Hematologic profile and C-Reactive protein in Oral Squamous Cell Carcinoma

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Abstract:

Introduction: Understanding the prognostic factors and underlying biological mechanisms of oral cancer is essential for improving diagnostic accuracy and therapeutic outcomes. Inflammatory responses mediated by immune cells can have dual roles in tumor development, either inhibiting or promoting growth. C-reactive protein (CRP), has been identified as a potential biomarker for various cancers. Additionally, hematological parameters such as hemoglobin levels, red and white blood cell counts, and platelet indices are associated with cancer pathogenesis. Alterations in these parameters indicate systemic inflammation and immune system dysregulation, which can influence tumor dynamics and prognosis. **Materials and Method:** 50 patients of confirmed oral squamous cell carcinoma (OSCC), and 30 healthy individuals were considered. Fasting venous blood samples were obtained from all participants for biochemical assessment. The evaluation focused on various hematologic parameters, including hemoglobin concentration, red and white blood cell counts, platelet count, hematocrit, and additional related indices. **Results:** OSCC patients demonstrated notable elevations in inflammatory indicators and significant shifts in blood-based markers. Increased CRP levels and a higher neutrophil-to-lymphocyte ratio (NLR) correlated with more advanced disease and heavy tobacco use. Furthermore, variations in CRP, absolute counts of neutrophils and lymphocytes, and NLR were significantly associated with different histological grades of carcinoma. **Conclusion:** Elevated CRP levels were closely linked with inflammation and known risk factors such as tobacco use, while shifts in hematological markers like altered white and red blood cell counts and platelet indices—reflected systemic responses to tumor progression and immune activation in oral cancer patients.

Key words: C Reactive Protein, Absolute neutrophils count, Absolute lymphocyte count, Neutrophil to Lymphocyte Ratio.

Introduction

The uncontrolled proliferation of cells invading nearby tissues presents a formidable global health issue known as cancer. Oral cancer, notably impacting areas like the lips, cheeks, tongue, and palate, assumes a prominent position among cancer types. India shoulders a disproportionately high load of oral cancer cases worldwide, greatly affecting public health with its elevated rates of occurrence and mortality. This emphasizes the critical necessity for prompt and efficient implementation of preventive and therapeutic measures[1].

Oral squamous cell carcinoma (OSCC) is the primary subtype of oral cancer, significantly adding to the overall disease load. Its onset frequently stems from potentially precancerous conditions, suggesting a preliminary phase before malignancy manifests. Various risk factors for oral cancer include habits like tobacco and alcohol use, inadequate oral hygiene, nutritional deficiencies, and infections like human papillomavirus (HPV)[2].

Comprehending the prognostic determinants and fundamental biological processes of oral cancer holds pivotal importance in enhancing diagnostic and therapeutic efficacy. The groundbreaking research by Hanahan and Weinberg identified inflammation as a fundamental characteristic of cancer, shedding light on its pivotal role in tumor advancement and spread. Inflammatory reactions orchestrated by immune cells can exert dual effects on tumor growth, either impeding or facilitating it, contingent upon the specific circumstances[3].

Serum biomarkers provide valuable insights into the development, progression, and treatment response of tumors. C-reactive protein (CRP), an acute-phase protein associated with inflammation, has emerged as a promising biomarker for various cancers, including oral cancer. Elevated CRP levels have been associated with poorer prognosis in several cancer types, suggesting its potential as a diagnostic and prognostic indicator[4].

In addition to CRP, hematological parameters such as hemoglobin concentration, red and white blood cell counts, and platelet indices have been implicated to modulate pathogenesis of cancer. Changes in these parameters reflect systemic inflammation and immune dysregulation, which can impact tumor behaviour and patient outcomes[5].

Despite the increasing evidence implicating hematological markers in cancer prognosis, their significancy in oral cancer remains relatively unexplored. This study seeks to assess the diagnostic and prognostic implications of pretreatment serum CRP levels and hematological parameters, including the neutrophil-to-lymphocyte ratio (NLR), in patients with OSCC. By comparing these parameters between OSCC patients and healthy individuals, we aim to elucidate their potential role in improving the diagnosis and management of oral cancer[6].

Materials and Methods

A retrospective case-control study was conducted, involving a total of 80 subjects, comprising fifty oral squamous cell carcinoma (OSCC) patients and 30 healthy controls.

