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Original Research Article

A retrospective study of thyroid functional status in patients treated with radiation therapy over head and neck region for squamous cell carcinoma of head and neck

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ABSTRACT

Background: Head and neck cancer is the sixth most common carcinoma in the world.Management of head neck cancer is either surgery or radiotherapy (RT) for early stage tumour and surgery combined with radiotherapy, radical radiotherapy or concurrent chemoradiotherapy (CCRT) for advanced stages. One of the most common clinical late effects of thyroid gland irradiation in patients exposed to therapeutic doses to the neck is hypothyroidism.

Aims & Objectives: To estimate the prevalence of hypothyroidism in post radiation head neck cancer patients where radiation portal included total or most of the thyroid gland and **t**o calculate the Odds ratio for the development of subclinical or clinical hypothyroidism.

Materials and Methods: From February 2018 to May 2019, 102 patients with histopathologically proven advanced (stage III, IV) squamous cell carcinoma of head and neck region (excluding patients with thyroid malignancy and prior neck surgery) who were treated with radical external beam radiotherapy (68-70 Gy) delivered by Cobalt 60 Teletherapy machine with conventional fractionation over head and neck region at least 6 months back were studied.

Thyroid function tests (T3, T4, TSH, f-T4) were done at 6 months,9 months and 12 months after completion of radiotherapy.

Results: Out of the 102 patients with mean age of 50.9 (±9.4) years, 64 (62.7%) were males and 38 (37.3%) were females. Most common Primary tumour site was larynx (36.1%). CCRT was given to 65.7% of patients and 75.5% of patients had stage-III disease. Two patients were lost to follow-up. Overall, 35% developed hypothyroidism of which 18% were clinical (high TSH, low f-T4) and 17% were sub-clinical hypothyroidism (high TSH, normal f-T4) at one year of follow-up.

No significant associations were found with age, gender, stage and addition of chemotherapy. In comparison with control group (patients attending other OPDs, N=200) odds ratio for the development of hypothyroidism was found to be 3.5 (subclinical-4.9, Clinical- 1.9).

Conclusion: Hypothyroidism is an under-recognized morbidity of external beam radiation to the neck. Recognizing hypothyroidism early and treating it prevents associated complications. Hence, thyroid function tests should be done during routine follow up.

1. Introduction

Head and neck cancer is the sixth most common carcinoma in the world,[1] and most common cancer among Indian male according to ICMR report.

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In India, 60% of patients are found in locally-advanced stage at the time of diagnosis (Stage III, IVA and IVB) and only 5% shows distant metastasis.[2]

Management of head neck cancer is either surgery or radiotherapy (RT) for early stage tumor and radiotherapy in combination with surgery and/ or chemotherapy for advanced stages. Hence, the radiotherapy treatment field covers the primary site of the tumor and whole neck including the thyroid gland. In definitive Radiotherapy for head and neck cancer standard target dose is 66-70 Gy in 33-35 fractions, 5 fractions/week (conventional fractionation).[3]

The limiting factor in radiation is the toxicity of the surrounding normal tissues (Organ at Risk). The greatest challenge in radiotherapy is to optimize disease control while minimizing toxicity to normal tissue. Over the past three decades there has been a significant technological development in the delivery of RT, from Two-Dimensional (2D)-Radiotherapy to Three-Dimensional Conformal Radiotherapy (3D-CRT), Intensity Modulated RT (IMRT) and later Volumetric Modulated Arc Therapy (VMAT). With these novel techniques, there is potential for sparing the normal tissues while increasing radiation dose to the tumor and other target areas.[4]

In spite of all those measures we cannot spare thyroid gland totally. The incidence of post radiation biochemical hypothyroidism varies widely from 3-44% and only 5-10% patients develop clinical hypothyroid status.[2,5–8] However in this proposed study, all the patients were treated in Tele Cobalt 60 machine (THERATRON 780C).

