ORIGINAL RESEARCH

Assessment of Relationship of ABO-RH Blood Group in Oral Cancer Patients: A Prospective Cohort Study of Hospital Patients

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ABSTRACT
Developing countries, particularly in South Asia, have a high prevalence of oral cancer, accounting for approximately 50% of cases worldwide. This trend is attributed to a group of conditions known as "oral potentially malignant disorders" (OPMD), which comprises of oral hypoplasia, dysplasia, leukoplakia, erythroplakia, and oral submucousfibrosis.Tobacco usage and alcohol consumption are the primary causes of more than 90% of oral cancer cases. Moreover, some genetic factors, including the ABO blood group, have also been hypothesized to be linked to the development of different forms of cancer. Several studies have explored the possible association between ABO blood type and oral cancer, as well as other conditions that could potentially lead to cancer. However, the results of these studies have been inconsistent and inconclusive. As a result, it has not been established as a confirmed risk factor. The suggested theory linking blood group A with carcinomas postulates that the cancerous cells may generate an antigen that shares certain immunological features with blood group A.People who have blood types A and AB lack antibodies for A, which can render them more vulnerable to developing carcinomas. Several studies have explored the possible association between ABO blood type and oral cancer, oral submucous fibrosis, and other related conditions that have the potential to become malignant.The aim and objective of this study is to investigate the relationship between ABO blood group types and oral cancer, oral potentially malignant disorders (OPMD), and oral submucous fibrosis (OSMF) in greater detail.

Keywords: ABO-RH Blood Group, Oral cancer, oral potentially malignant disorders, oral submucous fibrosis

INTRODUCTION

Oral cancer is a commonly occurring form of malignancy and a significant concern for public health. It is estimated that each year, there are 657,000 newly diagnosed cases of oral cancer, resulting in over 330,000 fatalities[1].Oral and pharyngeal cancer, when considered together, is ranked as the 6th most prevalent form of cancer globally. Head and neck cancer is the most prevalent type of cancer in India[2]. Oral cancer is most prevalent in developing countries worldwide, with half of the cases concentrated in South Asia[3]. More than a quarter of the total global oral cancer mortality is reported in India, with an age-standardized incidence rate of 12.6 per 100,000 people. It is projected that the incidence of oral cancer in India will increase by 12% by the year 2025[4].

In 2005, the WHO proposed the term "oral potentially malignant disorders" (OPMD) to describe a lesion or condition that has a risk of malignancy at the time of initial diagnosis or the potential for malignancy to develop at a later date[5].Oral potentially malignant disorders (OPMD) is a broad term that encompasses various conditions such as erythroplakia, dysplasia, leukoplakia, oral hypoplasia, and oral submucous fibrosis. These conditions have a considerable likelihood of turning malignant, with reported transformation rates ranging from 0.6% to 36% [6].The rise in oral malignancy and related morbidity and mortality due to crucially malignant disorders is attributed to a multi-factorial etiology[7]. The

development of cancer is influenced by various factors, including lifestyle and environmental factors, as well as genetics and heredity. The majority of oral cancer cases, over 90%, are caused by tobacco use and alcohol consumption. Around 5% to 10% of cases are linked solely to hereditary factors[8](**Figure 1**).