Patients were recruited from the "Head and Neck Surgical OPD" at Gujarat Cancer Research Institute (GCRI), Civil Hospital Ahmedabad. Detailed clinical histories were recorded for each participant using a standardized proforma (Appendix II), followed by clinical examinations and lymph node palpation.

Study included clinically diagnosed and histopathologically confirmed cases of OSCC, while patients with preoperative chemotherapy or radiotherapy, recurrence, granulomatous diseases like tuberculosis, other malignancies, or systemic diseases such as anemia, liver diseases, renal diseases, cardiovascular disease, or diabetes were excluded. Ethical clearance was obtained from the Institutional Ethical Committee and Review Board, Government Dental College and Hospital, Ahmedabad (IEC GDCH/OP.1/20) (Appendix I), and written consent was obtained from all participants.

Histopathological analysis involved incisional biopsy of OSCC patients, with tissue fixed in 10% neutral buffered formalin, processed, embedded in paraffin wax, and stained with routine Hematoxylin and Eosin stain for diagnosis and grading. OSCC patients were categorized into well-differentiated, moderately differentiated, and poorly differentiated grades based on histopathological characteristics[6,7]

Biochemical analysis included the collection of fasting venous blood samples from OSCC patients and controls. Hematological parameters such as hemoglobin concentration, red and white blood cell counts, platelet count, hematocrit value, and various indices were analyzed using a Mindray CAL 8000 Hematological Analyzer. Serum CRP levels were determined using a Turbodyne SC analyzer through immunoturbidimetric assay.

Participants were classified into two groups based on CRP values (≤ 5 mg/dl and > 5 mg/dl) and median pretreatment NLR ratio (≤ 2.31 and > 2.31). Correlation analyses were performed between pretreatment CRP levels and NLR with clinicopathological parameters of OSCC. Statistical analyses were conducted using SPSS statistical software Version 23, employing Chi-square and ANOVA tests, with significance set at $p < 0.05$.

Results

Table 1: Demographic details of patients

	Overall		Male		Female	
Groups	**Total**	**Age (Mean±SD)**	**n (%)**	**Age (Mean±SD)**	**n (%)**	**Age (Mean±SD)**
Study	50	46.80 ± 10.55	42 (84)	46.05 ± 10.82	8 (16)	43.29 ± 15.51
Control	30	46.91 ± 13.55	17 (56.66)	43.29 ± 15.51	13 (43.33)	52.08 ± 19.63

The study group had 84% males with a mean age of 46.05 years (± 10.82) and 16% females with a mean age of 43.29 years (± 15.51). The control group included 56.66% males with a mean age of 43.29 years (± 15.51) and 43.33% females with a mean age of 52.08 years (± 19.63).

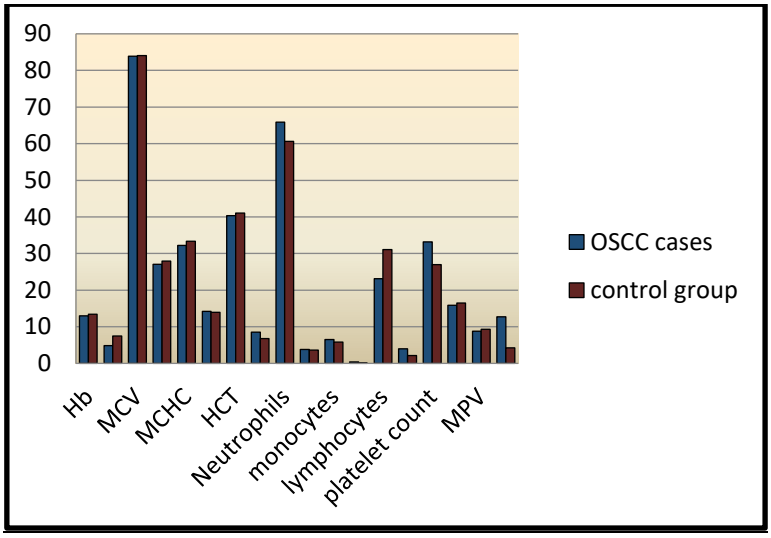
Table 2: Comparison of values of C-reactive protein and Hematological parameters