Toxicity due to RT is divided into two categories: acute reactions, defined as the effects which may occur up to 90 days from the start of Radiation, and late reactions which develop ≥90 days after completion of Radiotherapy. The most common clinical late effect of thyroid gland irradiation in patients exposed to therapeutic doses to the neck is hypothyroidism. This effect may be clinically overt (clinical hypothyroidism) characterized by low free T4 and high thyroid stimulating hormone (TSH), or subclinical (biochemical or compensated hypothyroidism) with normal free T4 and high TSH. In the majority of cases, subclinical hypothyroidism evolves to clinical hypothyroidism. Progression to clinical hypothyroidism occurs at a rate of about 5 to 20% per year. Hypothyroidism is one of the late side effects of Radiation.[9]

2. Aims and Objectives

2.1. Primary aim

To estimate the prevalence of biochemical hypothyroidism in patients with head and neck Squamous Cell Carcinoma (HNSCC) (Oral Cavity, Oropharynx, Hypopharynx, Nasopharynx and Larynx etc.) treated with definitive radiotherapy or concurrent chemoradiation.

2.2. Specific objectives

1. Prevalence of hypothyroidism in post radiation head neck cancer patients where radiation portal included total or most of the thyroid gland.
2. To calculate the Odds ratio of prior head and neck radiation patients as a risk factor for development of subclinical or clinical hypothyroid

3. Materials and Methods

3.1. Study location

Department of Radiotherapy, Burdwan Medical College and Hospital, Burdwan, West Bengal.

3.2. Study population

1. **Cases:** Follow up patients with biopsy proven squamous cell carcinoma of head and neck region who were treated with radical radiotherapy at head and neck region at least 6 months back.
2. **Controls:** Patients attending General Medicine and Neuromedicine OPD (outpatient department) who are not on treatment for any endocrine disorder (control is necessary to calculate Odds ratio of patients of prior head and neck radiation as a risk factor for subsequent development of hypothyroidism).

3.3. Study period

February, 2018 to May, 2019.

3.4. Sample size

1. **Cases-** 102 patient,
2. **Controls**- 200 patients

3.5. Sample design

The following were considered for inclusion and exclusion criteria-

3.6. Inclusion criteria

1. All patients with biopsy proven squamous cell carcinoma of head and neck region who received radical radiotherapy > 6 month ago with curative intent to head and neck region where the radiation portal had included the thyroid gland.
2. Age between 18-70 years.
3. Patients with good performance status (ECOG -1, 2).

3.7. Exclusion criteria

1. Patients with malignancy of orbit, brain , skin
2. Malignancy of thyroid gland itself
3. Severe uncontrolled co morbid illness

4. History of thyroid or neck surgery due to any cause
5. No history of any thyroid replacement therapy or using any anti-thyroid drugs prior to onset of radical radiotherapy
6. History of any other endocrine disorder
7. Inability or not willing to give consent.
8. Patients with residual / recurrent / metastasis disease

3.8. Study design

Retrospective analytical case control study.

3.9. Parameters to be studied

T3, T4, TSH level to assess thyroid function at one point of time during follow up for patient having >=6 months disease free survival following radical radiotherapy for carcinoma in head neck region.

3.10. Study tools

1. History
2. Physical examination.
3. Investigations: Thyroid function test
4. Machine: for external beam radiotherapy (EBRT) done by Telecobalt-60 machine [THERATRON 780C].

3.11. Study techniques

Follow up patients with biopsy proven squamous cell carcinoma of head and neck region treated with radical radiotherapy with curative intent in head neck region where the portal of radiation had included the thyroid gland at least 6 months back, were included in the study populations after consideration of inclusion and exclusion criteria and obtaining informed consent.

All the patients were assessed for thyroid function by estimation of T3, T4, TSH, free T4 (f-T4) at three monthly interval till the completion of the study (ie, at 6 months, 9 months and 12 months from the date of inclusion into the study). Patient having increased TSH level (> 4.78ng/dl) and normal free T4 were regarded as having subclinical hypothyroidism and low free T4 (< 0.89 ng/dl) with high TSH were regarded as clinical hypothyroidism.