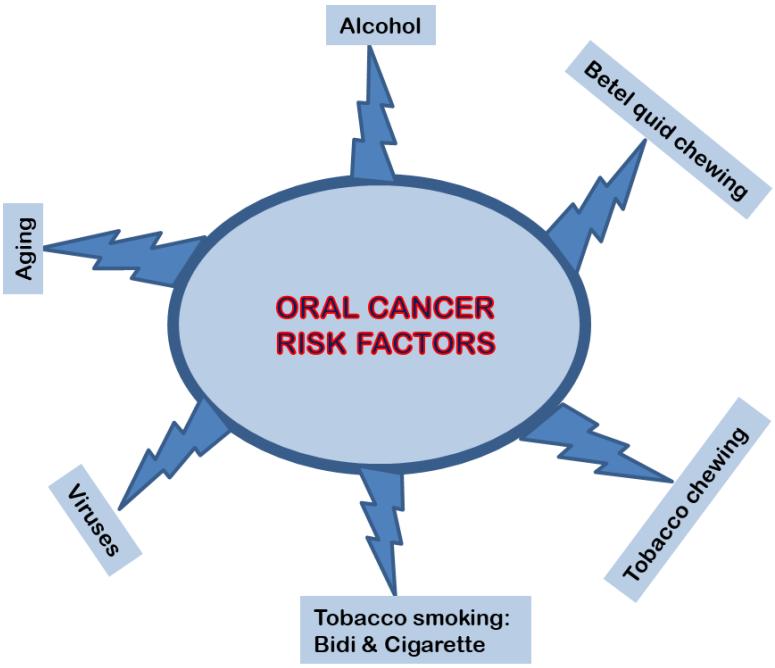

Figure: 1 Oral Cancer risk factor

ABO blood group is considered one of the genetic factors that may contribute to the development of various types of cancer.This association was first studied by Alexander in 1921 and later by Anderson and Haas in 1984[9]. Research studies and systematic reviews have reported an association of blood group A with various forms of cancer, including breast cancer, gastric cancer, pancreatic cancer, ovarian cancer, skin cancer, and esophageal cancers[10]. Although researchers have investigated the connection between ABO blood type and oral cancer, as well as other crucially malignant disorders, the findings have been inconclusive. Consequently, ABO blood type has not been confirmed as a risk factor for these conditions[11].

Blood group antigens can be found on the exterior of red blood cells, as well as on the epithelial cells of various human tissues, including mucous membranes and bodily fluids[12]. A possible explanation for the relationship between blood group A and carcinoma is that cancer cells produce antigens with immunological properties similar to those of blood group A[13]. This antigen, when present in individuals with blood group O, may inhibit the growth and spread of the tumor through a protective mechanism.Individuals with blood groups A and AB are lacking in antibodies for A, making them more susceptible to developing carcinomas[14]. Evidence from immunohistochemical analyses suggests that more than 80% of cases involving oral squamous cell carcinoma (OSCC) and oral potentially malignant disorders (OPMD) show a lack of expression of A or B antigens [15].

A multimodal approach that combines different treatment modalities is often used in the management of oral cancer as well. The choice of treatment will depend on the stage and location of the cancer, as well as the patient's overall health and preferences. **Surgery** is often the first line of treatment for oral cancer, and it may involve removal of the tumor and surrounding tissue, as well as nearby lymph nodes. Depending on the extent of the surgery, reconstruction may also be necessary[53]. **Radiotherapy** may be used alone or in combination with surgery to destroy cancer cells that may have spread beyond the primary site[53]. **Chemotherapy** may also be used, either alone or in combination with other treatments, to destroy cancer cells throughout the body[55]. **Hormone therapy** is not typically used in the management of oral cancer, as this type of cancer is not typically hormone-dependent. In addition to these treatments, targeted therapy may be used in certain cases, such as for cancers that are positive for the epidermal growth factor receptor (EGFR). Overall, the goal of a multimodal approach to oral cancer treatment is to provide the most effective and individualized care possible for each patient, with the aim of achieving the best possible outcomes in terms of both survival and quality of life[56].

Numerous studies have been carried out to examine potential links between ABO blood type and the development of oral cancer, as well as other potential malignancies and oral submucosal fibrosis[16].

Despite extensive research, the association between ABO blood group and oral cancer and other potential malignancies with oral submucosal fibrosis remains

unclear. Therefore, further investigation is needed to draw definitive conclusions [16a].

The primary aim of this research is to investigate the association between ABO blood group types and oral cancer, oral potentially malignant disorders (OPMD), and oral submucous fibrosis (OSMF) in greater depth.

MATERIALS AND METHODS

LITERATURE SEARCH

For this study, a comprehensive literature review was performed by searching the NCBI Pubmed database using the keywords "oral cancer", "risk factor", "epidemiology", and "cancer pathology". Additionally, supplementary information was obtained from reputable medical textbooks and university websites.

STUDY DESIGN AND AREA

Well experienced Head and Neck Oncologist meticulously reviewed the medical records of 600 patients (consisting of 463 males and 137 females) who presented to the Department of Pathology at G.S.V.M Medical College in Kanpur Nagar, Uttar Pradesh, India.

STUDY POPULATION

The study, which occurred between June and November of 2022, focused on 600 patients who had received a histologically confirmed diagnosis of oropharynx and oral cavity (OC) cancer, encompassing primary and secondary malignancies.

DATA COLLECTION AND PROCESSING

Prior to the study, each subject provided written and informed consent in both the local language and English. The confidentiality of the collected data was also safeguarded. The research was conducted in accordance with the Declaration of Helsinki and was approved by the Ethics Committee of the local Institute. If the patient was unaware of their ABO blood type, it was determined as part of standard hematological studies by utilizing monoclonal antibodies derived from mice.

