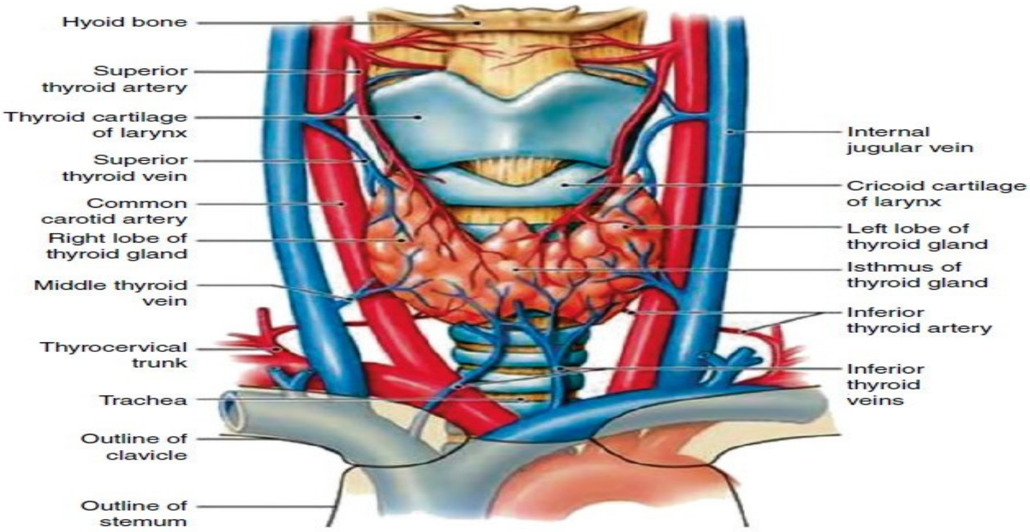

Figure 3: The thyroid gland and associated blood vessels [10]

TRH acts on the anterior pituitary to stimulate the secretion of thyroid-stimulating hormone (TSH), also known as thyrotropin. TSH then binds to receptors on the thyroid follicular cells, activating adenylate cyclase and increasing intracellular cyclic adenosine monophosphate (cAMP). This cascade enhances nearly all stages of thyroid hormone synthesis and secretion.

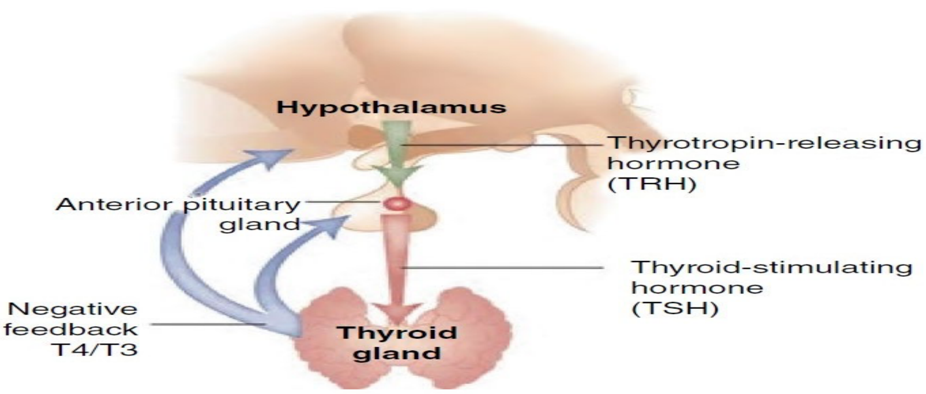

Figure 4: The hypothalamic-pituitary- thyroid axis [13]

Clinical Manifestations: The clinical features of primary hypothyroidism (PH), includes fatigue, cold intolerance, muscle cramps, weight gain, depression, slow mentation, delayed wound healing, hypercholesterolemia, accelerated atherosclerosis, constipation, pericardial and pleural effusions, and reduced gastrointestinal motility.

Hypothyroidism & Radiotherapy

a. Hypothyroidism and Irradiated Thyroid Volume: Several factors have been implicated in the development of radiation-induced hypothyroidism, including tumour site, stage of disease, unilateral or bilateral neck irradiation, mode of treatment (Cobalt or Linac), dose given, and volume of dose received by thyroid gland.