But clinical manifestations of clinical hypothyroidism are more evident for e.g.-dry skin, slowed speech and movement, dull facial expression, peri-orbital puffiness, macroglossia, hypothermia, non-pitting oedema, bradycardia, hyporeflexia with delayed relaxation, ataxia or both ,decreased systolic and increased diastolic blood pressure etc.

Hence, patients were divided into subclinical and clinical hypothyroidism groups based on mainly biochemical findings supported by clinical history and examination findings for evidences of hypothyroidism.

Data regarding one time thyroid function tests of control group patients were collected from other OPDs (mainly from General Medicine and Neuromedicine OPD) and compiled for comperative analysis. Same definition for the subclinical and clinical hypothyroidism were followed for the control group patients

3.12. Statistical analysis

All relevant data were collected, properly tabulated and analyzed by SPSS (Ver.20, IBM). Chi-square test was used for categorical variables(i.e. qualitative data) while for continuous variables; the mean and standard deviation were compared using independent student-t test. P value < 0.05 was considered as significant.

4. Results

Out of the 102 patients with mean age of 50.9 (±9.4) years, 64 (62.7%) were males and 38 (37.3%) were females. Most common Primary tumour site was larynx (36.1%). CCRT was given to 65.7% of patients and 75.5% of patients had stage-III disease. Two patients were lost to follow-up. Overall, 35% developed hypothyroidism of which 18% were clinical (high TSH, low f-T4) and 17% were sub-clinical hypothyroidism (high TSH, normal f-T4) at one year of follow-up.(Figure 1)

No significant associations were found with age, gender, stage and addition of chemotherapy. In comparison with control group (patients attending other OPDs, N=200) odds ratio for the development of hypothyroidism was found to be 3.5 (subclinical-4.9, Clinical- 1.9).

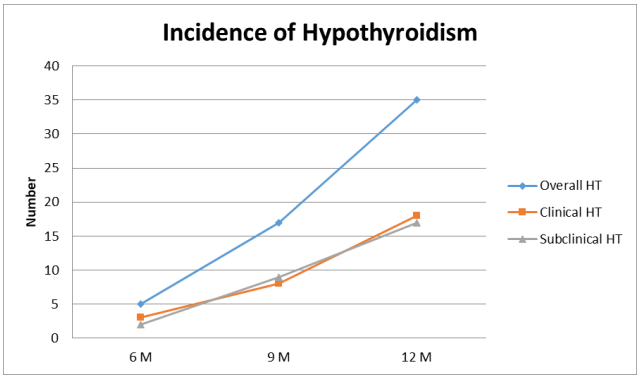

Figure 1: Incidence of hypothyroidism with duration of follow-up

The prevalence of overall hypothyroidism among the control group (N=200) was 13.5% (n=27) of which 9.5% (n=19) were clinical hypothyroid and 4% (n=8) were subclinical hypothyroid.

Majority of the patients who developed hypothyroidism were females than males (7.5% vs 6%) including clinical (5% vs 4.5%) and subclinical (2.5% v 1.5%) hypothyroidism ().

5. Discussion

In this study, after consideration of inclusion and exclusion criteria 102 euthyroid patients with histopathology proven advanced (stage III, IV) squamous cell carcinoma of head and neck region who were treated with radical RT with or without concurrent chemotherapy and who had completed RT at least 6 month ago were included. Patients were followed up with thyroid function tests (T3, T4, TSH and f-T4) at 6 months, 9 months and 12 months from the time of inclusion to the study.

Two male patients with clinical stage-III diseases of oral cavity and oropharynx were lost to follow-up, one each before 9th and 12th months. Finally 100 patients were analysed after follow-up at 12 months.