INCLUSION CRITERIA

The inclusion criteria for the study were as follows: **(1)**The patient records contain comprehensive clinicopathological information on oral cancer (OC), such as age, sex, stage, tobacco use, alcohol consumption, histologic differentiation, radiographs, ABO blood group, and treatment status.**(2)**The malignant lesions were restaged based on the 2002 Union for International Cancer Control Cancer Staging System, using the available records.The exclusion criteria were: **(1)** Patient records demonstrating initial treatment with curative intent through surgery, radiation therapy, or chemotherapy alone or in combination. **(2)** Patients with tumours in the salivary glands. **(3)**The patient records were recorded in a standardized format, documenting information on variables such as gender, age, ABO blood group, habits of tobacco/betel nut/alcohol consumption, and the location of the tumor. The study covered a total of 9 possible tumor sites, which were the tongue, buccal mucosa, alveolar ridge, gingivo-buccal sulcus, lip, pharynx/peritonsillar region, palate, floor of mouth, and retromolartrigone. However, biopsy reports were not included in the patient records. **(Figure 2)**

BLOOD GROUPING

ABO-Rh blood grouping was done based on agglutination reaction.

STATISTICAL ANALYSIS

Data on the blood groups of individuals with patients diagnosed with benign lesion. Once the data has been collected, it can be analyzed to determine any associations between the blood group and the diagnosis of a benign lesion. Statistical methods, such as chi-square can be used to explore any potential relationships[17].Calculate the proportions of individuals with each blood group who have patients diagnosed and who have benign lesion by using the R programming[18]. Calculate the risk ratio (RR) by dividing the proportion of individuals with a given blood group who have diagnosed by the proportion of individuals with the same blood group who have benign lesion by help of R programming and mathematical concept is given below:

Risk Ratio =Risk of an event in one group**/** risk of the event in the other group

Where, risk = chance of the outcome of interest/all possible outcomes.

Calculate the odds ratio (OR) by dividing the odds of having patients diagnosed for individuals with a given blood group by the odds of having benign lesion for individuals with the same blood group, by help of R programming and mathematical concept is given below:

Odds Ratio = Odds of an event in one group **/** odds of the event in the other group.

Where, Odds= the probability of occurrence of an event/probability of the event not occurring.

Figure 2: Various oral cancer sites observed during present study.

RESULTS

Table 1: Risk ratio (RR) for different blood groups

Blood groups	Patients diagnosed	Benign lesion	Risk ratio	Lower	Upper	P value
A+	71	87	1	1.045857	1.0625	0.00385
A-	2	2	0.908046	0.337391	2.443896	0.8407
B+	68	153	1.257294	1.064951	1.484377	0.004776
B-	0	6	1.816092	1.577477	2.090801	0.02922
AB+	17	42	1.292811	1.042777	1.602797	0.031376
AB-	2	1	0.605364	0.12143	3.017914	0.453882
O+	42	102	1.286398	1.079257	1.533297	0.004675
O-	1	4	1.452874	0.916862	2.302246	0.268942

We find that the risk ratio is less than 1in the blood groups A-, AB- in the above **table.1**, this would recommend that there are less chances of risk in the patients diagnosed group, the risk ratio is greater than 1in the blood groups B+, B-, AB+, O+, O- in the above **table.1**, this would recommend that there are a high risk in the patients diagnosed group and the risk ratio is equal to 1in the blood group A+, it recommends that there is no difference or little difference in risk. It means the incidences in both groups patient diagnosed and benign lesion are equal.

Based on the results presented above, the risk ratio was determined to be 1, with a 95% confidence interval of 1.05 to 1.06. This indicates an elevated risk of only 5% to 6%. Additionally, the p-value is less than 0.05, demonstrating statistical significance in individuals with the A+ blood group.Similarly the risk ratio lies with the 95% confidence interval in the each blood group A-, B+, B-, AB+, AB-, O+, and O-. And similarly the p-value is less than 0.05 then the result will be statistically significant for the blood groups B+, B-, AB+ and O+. And P-value is greater than 0.05 then the result will not be statistically significant for the blood groups A-, AB- and O-.