One of the factors that might greatly influence is the anatomical location of the tumour. For tumours of the larynx and laryngopharynx, the thyroid gland typically falls within the radiation field. While studies have found relationship between incidence of hypothyroidism with tumour site and stage [9]. Several studies, did not find a significant association between the development of post-radiation hypothyroidism and primary tumour location or disease stage [8,10,11].

Patients treated with telecobalt therapy showed a higher incidence compared to those treated with linear accelerators.

Data from Yoden et al, support that the proportion of thyroid volume receiving ≥10 Gy (V10), ≥20 Gy (V20), or ≥30 Gy (V30) correlates with changes in TSH levels [27]. Prior research by Bhandare et al [14] indicated that clinical hypothyroidism became more probable with thyroid doses exceeding 45 Gy, suggesting a dose-response relationship. Reducing the irradiated thyroid volume and limiting exposure doses may thus mitigate risk.

More recent studies, such as that by Diaz et al. in 2010, demonstrated that IMRT without specific thyroid constraints could yield higher V10, V20, and V30 compared to conventional 3D-CRT, emphasizing the need for updated dose constraints specific to IMRT [30].

In the study from Seoul National University College of Medicine, Korea by Mi Young Kim [32], V45 ≥50% emerged as a practical threshold for predicting hypothyroidism, although the ROC curve indicated a higher discriminatory point at 65%. Given the goal of minimizing hypothyroidism, they recommend the more conservative threshold of 50%. The relatively short median follow-up duration of 25 months may be a limitation of this study, although most cases of hypothyroidism occur within the first three years post-treatment, with a median latency of 1.4–1.8 years. The observed hypothyroidism rate in this study was 46%, which is higher than previously reported in literature and may increase with extended follow-up.

b. Hypothyroidism and Latency: Several studies have examined the latency period associated with radiation-induced hypothyroidism, highlighting variability in the time of onset. Although hypothyroidism has been observed as early as three months following radiotherapy [12,13], the peak incidence is typically reported between two to three years post-treatment [14]. Some authors suggest that higher radiation doses to the thyroid gland may correlate with a shorter latency period; however, further prospective research with consistent, periodic thyroid function assessments is needed to validate this hypothesis [15].

Materials & Methodology

Study Design: This study is a prospective cohort study conducted at a single tertiary care institute, specifically the Radiotherapy Department of Government General Hospital (GGH), Guntur. The primary aim of this study is to assess the incidence and pattern of thyroid dysfunction following Intensity-Modulated Radiotherapy (IMRT) in patients with non- thyroid head and neck cancers.

Total Duration: 12 months

Study Period: August 2024 – August 2025

Ethical Considerations: Prior to initiation, the study was reviewed and approved by the Institutional Ethical Committee of Guntur Medical College. Written informed consent was obtained from all participating patients after thoroughly explaining the objectives, procedures, risks, and benefits of the study.

Study Population: The study population comprises patients diagnosed with non-thyroid head and neck squamous cell carcinomas (HNSCC) or poorly differentiated carcinomas who are planned for definitive or adjuvant IMRT as part of their treatment protocol.

Sample Size: A total of 70 patients were included in the study based on sample size calculations and department capacity for long-term follow-up.

Source of Data: Patients were recruited from those referred to the Radiotherapy Department of GGH, Guntur. Only those who met the eligibility criteria and consented to participate were enrolled.