5.1. Age and gender

The mean age of the patients was 50.9 (±9.4) years, range 23-70 years of which 21.6% patients were of elderly age group (≥ 60 year) and there was male preponderance (64, 62.3%) in the study population with male: female ratio of 5: 3.

The most common diagnosis among the patients was squamous cell carcinoma of larynx (36, 36.1%) followed by carcinoma of oropharynx (26, 26.1%). Only one patient had salivary gland tumour (submandibular gland carcinoma). Other sites of primary tumour were oral cavity (19, 19.1%), nasopharynx (12, 11.8%) and hypopharynx (8, 7.8%)

5.2. Stage of the disease and treatment received

The study population included only the patients with advanced stage diseases ie, stage-III and IV. Two third patients had stage-III (77. 75.5%) disease and rest one third had stage-IV (35, 35.1%) disease.

The majority of the patients (67, 67.1%) received concurrent chemoradiotherapy (CRT) in this study group and a third of them received RT alone (35.1%).

In the follow-up period after 6 months incidence of hypothyroidism was 4.9% (n=5) of which clinical hypothyroidism was 2.9% (n=3) and subclinical hypothyroidism was 2% (n=2).

At 9 month of follow-up, one patient lost to follow-up and 12 new patients (subclinical-7 and clinical-5) developed hypothyroidism (total 12 + 5=17, 16.8%).

After 12 months, another patient lost to follow-up and out of 100 patients total 35 (35%) had hypothyroidism (18 new patients), among them 18% (n=10+8) patients were found to have clinical hypothyroidism and 17% (n=8+9) patients were found to have subclinical hypothyroidism.

5.3. Relationship of hypothyroidism with age

The mean age of the patients who developed hypothyroidism was 51.91±8.30 (p=0.65) year, which was 49.39±7.77 (p=0.38) years in the clinical group and 49.39±7.77 (p=0.13) years in the subclinical group and in the none of the groups, age was significantly associated

Among the patients who developed hypothyroidism (n=35), 22 patients were male and 13 were female, in the subclinical group (n=18) number of male and female patients were 13 and 4 respectively, whereas equal number of male and female patients (9 each) developed clinical hypothyroidism (n=18).

Gender of the patients (female gender) was significantly associated with development of hypothyroidism only among the clinical hypothyroid patients (p=0.001), but it failed to reach significance in the subclinical group (p=0.41) as well as in the overall hypothyroid group

5.4. Relationship of hypothyroidism with stage of disease

Out of 35 patients who developed hypothyroidism among the 100 patients after 12 months of follow-up, 30 patients (30%) had stage –III tumour and only 5 patients (5%) had stage-IV tumour. Similarly majority of the patients who had clinical (15 out of 18) and subclinical hypothyroidism (15 out of 17) were of stage-III disease and stage of the disease was not significantly associated with development of hypothyroidism as p value for the overall hypothyroidism, clinical and subclinical hypothyroidism were 0.07, 0.36 and 0.16 respectively.

In other words out of 75 patients with stage-III disease (2 patients with stage-III disease were lost to follow-up before last follow-up) 30 patients developed hypothyroidism, ie, 40% whereas only 20% patients with stage-IV disease (5 out of 25) developed hypothyroidism after 12 months of follow-up.

5.5. Relationship of hypothyroidism with treatment received

Among 35 patients who developed hypothyroidism 22 patients (22%) were from CCRT followed by RT group and 13 patients (13%) were from RT alone group (p=0.62), the same for the clinical hypothyroid patients (n=18) were 11 and 7 (p=0.62) and for the subclinical hypothyroidism patients (n=17) were 11 and 6 (p=0.9).

So, out of 66 patients who received concurrent chemotherapy followed by RT (CCRT), one third patients (n=22, 33.3%) developed hypothyroidism and for the RT alone group (n=13) also this rate is almost similar (n=13, 33.7%).(Table 1)

No association was found between development of hypothyroidism (including clinical and subclinical) and two treatment groups.