Parameters		Study Group		Control Group		Mean difference	P value
		Mean	Standard Deviation	Mean	Standard Deviation		
CRP		12.75	15.54	4.26	1.04	8.49	.004
RBCs	Hb (g/dL)	13.006	1.67	13.43	1.35	-0.42	.247
	RBC Count (10^6/cmm)	4.88	0.73	7.45	14.68	-2.57	.218
	MCV (fL)	83.88	11.75	84.09	6.50	-0.20	.930
	MCH (Pg)	27.07	4.34	27.98	2.06	-0.91	.288
	MCHC (%)	32.17	1.14	33.32	1.41	-1.15	.000
	RDW (%)	14.25	1.69	13.91	1.62	0.34	.377
	HCT (%)	40.36	4.46	41.03	3.44	-0.67	.485
WBCs	TLC(10^3/µL)	8.55	2.57	6.76	2.42	1.79	.003
	Neutrophils (%)	65.85	9.89	60.64	9.55	5.20	.024
	Eosinophils (%)	3.84	3.44	3.59	1.68	0.24	.719
	Monocytes (%)	6.48	1.75	5.84	2.37	0.64	.168
	Basophils (%)	0.40	0.24	0.07	0.25	0.34	.000
	Lymphocytes (%)	23.16	9.06	31.06	7.40	-7.90	.000
	NLR	3.94	3.37	2.12	0.79	1.82	.005
Platelets	Platelet count (10^5cells/cmm)	3.32	1.06	2.70	0.78	0.62	.007
	PDW	15.89	0.46	16.48	0.45	-0.59	.000
	MPV(fL)	8.82	1.14	9.31	0.94	-0.49	.052

($p \leq 0.05$ significant)

In the OSCC group, CRP levels were significantly elevated (12.75 ± 15.54 mg/L) compared to controls (4.26 ± 1.04 mg/L), showing a mean difference of 8.49 mg/L ($p = 0.004$). Regarding red blood cell (RBC) parameters, no significant differences were observed in hemoglobin (Hb) or RBC count, but mean corpuscular hemoglobin concentration (MCHC) was lower in the OSCC group (32.17 ± 1.14%) compared to controls (33.32 ± 1.41%) ($p < 0.001$). White blood cell (WBC) analysis revealed a higher total leukocyte count in the OSCC group (8.55 ± 2.57 x10^3/µL) compared to controls (6.76 ± 2.42 x10^3/µL) ($p = 0.003$), with elevated neutrophil percentage ($p = 0.024$) and reduced lymphocyte percentage ($p < 0.001$) in the OSCC group. Additionally, the neutrophil-to-lymphocyte ratio (NLR) was significantly elevated in the OSCC group ($p = 0.005$). Platelet count was also higher in the OSCC group (3.32 ± 1.06 x10^5/cmm) compared to controls (2.70 ± 0.78 x10^5/cmm) ($p = 0.007$), while platelet distribution

width (PDW) was lower ($p < 0.001$). These findings collectively suggest that OSCC patients exhibit elevated inflammatory markers and altered hematological parameters, indicative of systemic inflammation and immune disruption.



Graph 1: Comparison of various measured parameters among Study group and control group.

The graph compares various hematological parameters and CRP levels between OSCC patients and controls, highlighting significant differences in CRP, neutrophil, lymphocyte percentages, and NLR. OSCC patients show elevated inflammation markers and altered blood cell counts compared to controls.

Table 3: Demographic details of OSCC patients based on CRP groups and NLR groups

Groups	CRP group	N (%)	NLR group	N (%)
Study group n=50	Group 1 (CRP ≤ 5mg/dl)	28(56)	Group 1 (NLR ≤ 2.31mg/dl)	18(36)
	Group 2 (CRP > 5mg/dl)	22(44)	Group 2 (NLR > 2.31mg/dl)	32(64)
Control group n=30	Group 1 (CRP ≤ 5mg/dl)	25(83.33)	Group 1 (NLR ≤ 2.31mg/dl)	21(70)
	Group 2 (CRP > 5mg/dl)	5(16.67)	Group 2 (NLR > 2.31mg/dl)	9(30)

Table 3 categorizes patients from the study and control groups according to their C-reactive protein (CRP) levels and Neutrophil-to-Lymphocyte Ratio (NLR). In the study group of 50 OSCC patients, 56% (28 patients) had CRP levels ≤ 5 mg/dL (Group 1), while 44% (22 patients) had CRP levels > 5 mg/dL (Group 2). For NLR, 36% (18 patients) were in Group 1 (NLR ≤ 2.31), and 64% (32 patients) were in Group 2 (NLR > 2.31). In contrast, the control group of 30 individuals showed that 83.33% (25 patients) had CRP levels ≤ 5 mg/dL, and only 16.67% (5 patients) had CRP levels > 5 mg/dL.