Table 2: Odds ratio (OR) for different blood groups

Blood groups	Patients diagnosed	Benign lesion	Odds ratio	Lower	Upper	P value
A+	71	87	1	1.15024	1.18026	0.003956
A-	2	2	0.816092	0.11213	5.939614	0.8407
B+	68	153	1.836207	1.20154	2.806113	0.004776
B-	0	6	Inf		Inf	0.02922
AB+	17	42	2.016227	1.058113	3.841908	0.031376
AB-	2	1	0.408046	0.036254	4.592667	0.453882
O+	42	102	1.981938	1.230261	3.19288	0.004675
O-	1	4	3.264368	0.356812	29.86476	0.268942

We find that the odds ratio is less than 1in the blood groups A-, AB- in the above table.2, this would recommend that there are reduce the chances of risk in the patients diagnosed group, Odds ratio is greater than 1in the blood groups B+, B-, AB+, O+, O- in the above table.1, this would recommend that there are increase the risk in the patients diagnosed group and odds ratio is equal to 1in the blood group A+, it recommends that there is no difference or little difference in risk. It means the incidences in both groups patient diagnosed and benign lesion are equal.
According to the results presented above, the risk ratio was found to be 1, with a 95% confidence interval of 1.15 to 1.18. This suggests a modest increase in risk of 15% to 18%. Moreover, the p-value is less than 0.05, indicating statistical significance in individuals with blood group A+.Similarly the risk ratio lies with the 95% confidence interval in the each blood group A-, B+, AB+, AB-, O+, and O-. And similarly the p-value is less than 0.05 then the result will be statistically significant for the blood groups B+, B-, AB+ and O+. And P-value is greater than 0.05 then the result will not be statistically significant for the blood groups A-, AB- and O-.

Table 3: Chi-squared test for different blood groups

Pearson's Chi-squared test		
Chi-square	**Degree of freedom**	**p-value**
17.1	7	0.01676

Null hypothesis (H_0)**:** The blood groups are in risk of equal proportions for patient diagnosed and benign lesion.Alternative hypothesis (H_A)**:** The blood groups are in risk of different proportions for patient diagnosed and benign lesion **(Table 3)**. Here the level of significance is 0.05, p-value is 0.01676 and degree of freedom is 7, Since the p-value is below the level of significance, and the observed data differs significantly from the expected values, the outcome is considered statistically significant. Therefore, we can reject the null hypothesis and conclude that the data does not conform to a distribution with specific proportions.

Table 4: Risk ratio (RR) for different blood groups of male patients

Blood groups	Patients diagnosed	Benign lesion	Risk ratio	lower	upper	P value
A+	58	65	1	1.02553	1.0430267	0.015260
A-	2	1	0.630769	0.126211	3.152426	0.50376
B+	55	110	1.261538	1.034133	1.53895	0.017494
B-	0	5	1.892308	1.601371	2.236102	0.037861
AB+	13	34	1.368903	1.073438	1.745697	0.021158
AB-	1	1	0.946154	0.234272	3.821227	0.936267
O+	29	85	1.410931	1.157016	1.720569	0.000529
O-	1	3	1.419231	0.786792	2.560036	0.38195

We find that the risk ratio is less than 1in the blood group A- in the above **table.4,** this would recommend that there is less chances of risk in the patients diagnosed group, the risk ratio is greater than 1in the blood groups B+, B-, AB+, O+, O- in the above **table.4**, this would recommend that there are a high risk in the patients diagnosed group and the risk ratio is equal to 1in the blood group A+ and the risk ratio near to 1 in AB-, it recommends that there are no difference or little difference in risk. It means the incidences in both groups patient diagnosed and benign lesion are equal.
From the above results that indicated a risk ratio of 1 with a 95% confidence interval of 1.03 - 1.04, this would indicate an increase in risk of only 3% - 4% and p-value is less than 0.05, thus the result is statistically significant in the blood group A+. Similarly the risk ratio lies with the 95% confidence interval in the each blood group A-, B+, B-, AB+, AB-, O+, and O-. And similarly the p-value is less than 0.05 then the the result will be statistically significant for the blood groups B+, B-, AB+ and O+. And P-value is greater than 0.05 then the result will not be statistically significant for the blood groups A-, AB- and O-.

