e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2024; 16(2); 92-96

Original Research Article

Measurement of Biomarkers in Squamous Cell Carcinoma of Head and Neck Region: Pre vs. Post Treatment Analysis

Nishant Shrivastava[1], Shriram Gautam[2], Shikha Shrivastava[3]

[1]Consultant Neurosurgeon and Head, Department of Neurosurgery, M.P. Birla Hospital, Satna, Madhya Pradesh, India

[2]Consultant and Head, Department of Anesthesia and Critical Care, M.P. Birla Hospital, Satna, Madhya Pradesh, India

[3]Senior Resident, Department of Forensic Medicine & Toxicology, SS Medical College, Rewa, Madhya Pradesh, India

Received: 10-12-2023/Revised: 28-01-2024/Accepted: 20-02-2024

Corresponding author: Dr. Shikha Shrivastava

Conflict of interest: Nil

Abstract

Introduction: Head and neck cancer ranks as the most common cancer in men and both sexes in India. However, due to extensive loco-regional involvement, poor patient general condition, or comorbidities, curative treatment often becomes unfeasible. The aim of this study was to assess serum biomarker levels in patients with head and neck squamous cell carcinoma (HNSCC) before and after treatment.

Methodology: This research was conducted at a tertiary care hospital in India. The study included 56 newly diagnosed HNSCC patients and 45 age- and sex-matched healthy individuals. Chi-square and t-tests were employed to explore associations and comparisons between the case and control groups, respectively.

Results: The subjects were divided into three groups: group A consisted of pretreatment cases, group B comprised post-treatment cases, and group C served as controls. There was a significant difference between group A and group B, suggesting notable changes in glucose levels before and after treatment. Furthermore, significant differences were observed between cases before treatment and controls concerning creatinine, ALT, albumin, total protein, and TBIL levels.

Conclusion: The study revealed highly significant differences between case and control groups, particularly in terms of LDL, protein, and calcium levels. These findings underscore the importance of assessing serum magnesium levels in HNSCC patients before and after treatment to understand their implications on disease progression and management.

Keywords: Head and neck, Malignancy, Creatinine, Glucose, Albumin.

Introduction

Head and neck cancers, primarily squamous cell carcinomas (SCC), present a significant global health challenge, ranking as the sixth most common cancer worldwide. Predominantly affecting males in their fifth to sixth decade, these malignancies have an estimated annual incidence of approximately 650,000 cases, with a mortality rate of around 50%. While the overall incidence of head and neck squamous cell carcinomas (HNSCC) has stabilized or decreased since the late 1980s due to declining risk behaviors, SCCs in the oro-pharyngeal (OP) region, particularly the tonsils and base of the tongue, have seen an increase in prevalence [1-3].

Globally, head and neck cancer ranks as the seventh most common cancer, yet in India, it is the most prevalent cancer among men and in both sexes combined. In 2012, cancer-related incidence and deaths in India were staggering, with projections indicating a concerning rise in tobacco-related and head and neck cancers by 2020. Squamous cell carcinoma accounts for approximately 90% of all head and neck carcinoma cases [2-5]. Head and neck cancers significantly impact the upper aerodigestive tract and are among the most frequently diagnosed cancers worldwide. In India, where smoked tobacco and alcohol are major risk factors, smokeless tobacco, betel nut, and Epstein–Barr virus play significant roles in disease etiology. Unfortunately, due to extensive loco-regional involvement or co-morbid conditions, curative treatment may not be feasible for many patients. As a result, the relevance of aggressive treatment strategies for non-resectable locally advanced head and neck cancer is debated, with poor response rates and significant treatment-related toxicities associated with chemoradiotherapy [6-9].

Against this backdrop, the main objectives of this study were to evaluate serum biomarker levels in patients with head and neck squamous cell carcinoma before and after treatment. This research aims to shed light on potential biomarkers that may aid in diagnosis, prognosis, or treatment response assessment for this challenging disease.