Table 1: Occurrence of hypothyroidism according to the treatment received

Hypothyroidism	Treatment Received (n, %)	p value
Subclinical Hypothyroidism (n=17)	RT alone - 6 (6) Concurrent CRT - 11 (11)	0.90
Clinical Hypothyroidism (n=18))	RT alone - 7 (7) Concurrent CRT - 11 (11)	0.62
Overall Hypothyroidism (n=35)	RT alone - 13 (13) Concurrent CRT - 22 (22)	0.62

5.6. Control group

Control group comprised of total 200 patients who attended other outpatient departments (OPD) except oncology, radiotherapy and endocrinology OPDs (predominantly general medicine and neurology OPD). Thyroid function test (T3, T4, TSH and f-T4) was done for those patients once to compare with the study population.

The mean age of the control population was 37.05±13.05 years with female preponderance (n=112, 66%) and female : male ratio of hypothyroidism

5.7. Prevalence of hypothyroidism in control group

In (Table 2) The prevalence of overall hypothyroidism among the control group (N=200) was 13.5% (n=27) of which 9.5% (n=19) were clinical hypothyroid and 4% (n=8) were subclinical hypothyroid.

Majority of the patients who developed hypothyroidism were females than males (7.5% vs 6%) including clinical (5% vs 4.5%) and subclinical (2.5% vs 1.5%) hypothyroidism

Table 2: Prevalence of hypothyroidism in control group (N=200)

Hypothyroidism	Total Number (n, %)	Gender (n, %)
Subclinical Hypothyroidism	8 (4)	Male –3 (1.5) Female – 5 (2.5)
Clinical Hypothyroidism	19 (9.5)	Male- 9 (4.5) Female – 10 (5)
Overall Hypothyroidism	27 (13.5)	Male- 12 (6) Female – 15 (7.5)

5.8. Comparison of hypothyroidism between cases and controls with odds ratio

The Odds ratio for the development of hypothyroidism among study population in comparison to control group was found to have 3.5 and the same for the clinical hypothyroidism was 1.9 and for the subclinical hypothyroidism was 4.9.

With this background, the present study was done at the Department of Radiotherapy, Burdwan Medical College, Burdwan, between February 2018 to May 2019 in 102 eu-thyroid patients, after consideration of inclusion and exclusion criteria, with histopathology proven advanced (stage III, IV) squamous cell carcinoma of head and neck region who were treated with radical RT with or without concurrent chemotherapy and who had completed RT at least 6 month ago. Patients were followed up with thyroid function tests (T3, T4, TSH and f-T4) at 6 months, 9 months and 12 months from the time of inclusion to the study.

Two patients were lost to follow-up, one each before 9th and 12th month follow-up. Finally 100 patients were analysed after follow-up at 12 months for the development of hypothyroidism.

In our study the age group of the patients varied from 23 to 70 years with mean age of 50.9 (±9.4) years and 21.6% (n=22) of the patients were of elderly age group (≥ 60 year). Out of 102 patients, 62 were males (62.3%) and 38 were females (38.1%) and the most common diagnosis was carcinoma of larynx (n=36, 36.1%).

After 12 months of follow-up, out of the final 100 patients total 35 (35%) developed hypothyroidism, among them 18% (n=18) patients were found to have clinical hypothyroidism and 17% (n=17) patients were found to have subclinical hypothyroidism.

The incidence of 35% found in the RT group in our study is within a range from 3% to 47% cited in the literature (Weissler and Berry et al., 1991; Turner et al., 1995; 1996; Kuten et al. 1996; August et al., 1996; Aich et al., 2005). [10–14]

This wide variation could be related to several factors, including heterogeneity in the radiation technique, treatment dose, field size, and the interval of follow-up. Although in the present study there was uniformity in all the above mentioned factors.