Regarding NLR, 70% (21 patients) were in Group 1 (NLR ≤ 2.31), and 30% (9 patients) were in Group 2 (NLR > 2.31). These findings indicate that a significantly higher proportion of OSCC patients exhibit elevated CRP and NLR levels compared to the control group, suggesting heightened inflammatory and immune responses among the OSCC patients.

Table 4: CRP, NLR and Clinicopathological parameters in OSCC patients (n=50)

Parameters	CRP			NLR		
	Negative CRP, n (%)	Positive CRP, n (%)	P value	Negative NLR, n (%)	Postitive NLR, n (%)	P value
Histopathological grading of OSCC						
WDSCC	5(17.9)	3(13.6)		6(33.3%)	2(6.3%)	
MDSCC	23(82.1)	16(72.7)		12(66.7%)	27(84.4%)	
PDSCC	0(0)	3(13.6)	0.129	0(0)	3(9.4%)	0.024*
Lymph node status						
Palpable	5(17.86)	13(59.09)		6(33.3)	12(37.5)	
Non-palpable	23(82.14)	9(40.91)	0.003*	12(66.7)	20(62.5)	0.768
Type of lesion						
Ulcerative	11(39.3)	4(18.2)		7(38.9)	8(25)	
Proliferative	2(7.1)	3(13.6)	0.248	3(16.7)	2(6.3)	0.21
Ulcero-proliferative	15(53.6)	15(68.2)		8(44.4)	22(68.80	
Types of habit (tobacco)						
Smokeless	21(75%)	15(68.2%)		14(77.8)	22(68.8)	
Smoking	3(10.7%)	4(18.2%)	0.715	1(5.6)	6(18.8)	0.426
Mixed	4(14.3%)	3(13.6%)		3(16.7)	4(12.5)	
Duration of habits						
1-10 years	21(75)	5(22.7)		12(66.7)	14(43.8)	
11-20 years	4(14.3)	9(40.9)		4(22.2)	9(28.1)	
21-30 years	2(7.1)	7(31.8)	0.025*	1(5.6)	8(25)	0.272
>30years	1(3.6)	1(4.5)		1(5.6)	1(3.1)	
Frequency of habits						
1-3 packets/day	18(64.3)	12(54.5)		11(61.1)	19(59.4)	
4-6 packets/day	9(32.1)	8(36.4)	0.022*	7(38.9)	10(31.3)	0.388
>6 packets/day	1(3.6)	2(9.1)		0(0)	3(9.4)	

(* significant p value <0.05)

Table 4 explores the association between CRP, NLR, and clinicopathological parameters in 50 OSCC patients. Significant associations were found between elevated CRP levels

and histopathological grading (p = 0.129), lymph node status (p = 0.003), duration of habits (p = 0.025), and frequency of habits (p = 0.022). Specifically, patients with positive CRP were more likely to have moderately or poorly differentiated SCC and palpable lymph nodes. Those with shorter habit durations and higher frequency of tobacco use also had higher CRP levels.

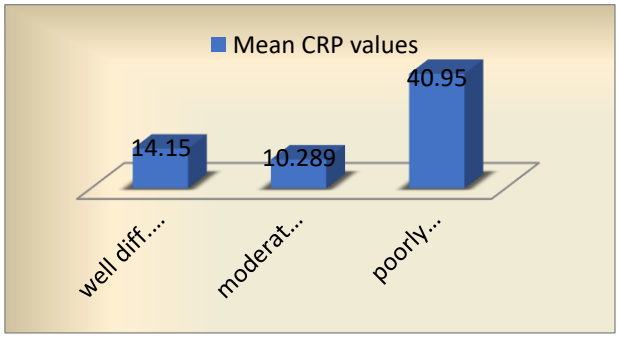
NLR was significantly associated with histopathological grading (p = 0.024), indicating that patients with higher NLR tended to have more advanced SCC. No significant associations were observed between NLR and lymph node status, type of lesion, or types of habits. These findings suggest that elevated CRP and NLR are linked to more severe disease features and higher tobacco consumption in OSCC patients.