Eligibility Criteria Inclusion Criteria

1. Histologically confirmed diagnosis of:

- Squamous cell carcinoma
- Poorly differentiated carcinoma of head and neck (excluding thyroid malignancies)

2. Clinical stage: Stage I to IVA (AJCC criteria)

3. Baseline Thyroid Function Tests (T3, T4, TSH) within normal limits

4. No prior history of thyroid disorders or thyroid medications

Exclusion Criteria

1. Diagnosed thyroid malignancy
2. Pre-existing thyroid dysfunction or abnormal baseline thyroid function tests
3. Patients on thyroid hormone replacement or anti-thyroid medications
4. Prior history of radiation therapy to the head and neck
5. Diagnosed or suspected pituitary dysfunction

Methodology

Pre-treatment Assessment

All eligible patients underwent comprehensive baseline evaluation including:

1. Thyroid Function Tests (T3, T4, TSH)
2. Routine Haematological and Biochemical Investigations
3. Histopathological confirmation of diagnosis
4. Imaging: Contrast-Enhanced CT (CECT) of face and neck, with or without MRI as per clinical indication
5. Staging workup: USG Abdomen, Chest X-ray

Patients with normal thyroid function were included. Baseline values were recorded prior to initiation of radiation therapy.

Radiotherapy Protocol: All patients received Intensity-Modulated Radiotherapy (IMRT) as per the standard institutional protocol. Treatment planning included:

1. CT Simulation for precise tumour and organ-at-risk (OAR) delineation
2. Radiation dose and fractionation according to tumour stage and location
3. Radiation fields were carefully planned to minimize dose to the thyroid gland, though incidental exposure was unavoidable due to anatomical proximity

Follow-Up and Monitoring: Patients were followed prospectively for a period of 12 months post-radiotherapy. Thyroid function was assessed at multiple intervals:

1. Baseline (Pre-RT)
2. 3 months post-RT
3. 6 months post-RT
4. 12 months post-RT

Clinical symptoms of thyroid dysfunction were also monitored, including fatigue, weight changes, cold intolerance, constipation, and neck swelling.

Patients developing symptoms were evaluated further and managed accordingly.

Investigations Required: Investigations were routinely carried out as part of the study:

1. Thyroid Profile: T3, T4, TSH
2. Histopathological Report
3. Imaging: CECT/MRI of face and neck
4. CT Simulation Data
5. Additional Work-up: USG abdomen and chest X-ray for staging

Outcome Measures: The primary outcomes assessed in the study include:

1. Incidence of thyroid dysfunction post-IMRT (clinical or subclinical hypothyroidism)
2. Time of onset of thyroid dysfunction
3. Association between thyroid dysfunction and patient or cancer characteristics.

Result

In this prospective study 70 patients with non-thyroid head and neck squamous cell carcinoma (HNSCC) were recruited.

Of these 70 patients, 8 patients (11.4%) developed subclinical hypothyroidism following treatment, whereas 62 (88.6%) retained normal thyroid function during the follow-up period.

Median period for the development of the subclinical hypothyroidism is 3 months.

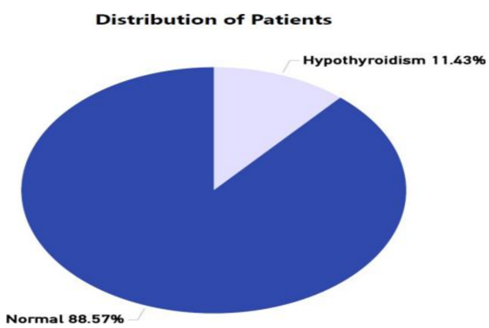

Figure 5: Distribution of patients

There were 56 males (80%) and 14 females (20%), highlighting a clear male predominance.

The gender distribution within the hypothyroid group included 7 males (87.5%) and 1 female (12.5%). Among the 62 patients without hypothyroidism, 49 were males (79.0%) and 13 were females (21.0%). There is no statistically significant association between gender and the occurrence of hypothyroidism post-RT as the p-value is 0.925. Most patients were in the age group of 61-70, with 24 patients i.e. 34.2%, followed by 15 patients of 51-60.