Materials and Methods

The study was conducted at a tertiary care hospital in India. It involved enrolling 56 newly diagnosed patients with HNSCC and 45 age- and sex-matched healthy individuals. Detailed patient history was obtained, focusing on presenting complaints and cancer risk factors. Diagnosis was confirmed through thorough history-taking, clinical examination, radiological imaging, and histopathological analysis. Staging was performed according to the American Joint Committee on Cancer 2010 criteria. Informed consent was obtained from all patients, and the study's follow-up nature was explained to them. In this study, the inclusion criteria encompass newly diagnosed adult patients with histopathologically confirmed HNSCC, irrespective of age, gender, or disease stage, who have not yet commenced any form of treatment. Conversely, the exclusion criteria delineate certain parameters to refine the participant pool. Patients with concurrent chronic conditions such as renal, hepatic, endocrine disorders, or other malignancies, which might influence their ability to participate in the study or potentially confound data analysis, are excluded. Additionally, individuals taking medications or supplements are excluded, along with lactating and pregnant females. These criteria are crucial for ensuring the homogeneity of the study population and the integrity of the research findings.

Methodology: 6 ml of venous blood was collected in a plain red-capped vacutainer and 4 ml in an EDTA vacutainer under aseptic conditions from all patients at diagnosis and upon completing treatment. Similar samples were collected from healthy controls. Blood samples were processed within an hour, with serum separated by centrifugation at 3000 rpm for 5 minutes after clotting. Routine biochemical investigations (liver function tests, renal function tests, glucose, and lactate dehydrogenase) and complete blood counts were conducted on the same day. A total of 56 cases and 45 healthy subjects were enrolled, with all participants undergoing detailed history-taking and clinical profiling according to a standardized proforma. The subjects were categorized into three groups: group A comprised pretreatment cases, group B included post-treatment cases, and group C served as controls.

Results

The average age of individuals diagnosed with HNSCC was 55.54 ± 8.16 years, while among the control group, it was 54.48 ± 9.06 years. The variance between the two groups was not statistically significant. Table 1 depicts the distribution of head and neck squamous cell carcinoma (HNSCC) cases based on site, stage, and presenting complaints. Among 56 HNSCC patients, carcinoma of the larynx was the most prevalent, followed by carcinoma of the oropharynx. The majority of cases presented at stage III cancer, with the most common complaints being throat pain, dysphagia, and hoarseness of voice. Table 2 illustrates the distribution of risk factors among HNSCC cases and controls. The majority of cases were smokers and habitual alcohol consumers, with approximately half being both alcoholic and smokers.

Table 3 presents plasma glucose and lipid parameters in cases and controls. Significant differences were observed in glucose levels before and after treatment, with cases before treatment showing significantly lower glucose values than controls. Total cholesterol levels differed significantly among all groups, while triglyceride levels were significant between groups A and C. LDL-C levels were significantly different among all groups, as were HDL-C levels. Table 4 outlines liver function tests in cases and controls. ALT enzyme levels differed significantly among all groups except between groups A and C. Albumin, total protein, and total bilirubin levels also showed significant differences among all groups. Table 5 displays renal function tests in cases and controls. Blood urea levels did not differ significantly among all groups except between groups A and C. S. Uric acid levels showed no significant differences among all groups. Table 6 presents serum amylase, calcium, and phosphorus levels in cases and controls. Total calcium levels differed significantly among all groups, as did phosphorus levels.

Table 1: Distribution of parameters in HNSCC patients

Parameter of cancer	n	%
Location of cancer		
Ca Larynx	20	35.71
Ca Oropharynx	19	33.93
Ca base of tongue	11	19.64
Ca Tonsil	6	10.71
Cancer Stage		
stage 4	21	37.50

stage 3	35	62.50
Complaints		
Dysphagia	15	26.79
Pain in throat	22	39.29
Hoarseness of voice	15	26.79
Neck swelling	4	7.14

Table 2: Distribution of Risk factors in HNSCC cases and controls

Risk factor	Cases		Controls	
	n	%	n	%
Smoker	52	92.86	37	82.22
Non Smoker	4	7.14	8	17.78
Alcoholic	37	66.07	23	51.11
Non Alcoholic	19	33.93	22	48.89
Tobacco user	47	83.93	15	33.33
Tobacco non user	9	16.07	30	66.67
Both alcoholic and smoker	28	50.00	23	51.11

Table 3: Plasma Glucose and lipid parameters in cases and controls

Parameter (mg/dl)	Group A	Group B	Group C	p Value A vs B	p Value B vs C	p Value C vs A
Plasma Glucose	86.20 ± 3.10	101.50 ± 5.50	98.90 ± 3.00	<0.05	0.62	<0.05
Total Cholesterol	175.00±7.10	148.0±7.00	126.00±7.10	<0.05	<0.05	<0.05
Triglycerides	140±11.50	190.00±24.00	122.00±12.50	0.13	<0.05	0.2
VLDL-C	28.00±2.30	38.00±4.90	23.00±2.50	0.17	<0.05	0.16
LDL-C	105.00±5.50	86.00±4.90	73.00±5.30	<0.05	<0.05	<0.05
HDL-C	38.50±1.80	30.00±1.70	31.00±1.50	<0.05	<0.05	<0.05