Table 5: Correlation of histopathological grading and mean CRP in patient with OSCC

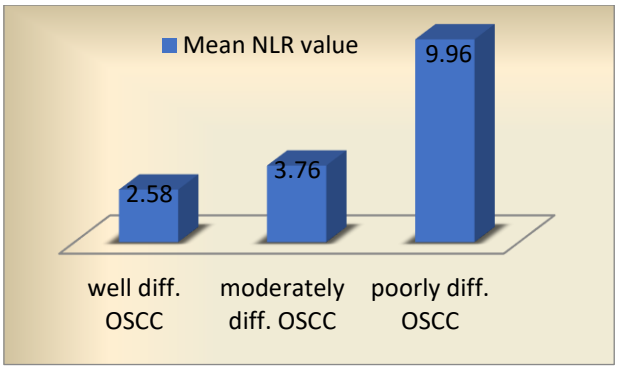
Groups	H/P Grading	N (%)	Mean	Standard Deviation	df	Significance
Study group (OSCC) n=50	WDSCC	8(16)	14.15	20.0	2	**0.035***
	MDSCC	39(78)	10.289	12.6		
	PDSCC	3(6)	40.95	12.33		
	Total	50(100)	12.7464	15.54		

(* significant p value <0.05)

Table 5 presents the correlation between histopathological grading and mean CRP levels in 50 OSCC patients. Significant differences were observed across different histopathological grades (p = 0.035). Patients with poorly differentiated SCC had the highest mean CRP level (40.95 ± 12.33 mg/dL), followed by those with well-differentiated SCC (14.15 ± 20.0 mg/dL). Patients with moderately differentiated SCC had a mean CRP level of 10.29 ± 12.6 mg/dL. The overall mean CRP level in the study group was 12.75 ± 15.54 mg/dL. These findings indicate that higher CRP levels are associated with poorer histopathological differentiation in OSCC.



Graph 2 Correlation of Histopathological grading and mean CRP in patient with OSCC

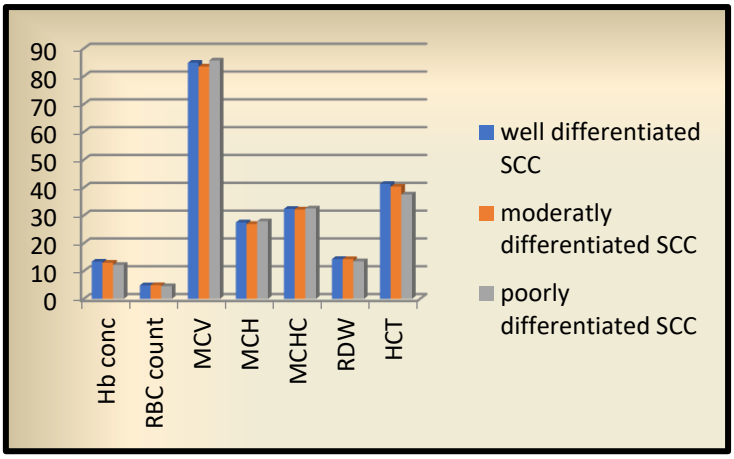


Graph 3 Correlation of Histopathological grading and mean NLR in patient with OSCC

Table 6: Correlation of Histopathological grading, Hb conc. and RBC indices in patient with OSCC

Parameters	H/P Grading	N(%)	Mean	Standard Deviation	df	Significance
Hb conc	WDSCC	8(16)	13.39	2.43	2	0.584
	MDSCC	39(78)	12.99	1.56		
	PDSCC	3(6)	12.2	0.7		
RBC count	WDSCC	8(16)	4.88	0.71	2	0.74
	MDSCC	39(78)	4.91	0.71		
	PDSCC	3(6)	4.56	1.25		
MCV	WDSCC	8(16)	84.89	7.86	2	0.923
	MDSCC	39(78)	83.53	12.02		
	PDSCC	3(6)	85.73	20.18		
MCH	WDSCC	8(16)	27.49	3	2	0.895
	MDSCC	39(78)	26.92	4.47		
	PDSCC	3(6)	27.9	6.85		
MCHC	WDSCC	8(16)	32.34	1.1	2	0.783
	MDSCC	39(78)	32.12	1.2		
	PDSCC	3(6)	32.5	0.46		
RDW	WDSCC	8(16)	14.35	2.04	2	0.756
	MDSCC	39(78)	14.28	1.66		
	PDSCC	3(6)	13.53	1.55		
HCT	WDSCC	8(16)	41.34	6.37	2	0.461
	MDSCC	39(78)	40.38	4.15		
	PDSCC	3(6)	37.53	1.76		

Table 6: Correlation of Histopathological Grading, Hb Concentration, and RBC Indices in Patients with OSCC. Which shows differences in the mean values of all parameters across the groups, none of these differences were statistically significant.