In the age group of 31-40 there were 10 patients, in 41-50 age group 12 patients and above 70 years age 8 patients. Only one patient was in the age group of below

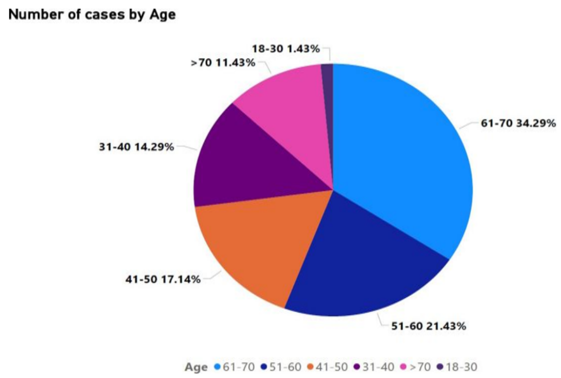

Figure 6: Number of cases by age

Out of the 8 people who were diagnosed with hypothyroidism during the follow-up, 4 were from the 51 - 60 age group, 2 from the 41- 50 age group and the remaining 2 from the 61-70 age group. The p-value for the association between age group and hypothyroidism status is 0.265 which statistically not significant.

A total of 70 patients with non-thyroid head and neck squamous cell carcinoma (HNSCC) were prospectively evaluated for thyroid dysfunction following radiation treatment. Thyroid Stimulating Hormone (TSH) levels were measured during follow- up to assess post-treatment thyroid function. Out of the total, 8 patients (11.4%) had TSH values exceeding 4.0 mIU/L, meeting the criteria for radiation-induced hypothyroidism.

The majority of patients (60%) had TSH levels within the 1.0–2.0 mIU/L range, indicating euthyroid status post-therapy. The distribution of TSH values among the study is as follows

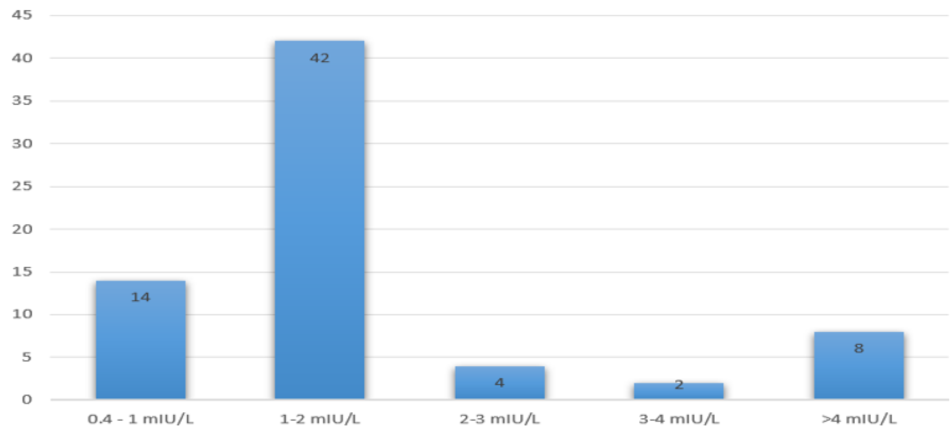

Figure 7:

In this graph the X axis represent the TSH values in mIU/L and the Y axis shows the number of cases.

When analyzing the primary site of carcinoma in this study, the result shows most of it occurs in the oral cavity (45.7%) followed by oropharynx (25.7%) and larynx (15.7%).

Hypopharynx carcinoma patients are 6 in number followed by nasopharynx with 2 cases and nasal cavity cancer with 1 case. Notably it's not surprising to see the hypothyroidism is most commonly occurring in oral cavity cancers with 4 cases followed by 2 cases each in oropharyngeal carcinoma and laryngeal carcinoma. With carcinoma of hypopharynx, nasopharynx and nasal cavity with 0 reported hypothyroidism.