In our study the prevalence of clinical hypothyroidism (18%) and subclinical hypothyroidism (17%) is almost similar, which is in contrast to others like Turner et al. (1995) [10] with a more frequent clinical hypothyroidism and others who found a higher proportion of subclinical HT (Posner et al., 1984; Liening et al., 1990; Tell et al., 1997). [15–17]

5.9. Comparison with control group

In the present study the prevalence of hypothyroidism in the study populations were compared with a control group to know the relative risk.

In (Table 3) control group comprised of total 200 patients who attended other outpatient departments (OPD) except oncology, radiotherapy and endocrinology OPDs (predominantly general medicine and neurology OPD). Thyroid function tests (T3, T4, TSH and f-T4) were done for those patients once to compare with the study population.

Table 3: Comparison of hypothyroidism between cases and controls with odds ratio

Hypothyroidism	Cases (n, %)	Controls (n, %)	Odds Ratio	p value
Subclinical Hypothyroidism (n=17)	17 (17)	8 (4.5)	4.9	0.003
Clinical Hypothyroidism (n= 18))	18 (18)	18 (9.5)	1.9	0.07
Overall Hypothyroidism(n= 35)	35 (35)	27 (13.5)	3.5	<0.001

The mean age of the control population was 37.05±13.05 years with female preponderance (n=112, 66%) and the female: male ratio of 3:2.

The prevalence of overall hypothyroidism among the control group (N=200) was 13.5% (n=27) of which 9.5% (n=19) were clinical hypothyroid and 4% (n=8) were subclinical hypothyroid.

Majority of the patients who developed hypothyroidism were females than males (7.5% vs 6%) including clinical (5% vs 4.5%) and subclinical (2.5% vs 1.5%) hypothyroidism.

The Odds ratio for the development of hypothyroidism among study population in comparison to control group was found to have 3.5 and the same for the clinical hypothyroidism was 1.9 and for the subclinical hypothyroidism was 4.9.

At 9 month of follow-up, one patient lost to follow-up and 12 new patients (subclinical-7 and clinical-5) developed hypothyroidism (total 12 + 5=17, 16.8%).

After 12 months, another patient lost to follow-up and out of 100 patients total 35 (35%) had hypothyroidism (18 new patients), among them 18% (n=10+8) patients were found to have clinical hypothyroidism and 17% (n=8+9) patients were found to have subclinical hypothyroidism.

The longer the follow-up period after radiation, the more developed thyroid disorder. Hence, it might be expected that with the passage of time the incidence will increase and some of the patients with subclinical hypothyroidism will progress to clinical one.

In our study all the patients who were detected to have clinical or subclinical hypothyroidism in the follow-up period were referred to and were treated by endocrinologists, actual progression rate from subclinical hypothyroidism to clinical one was not possible to calculate.

Other potential factors cited in the literature contributing to thyroid dysfunction are radiation dose, addition of chemotherapy, age and sex of patients and primary tumour site, staging or grading.

In our study, the maximum follow-up period was 12 months post-RT, which is lower than the majority of studies.

The earliest follow-up was done by Aich who evaluated the thyroid status at 6-week post-RT. They noticed a 4.2% incidence of clinical hypothyroidism at 12 months and not earlier.

5.10. Age

In our study, the age group of patients varied from 23 to 70 years with a mean of 50.9 (±9.4) years and the patients who developed hypothyroidism was slightly older (mean: 51.91±8.30 (p=0.65) years), but association of age with the development of hypothyroidism has failed to reach significance in, which was 49.39±7.77 (p=0.38) years in the clinical group and 49.39±7.77 (p=0.13) years in the subclinical group. In none of the above groups, age was significantly associated.

The mean age of the patients was 50.9 (±9.4) years, range 23-70 years of which 21.6% patients were of elderly age group (≥ 60 year) and there was male preponderance (64, 62.3%) in the study population with male: female ratio of 5: 3.

The mean age of the patients who developed hypothyroidism was 51.91±8.30 (p=0.65) year, which was 49.39±7.77 (p=0.38) years in the clinical group and 49.39±7.77 (p=0.13) years in the subclinical group and in the none of the groups, age was significantly associated.