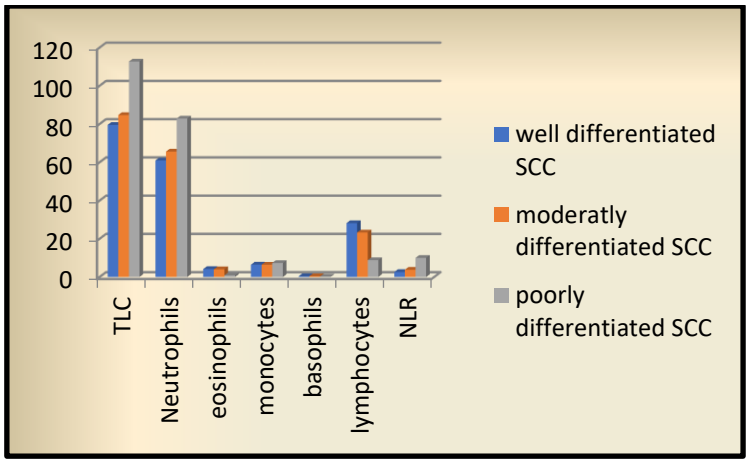
Graph 4: Correlation of Histopathological grading with mean Hb conc and RBC indices in patient with OSCC

Table 7: Correlation of Histopathological grading and WBC subtypes in patient with OSCC.

Parameters	H/P Grading	N(%)	Mean	Standard Deviation	df	Significance
TLC	WDSCC	8(16)	7.95	1.66	2	0.149
	MDSCC	39(78)	8.46	2.54		
	PDSCC	3(6)	11.26	4.14		
Neutrophils	WDSCC	8(16)	60.89	8.87	2	0.003*
	MDSCC	39(78)	65.56	9.13		
	PDSCC	3(6)	82.83	1.63		
Eosinophils	WDSCC	8(16)	4.13	2.83	2	0.31
	MDSCC	39(78)	4.01	3.61		
	PDSCC	3(6)	0.86	0.49		
Monocytes	WDSCC	8(16)	6.44	1.77	2	0.462
	MDSCC	39(78)	6.43	1.8		
	PDSCC	3(6)	7.3	1.23		
Basophils	WDSCC	8(16)	0.4	0.19	2	0.713
	MDSCC	39(78)	0.42	0.26		
	PDSCC	3(6)	0.23	0.23		
Lymphocytes	WDSCC	8(16)	28.15	9.2	2	0.005*
	MDSCC	39(78)	23.24	8.26		
	PDSCC	3(6)	8.79	2.43		
NLR	WDSCC	8(16)	2.58	1.54	2	0.003*
	MDSCC	39(78)	3.76	3.25		
	PDSCC	3(6)	9.96	2.77		

(* significant p value <0.05)

Table 7 shows Correlation of Histopathological Grading and WBC Subtypes in Patients with OSCC which were categorized into three groups based on histopathological grading: well-differentiated (8 patients, 16%), moderately differentiated (39 patients, 78%), and poorly differentiated (3 patients, 6%). Among all parameters, the absolute neutrophil counts, absolute lymphocyte counts, and neutrophil to lymphocyte ratio showed statistically significant differences ($p < 0.05$) across the different histopathological grades.

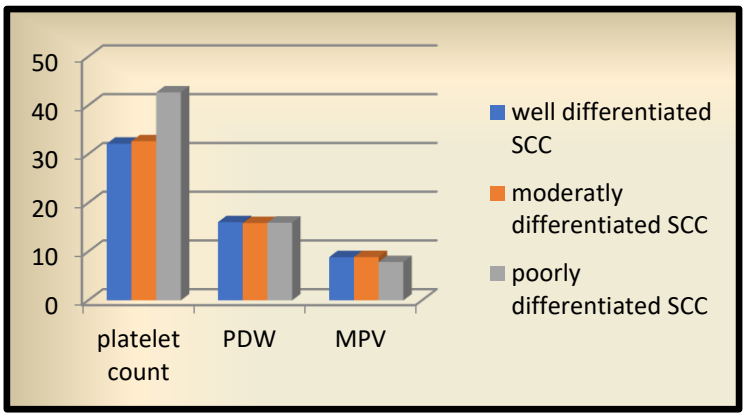


Graph 5: Correlation of Histopathological grading and WBC subtypes in patient with OSCC

Table 8: Correlation of Histopathological grading and platelet indices in patient with OSCC