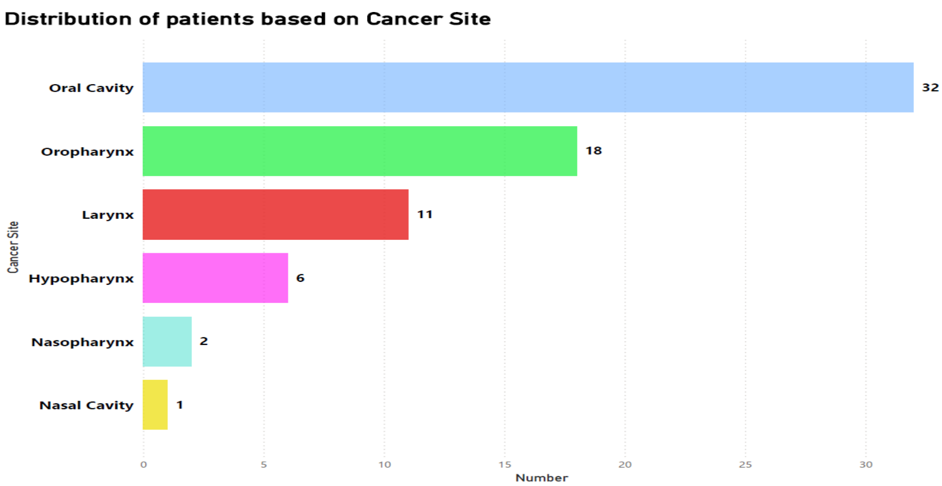

Figure 8: Distribution of patients based on cancer site

Table 1: Cancer Site vs. Hypothyroidism cases

Cancer Site	Total Patients	Hypothyroid	Non-Hypothyroid
Oral Cavity	32	4	28
Oropharynx	18	2	16
Nasopharynx	2	0	2
Hypopharynx	6	0	6
Larynx	11	2	9
Nasal Cavity	1	0	1

To evaluate the association between the primary cancer site and the incidence of hypothyroidism following radiotherapy, a Chi-square test was conducted. The resulting p-value was 0.89, which is substantially higher than the conventional threshold of 0.05 for statistical significance. This indicates that the observed distribution of hypothyroidism across different cancer sites is likely due to chance rather than a true underlying association.

Table 2: Cancer Site vs. % Hypothyroid cases

Cancer Site	Total Patients	Hypothyroid	% Hypothyroid
Oral Cavity	32	4	12.5
Oropharynx	18	2	11.11
Nasopharynx	2	0	0.0
Hypopharynx	6	0	0.0
Larynx	11	2	18.18
Nasal Cavity	1	0	0.0

The oral cavity represented the most common primary site in this cohort, accounting for 32 out of 70 cases (45.7%). Among these, 4 patients (12.5%) developed hypothyroidism during the follow-up period. Similarly, oropharyngeal cancers constituted 18 patients (25.7%), with 2 patients (11.1%) exhibiting post-radiotherapy hypothyroid changes. The laryngeal cancer group showed the highest proportion of hypothyroidism, with 2 of 11 patients (18.2%) affected, suggesting increased susceptibility possibly due to anatomical proximity to the thyroid gland and higher radiation dose exposure in adjacent fields. No cases of hypothyroidism were observed among patients with nasopharyngeal, hypopharyngeal, or nasal cavity tumours, although the numbers in these groups were notably small (2, 6, and 1 patient respectively), limiting the statistical power to infer low incidence. Overall, 8 out of 70 patients (11.4%) developed hypothyroidism within one year of treatment. The results indicate a notable risk of hypothyroidism following IMRT in head and neck cancer patients, particularly in cancers of the oral cavity and larynx. These findings underscore the importance of incorporating thyroid function monitoring into post-treatment surveillance protocols, especially for patients with primary sites in close anatomical proximity to the thyroid. No statistically significant correlation was drawn from the small numbers in certain subsites, but the data provides early insights into subsite-specific vulnerability and warrants further study with larger cohorts.

Discussion

Hypothyroidism following the radiation to head and neck cancer in this study, within the first 3 months of follow up 8 out of 70 i.e. 11.4% were diagnosed with subclinical hypothyroidism where the value of TSH is elevated while the values of T3 and T4 hormones values remains normal. With simple blood tests we can diagnose subclinical hypothyroidism before it transforms into the clinical hypothyroidism with symptoms. The key here being the diagnosis of the subclinical hypothyroidism which occurs earlier than that of clinical one.

The key factors are history taking, physical examination, routine blood investigations, Hb levels, WBC levels, MRI scanning and PET scanning. If the individual is suffering from clinical hypothyroidism, the symptoms such as fatigue, constipation, dry skin, cold intolerance. Studies have shown subclinical hypothyroidism following radiotherapy occurs within a shorter time interval compared to clinical hypothyroidism. Which if managed can prevent its transformation into clinical hypothyroidism.