5.11. Gender

Among the patients who developed hypothyroidism (n=35), 22 patients were male and 13 were female, in the subclinical group (n=18) number of male and female patients were 13 and 4 respectively, whereas equal number of male and female patients (9 each) developed clinical hypothyroidism (n=18).

Gender of the patients (female gender) was significantly associated with development of hypothyroidism only among the clinical hypothyroid patients (p=0.001), but it failed to reach significance in the subclinical group (p=0.41) as well as in the overall hypothyroid group (p=0.41).

5.12. Primary site of tumour and stage

In our study also most common diagnosis among the patients was squamous cell carcinoma of larynx (36, 36.1%) followed by carcinoma of oropharynx (26, 26.1%). Other sites of primary tumour were oral cavity (19, 19.1%), nasopharynx (12, 11.8%) and hypopharynx (8, 7.8%).

The study population included only the patients with advanced stage diseases ie, stage-III and IV. Two third patients had stage-III (77. 75.5%) disease and rest one third had stage-IV (35, 35.1%) disease.

Although the prevalence of hypothyroidism was higher among the patients with stage-III disease (30 out of 75,

40%) in comparison to stage-IV (5 out of 25, 20%), association of stage of the disease with development of hypothyroidism (p=0.07) including clinical (p=0.36) and subclinical hypothyroidism (p=0.16) was not statistically significant.

5.13. Concurrent chemotherapy

The majority of the patients (67, 67.1%) received concurrent chemoradiotherapy (CRT) in this study group and a third of them received RT alone (35.1%).

Among 35 patients who developed hypothyroidism 22 patients (22%) were from CCRT followed by RT group and 13 patients (13%) were from RT alone group (p=0.62), the same for the clinical hypothyroid patients (n=18) were 11 and 7 (p=0.62) and for the subclinical hypothyroidism patients (n=17) were 11 and 6 (p=0.9).

So, out of 66 patients who received concurrent chemotherapy followed by RT (CCRT), one third patients (n=22, 33.3%) developed hypothyroidism and for the RT alone group (n=13) also this rate is almost similar (n=13, 33.7%).

No association was found between development of hypothyroidism (including clinical and subclinical) and two treatment group.

In a prospective study by Nirmala et al. 16 (35.6%) patients received chemotherapy either concurrent (15 patients) or neoadjuvant (one patient) and 29 (64.4%) patients received RT alone. The use of chemotherapy in head and neck cancers varies from center to center. Turner et al. had a very high number of patients receiving chemotherapy (77%). Mercado et al. had 50% of the patients receiving chemotherapy. These studies had a higher percentage of patients with locally advanced disease or were randomized to compare the effect of chemotherapy on tumor response as well as incidence of hypothyroidism.

The incidence rate of development of hypothyroidism is high in our study when compared with other studies. The incidence in studies varies from 3 to 40%. Colevas et al. noted that 50% of the patients who developed hypothyroidism did so in the first year. This is one of the few studies which had a high incidence at first year. Most studies however have a lower rate even after the end of the second year. Tell et al. found that the Kaplan-Meier predictive risk for hypothyroidism after 5- and 10-year post-irradiation was only 20% and 27%, respectively. Aich et al. had an incidence of 16.6% at the end of 2-year follow-up.

6. Conclusion

We found a high incidence of hypothyroidism (35%) in patients with head and neck cancer who had undergone radiotherapy alone or in combination with other modalities. The comparison with a Control group showed that radiotherapy is an important predictive factor for development of hypothyroidism (Odds ratio 3.5).

Hypothyroidism is an under recognized morbidity of external beam radiation to the neck. Recognizing hypothyroidism early and treating it prevents associated complications. Hence, thyroid function tests should be done during routine follow up of such patients.

7. Source of Funding

None.

8. Conflict of Interest

None.

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