Table 4: Liver function tests in cases and controls

Parameter	Group A	Group B	Group C	p Value A vs B	p Value B vs C	p Value C vs A
AST (IU/L)	36.50±7.00	26.00±2.00	26.50±2.00	0.13	0.85	0.19
ALT (IU/L)	23.00±1.30	14.00±0.80	16.00±2.30	<0.05	0.45	<0.05
A:G Ratio	1.08±0.05	1.09±0.05	1.15±0.04	0.91	0.36	0.29
Serum Albumin (gm/dl)	3.65±0.10	2.95±0.10	3.30±0.10	<0.05	<0.05	<0.05
Total Proteins (gm/dl)	7.20±0.10	5.90±0.20	6.30±0.20	<0.05	0.23	<0.05
Total Bilirubin (mg/dl)	0.35±0.03	0.25±0.02	0.15±0.01	<0.05	<0.05	<0.05

Table 5: Renal function tests in cases and controls

Parameter (mg %)	Group A	Group B	Group C	p Value A vs B	p Value B vs C	p Value C vs A
Urea	25.80±2.00	28.30±1.40	21.70±1.30	0.23	<0.05	0.1
Creatinine	0.95±0.03	0.97±0.04	1.30±0.50	0.58	0.46	0.44
Uric Acid	4.42±0.60	4.42±0.20	4.25±0.40	0.97	0.72	0.81

Table 6: Serum levels of amylase, calcium, and phosphorus in cases and controls

Parameter	Group A	Group B	Group C	p Value A vs B	p Value B vs C	p Value C vs A
Amylase (IU/L)	98.40±30.50	88.10±11.00	98.40±30.50	0.73	<0.05	0.19
Calcium (mg/dl)	8.90±0.05	7.90±0.10	6.30±0.45	<0.05	<0.05	<0.05
Phosphorus (mg/dl)	4.00±0.50	3.50±0.15	3.30±0.20	<0.05	0.07	<0.05

Discussion

In this investigation, 56 newly diagnosed instances of histopathologically confirmed head and neck squamous cell carcinoma (HNSCC) and 45 age and sex-matched healthy individuals were recruited. The participants were categorized into three groups: group A representing cases prior to treatment, group B representing cases post-treatment, and group C representing healthy controls. Comparative statistical analysis was conducted among these groups. The average age of the HNSCC cases in this study was 55.54 ± 8.16 years, which was notably lower than reported in certain prior investigations. This lower age cohort might be attributed to alterations in lifestyle, heightened exposure to risk factors, and a tendency towards younger cohorts being affected by chronic illnesses, including cancer. Noteworthy findings from studies have indicated that HNSCC might exhibit a more aggressive nature with poorer prognostic outcomes in young adults compared to older demographics [10-12]. Predominantly, patients presented at stage 3, with no instances of early-stage presentations (stage I and II). This observation aligns with preceding research indicating challenges in disease management and delayed diagnosis among the population, influenced by factors such as limited healthcare access, socioeconomic disparities, and low literacy rates [13-16].

Substantial variances were noted in various biochemical parameters among the groups, encompassing ALT, albumin, total protein, TBIL, plasma urea, amylase, calcium, and phosphorus levels. These distinctions may signify the repercussions of cancer therapy on renal and hepatic functionalities, alongside other metabolic processes. Of particular note, the elevation in plasma urea levels in HNSCC patients post-treatment compared to healthy counterparts suggests nephrotoxic effects associated with cancer therapy [17-23]. Furthermore, this study underscores the significance of biomarkers in the early identification and monitoring of HNSCC. In summary, while this investigation offers valuable insights into the biochemical profiles of HNSCC patients pre- and post-treatment, it acknowledges its constraints as a single-center study and emphasizes the imperative for biomarkers to facilitate early detection and management of head and neck cancers.

Conclusion

The investigation highlighted notably significant variances between the HNSCC case and control cohorts, particularly regarding LDL, protein, and calcium concentrations. These results emphasize the necessity of evaluating serum biomarker levels in individuals with head and neck squamous cell carcinoma (HNSCC) both prior to and following treatment to grasp their ramifications on disease advancement and therapeutic strategies.

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