T.A Groover et al published the paper showing hypothyroidism following radiotherapy with him writing 'There are only two sequalae that need to be considered, hypothyroidism and telangiectasia of the skin' [4].

In our study of 70 patients, I have come across 8 patients with hypothyroidism. All of which having subclinical hypothyroidism with elevated Thyroid Stimulating Hormones levels with normal T3 and T4 level. These individuals were diagnosed with subclinical hypothyroidism within the first follow up itself.

Hypothyroidism & Age: Out of the 70 patients, 34.2% (24 patients) of them are within the age group of 61-70 years old. With the increase in age the threat in cancer incidence is increasing with 18-30, 31-40, 41-50, 51-60, 61-70 age groups showing 1.43%, 14.29%, 17.14%, 21.43%, 34.2% respectively. Only 8 patients (11.43%) were included in the age group of above 70 as individuals with poor ECOG performance status were mostly in this age group and were excluded from this study.

Those 8 patients who were diagnosed with hypothyroidism were in the age group 41- 50 with 2 patients, 51-60 with 4 patients and rest of the 2 from the age group of 61-70. It is easy to assume that there is a correlation between age and hypothyroidism as we see that there is an increase in incidence of hypothyroidism in an older age group.

In this study, 70 patients were recruited, with 80% of them being males, and the rest 20% females. There were 8 patients with hypothyroidism. In this hypothyroidism group, 87.5% were males, i.e. 7 patients, and 12.5% were females, i.e. only 1 patient. Among the study cohort, 12.5% of male patients and approximately 7.1% of female patients developed hypothyroidism following treatment. In the rest 62 individuals without hypothyroidism, 79% were males, and 21% were females. Statistical analysis with the Fisher's exact test revealed that the p-value in this case is 0.925, to be statistically significant. There is no statistical association between the gender and the incidence of post-radiotherapy hypothyroidism.

Primary cancer siter and Hypothyroidism: The study revealed that 11.4% (8 out of 70) of patients developed hypothyroidism within one-year post-IMRT. The highest incidence was observed among patients with laryngeal cancers (18.2%), followed by those with oral cavity (12.5%) and oropharyngeal tumours (11.1%).

Importantly, IMRT has been promoted for its ability to spare adjacent healthy tissues through highly conformal dose distributions. This study highlights that subclinical thyroid damage may still occur despite these advancements, particularly when target volumes are adjacent to or overlap with the thyroid gland.

Statistical analysis using a Chi-square test revealed a p-value of 0.89, indicating no statistically significant association between primary cancer site and the development of hypothyroidism post-radiotherapy. Overall, while hypothyroidism remains a known and relevant side effect of head and neck radiotherapy.

Hypothyroidism and TSH: In this prospective study, a total of 70 patients diagnosed with head and neck carcinoma were monitored to assess the onset of hypothyroidism following radiotherapy. 8 out of the 70 patients (11.43%) were identified as having developed subclinical hypothyroidism. The remaining 62 patients (88.57%) continued to maintain normal thyroid profiles (T3, T4, and TSH) during this initial post-treatment period.

Breakdown of TSH levels among the 70 patients is as follows: 14 patients (20%) had TSH values between 0.4–1 mIU /L, 42 patients (60%) between 1–2 mIU/L,4 patients

(5.71%) between 2–3 mIU/L, 2 patients (2.86%) between 3–4 mIU/L, and 8 patients (11.43%) had values exceeding 4 mIU/L, the threshold considered indicative of hypothyroidism.

This study highlights a notable prevalence (11.43%) of subclinical hypothyroidism within the early post-radiotherapy period among patients treated for head and neck malignancies. These findings reinforce the need for routine thyroid function assessment as part of post-treatment surveillance. Further follow-up over an extended period will be crucial to determine the long-term incidence and clinical course of hypothyroidism in this population, as well as to evaluate the potential need for preventive or early therapeutic interventions.