Parameters	H/P Grading	N (%)	Mean	Standard Deviation	df	Significance
Platelet count	WDSCC	8(16)	3.22	0.70	2	0.278
	MDSCC	39(78)	3.26	1.11		
	PDSCC	3(6)	4.26	0.79		
PDW	WDSCC	8(16)	16.04	0.44	2	0.613
	MDSCC	39(78)	15.86	0.46		
	PDSCC	3(6)	15.93	0.57		
MPV	WDSCC	8(16)	8.86	1.02	2	0.331
	MDSCC	39(78)	8.88	1.17		
	PDSCC	3(6)	7.86	0.67		

Table 8 in which A univariate ANOVA test examined the correlation between platelet indices and histopathological grading. Although there were differences in mean values across the groups, none of these differences were statistically significant.



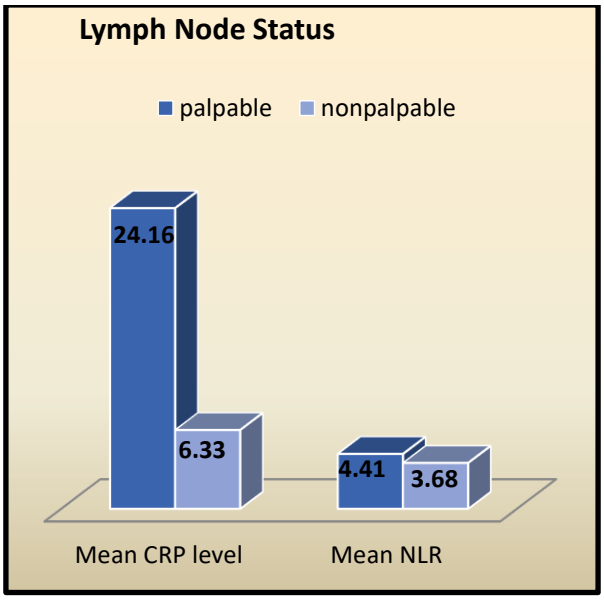
Graph 6: Correlation of Histopathological grading and platelets indices in patient with OSCC

Table 9: Correlation of Lymphnode status with mean CRP level and mean NLR in patient with OSCC.

	Lymphnode status	N (%)	Mean CRP	SD	Sig.	Mean NLR	SD	Sig.
OSCC group (n=50)	Palpable	18(36%)	24.16	19.78	**0.001***	4.41	3.34	0.464
	Nonpalpable	32(64%)	6.33	7.01		3.68	3.42	
	total	50(100)	12.75	15.54		3.94	3.37	

(* significant p value <0.05)

Table 9 shows the correlation between lymph node status and mean levels of C-reactive protein (CRP) and neutrophil-to-lymphocyte ratio (NLR) in patients with oral squamous cell carcinoma (OSCC) was examined in Table 9. Among the OSCC group consisting of 50 patients, 18 (36%) had palpable lymph nodes, while 32 (64%) had nonpalpable lymph nodes. The mean CRP level was significantly higher in patients with palpable lymph nodes (24.16 mg/L) compared to those with nonpalpable lymph nodes (6.33 mg/L), with a p-value of 0.001, indicating statistical significance. However, the mean NLR did not show a significant difference between the two groups (4.41 for palpable lymph nodes vs. 3.68 for nonpalpable lymph nodes). The standard deviation (SD) for CRP levels was 19.78 for palpable lymph nodes and 7.01 for nonpalpable lymph nodes, while for NLR, it was 3.34 and 3.42, respectively. Overall, these findings suggest a potential association between lymph node status and CRP levels in OSCC patients, indicating that higher CRP levels may correlate with palpable lymph nodes, whereas NLR levels do not exhibit such a correlation.



Graph 7: Correlation of Lymphnodes status, mean CRP and NLR levels in patient with OSCC

Table 10: Correlation of Habit – type, duration, frequency and mean CRP in patient with OSCC.

OSCC(n=50)	Habit group	n	Mean	Standard deviation	df	Sig.
Type of habits	smokeless	36	11.23	13.14	2	0.715
	smoking	7	8.53	6.45		
	mixed	7	24.76	26.87		
	total	50	12.75	2.20		
Duration of habits(in years)	Group 1 (1-10)	26	8.55	13.18	3	0.025*
	Group 2 (11-20)	13	12.79	9.75		
	Group 3 (21-30)	9	25.63	23.18		
	Group 4 (>30)	2	9.07	8.58		
	Total	50	12.75	15.54		
Frequency of habits (packets/day)	Group 1(1-3)	30	10.97	13.12	2	0.022*
	Group 2(4-6)	17	11.74	14.51		
	Group 3(>6)	3	36.28	29.18		
	Total	50	12.75	15.54		

(* significant p value <0.05)

Table 10 illustrates the correlation between types of habits, duration, frequency, and mean C-reactive protein (CRP) levels in 50 patients with oral squamous cell carcinoma (OSCC). While no significant differences were found among smokeless tobacco use, smoking, and mixed habits groups (p = 0.715), duration of habits revealed a significant impact on CRP levels (p = 0.025*), with patients habituated for 21-30 years exhibiting the highest CRP level (25.63 mg/L). Similarly, frequency of habits significantly influenced CRP levels (p = 0.022*), with patients consuming over 6 packets/day demonstrating the highest CRP level (36.28 mg/L). These results suggest that prolonged and frequent tobacco use may exacerbate systemic inflammation in OSCC patients, emphasizing the importance of tobacco cessation interventions in managing inflammation-associated complications.

Discussion

The prevalence of oral cancer is particularly high in India, with oral cancer ranking as the most common cancer among men and the third most common among women in the country [8].

As we know rapidly growing number of cancer patients put India at risk to become a cancer capital of world. As we move towards molecular targeted therapies which are costly and put financial burden on patients. Determination of prognosis, in areas of large population and low per capita GDP subjects healthcare system to high risk. To mitigate this challenge we tried to provide cost effective and accurate screening test to identify the malignancy at preliminary stage that would give better prognostic outcomes.

The search for biomarkers in oral cancer for early diagnosis and improved therapeutic outcomes is ongoing. Various biological media are being explored, including blood, serum, saliva, and urine.[9] Inflammation has long been implicated in tumorigenesis, with the relationship between inflammation and cancer well-established in recent years.[10]

CRP, a marker of inflammation, has been studied extensively in various cancers, including OSCC. In the current study, elevated CRP levels were observed in OSCC patients, which could be attributed to chronic inflammation, poor nutritional status, and the presence of risk factors such as smoking and alcohol abuse.[11] The elevated CRP levels may result from either chronic inflammation predisposing to cancer development or as a response to tumor growth itself.[12]

The study findings indicated a significant association between CRP levels and habits such as smoking and tobacco consumption, with higher CRP values observed in patients with mixed habits. The duration and frequency of habits also correlated with CRP levels, suggesting a cumulative effect of exposure to risk factors on inflammation and cancer progression.[13] Moreover, CRP levels were significantly associated with the histopathological grading of OSCC, indicating its potential application as a prognostic marker.

Regarding hematological parameters, alterations were observed in OSCC patients compared to healthy individuals. Parameters such as hemoglobin concentration, RBC counts, MCV, MCHC, and RDW differed significantly between the study groups. These alterations could be attributed to factors such as nutritional deficiencies, chronic inflammation, and the tumor's influence on host metabolism.[14] Additionally, platelet parameters and WBC counts were found to be significantly different in OSCC cases, indicating their potential role in cancer progression and systemic inflammation.[15]

The neutrophil-to-lymphocyte ratio (NLR), a marker of systemic inflammation, showed a significant correlation with histopathological grading of OSCC, with higher NLR values associated with poorly differentiated tumors. This suggests a link between the host inflammatory response and tumor aggressiveness.[16] Combining CRP and NLR may enhance the predictive ability of prognosis in OSCC patients, providing a simple and reproducible clinical tool for prognostic assessment.

However, the study had limitations, including its single-center design, small sample size, and lack of long-term survival data. Confounding factors such as comorbidities and other pathological conditions were not adjusted for, and larger prospective studies are needed to confirm the findings as prognostic markers in OSCC.

In conclusion, CRP and hematological parameters serve as important evaluation markers for OSCC patients, with potential implications for prognosis and therapeutic decision-making. Further multicenter studies with larger sample sizes and longer follow-up durations are warranted to validate these findings and elucidate their clinical utility.

Conclusion

In conclusion, this study highlights the importance of CRP and hematological parameters as potential prognostic markers in OSCC. Elevated CRP levels were associated with inflammation and risk factors such as tobacco use, while changes in hematological parameters reflected systemic responses to tumor progression. Combining CRP with hematological parameters offers a comprehensive approach to prognostic assessment in OSCC, aiding in treatment planning. However, larger studies are needed to validate these findings and their clinical utility.

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