Hypothyroidism, Surgery, and Chemotherapy: In the present study, no statistically significant association was observed between the development of hypothyroidism and patients undergoing surgical intervention or receiving chemotherapy as part of their treatment regimen.

The extent of dissection and proximity to the thyroid gland may influence the likelihood of subsequent hypothyroidism, particularly when combined with adjuvant radiotherapy [19].

Patients with undiagnosed or subclinical hypothyroidism may experience delayed wound healing, making them more susceptible to postoperative infections and other complications [16,17,18].

The incidence of post-treatment hypothyroidism [19[. Chemotherapy, has not been shown to play a significant role in the onset of hypothyroidism in patients undergoing treatment for head and neck malignancies [7, 11].

Follow up period

Understanding the Complexity: In our study, dose-volume constraints to the thyroid were not a primary focus due to the multifactorial nature of hypothyroidism development following radiotherapy (RT). The pathophysiology of hypothyroidism in patients undergoing RT for head and neck malignancies is complex and cannot be solely attributed to the radiation dose received by the thyroid gland. Several anatomical and physiological structures, such as the hypothalamus, pituitary gland, and the hypothalamic-pituitary (H-P) axis, are at risk of radiation exposure and may contribute to altered thyroid function.

Hypothyroidism following RT can arise from two principal mechanisms: primary hypothyroidism (PH) and central hypothyroidism (CH). PH results from direct radiation- induced damage to the thyroid gland, which impairs its ability to synthesize thyroid hormones.

In contrast, CH stems from dysfunction in the hypothalamus, pituitary, or H-P portal system, leading to insufficient stimulation of the thyroid gland despite its structural integrity [14]. While PH is the more commonly reported consequence of cervical irradiation, unfortunately, comparative data between PH and CH in the context of RT remains limited, making it difficult to clearly distinguish between the two in post-treatment patients. The lack of emphasis on dose-volume parameters to the thyroid in this study stems from the need for a more integrated approach to understanding thyroid dysfunction post-RT.

Hypothyroidism following radiotherapy for head and neck malignancies is a multifaceted complication involving not only direct thyroid damage but also potential injury to the hypothalamic-pituitary axis and immune system activation. By identifying high-risk patients prior to the initiation of RT, clinicians can better tailor treatment plans and follow-up strategies to preserve endocrine health and improve long-term patient outcomes.

Conclusion

This study highlights the early onset and prevalence of subclinical hypothyroidism as a measurable complication following radiotherapy in patients with head and neck cancers. Within just three months of follow-up, 11.43% of patients developed elevated TSH levels while maintaining normal T3 and T4, indicating early thyroid dysfunction that often remains undiagnosed in routine clinical practice. Despite initial assumptions, statistical analysis revealed no significant association between hypothyroidism and patient age, gender, or primary tumour site. These findings underscore that radiation exposure itself, rather than demographic or anatomical factors, is the primary driver of thyroid dysfunction in this population.

While the study found no significant link between hypothyroidism and surgical or chemotherapeutic interventions, it reaffirmed that radiotherapy remains the predominant risk factor. The potential for radiation to affect not only the thyroid gland but also the hypothalamic-pituitary axis and trigger immune-mediated responses further complicates the pathophysiology. This multifactorial mechanism suggests a need for holistic endocrine monitoring beyond thyroid gland dosimetry alone.

The study also identified a major limitation in patient follow-up beyond the three-month period, which restricted insight into the progression from subclinical to overt hypothyroidism. This challenge reflects a broader issue of poor compliance among head and neck cancer survivors, emphasizing the need for improved patient education, follow-up strategies, and perhaps alternative monitoring methods such as telehealth.

In conclusion, the study strongly advocates for early and sustained thyroid function monitoring post-radiotherapy, even in asymptomatic patients. Detecting subclinical hypothyroidism early opens a window for potential intervention before clinical symptoms arise. Future research should aim to explore long-term outcomes with larger sample sizes, integrate autoimmune and endocrine markers, and optimize radiation planning to mitigate risks. Such efforts are essential for improving survivorship quality and reducing the burden of preventable late effects in cancer care.

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