Table 5: Odds ratio (OR) for different blood groups of male patients

Blood groups	Patients diagnosed	Benign lesion	Odds ratio	Lower	Upper	P value
A+	58	65	1	1.0956	1.112506	0.015986
A-	2	1	0.446154	0.039419	5.049704	0.50376
B+	55	110	1.784615	1.104637	2.883165	0.017494
B-	0	5	Inf		Inf	0.037861
AB+	13	34	2.333728	1.123942	4.845699	0.021158
AB-	1	1	0.892308	0.05457	14.59064	0.936267
O+	29	85	2.615385	1.508275	4.535139	0.000529
O-	1	3	2.676923	0.270895	26.45279	0.38195

We find that the odds ratio is less than 1in the blood groups A-, AB- in the above **table.5,** this would recommend that there are reduce the chances of risk in the patients diagnosed group, Odds ratio is greater than 1in the blood groups B+, B-, AB+, O+, O- in the above **table.5**, this would recommend that there are increase the risk in the patients diagnosed group and odds ratio is equal to 1in the blood group A+, The findings suggest that there may be little or no difference in risk between the two groups. This implies that the incidence of diagnosed patients and benign lesions is similar, or in other words, equivalent.

From the above results that indicated a risk ratio of 1 with a 95% confidence interval of 1.09 - 1.11, this would indicate an increase in risk of only 9% - 11% and p-value is less than 0.05, thus the result is statistically significant in the blood group A+. Similarly the risk ratio lies with the 95% confidence interval in the each blood group A-, B+, B-, AB+, AB-, O+, and O-. And similarly the p-value is less than 0.05 then the result will be statistically significant for the blood groups B+, B-, AB+ and O+. And P-value is greater than 0.05 then the result will not be statistically significant for the blood groups A-, AB- and O-.

Table 6: Chi-square Odds ratio (OR) for different blood groups of male patients

Pearson's Chi-squared test		
Chi-square	**Degree of freedom**	**p-value**
18.346	7	0.0105

Null hypothesis (H0): The blood groups are in risk of equal proportions for patient diagnosed and benign lesion for male patients. Alternative hypothesis (HA): The blood groups are in risk of different proportions for patient diagnosed and benign lesion for male patients(**Table 6).**Here the level of significance is 0.05, p-value is 0.0105 and degree of freedom is 7, Since the p-value is less than the level of significance and the observed data shows a significant difference from the expected values, we reject the null hypothesis and conclude that the data does not follow a distribution with certain proportions. In other words, the results are considered statistically significant.

Table 7: Risk ratio (RR) for different blood groups of female patients

blood groups	Patients diagnosed	Benign lesion	Risk ratio	Lower	Upper	P value
A+	13	22	1	0.81235	1.5489	0.142327
A-	0	1	1.590909	1.233231	2.052326	0.445777
B+	13	43	1.221591	0.91173	1.636761	0.152456
B-	0	1	1.590909	1.233231	2.052326	0.445777
AB+	4	8	1.060606	0.660067	1.704197	0.812652
AB-	1	0	0	0	1.25623	0.203605
O+	13	17	0.901515	0.60222	1.349556	0.611541
O-	0	1	1.590909	1.233231	2.052326	0.445777

We find that the risk ratio is less than 1in the blood groups AB- and O+ in the above **table.7**, this would recommend that there are less chances of risk in the patients diagnosed group, the risk ratio is greater than 1in the blood groups A-, B+, B-, AB+ and O- in the above **table.7**, this would recommend that there are a high risk in the patients diagnosed group and the risk ratio is equal to 1in the blood group A+, it recommends that there is no difference or little difference in risk. It means the incidences in both groups patient diagnosed and benign lesion are equal.

From the above results that indicated a risk ratio of 1 with a 95% confidence interval of 0.81 - 1.55, this would indicate an increase in less risk and p-value is greater than 0.05, thus the result is will not be statistically significant in the blood group A+. Similarly the risk ratio lies with the 95% confidence interval in the each blood groups A-, B+, B-, AB+, AB-, O+, and O-. And the P-value is greater than 0.05 then the result will not be statistically significant for the blood groups all the blood groups.

Table 8: Odds ratio (OR) for different blood groups of female patients

Blood groups	Patients diagnosed	Benign lesion	Odds ratio	Lower	Upper	P value
A+	13	22	1	0.4526	2.9356	0.1256
A-	0	1	Inf	NAN	Inf	0.445777
B+	13	43	1.954545	0.775325	4.927285	0.152456
B-	0	1	Inf	NAN	Inf	0.445777
AB+	4	8	1.181818	0.296648	4.708262	0.812652
AB-	1	0	0	0	NAN	0.203605
O+	13	17	0.772727	0.285473	2.091641	0.611541
O-	0	1	Inf	NAN	Inf	0.445777

We find that the odds ratio is less than 1in the blood groups AB- and O+ in the above **table.8,** this would recommend that there are reduce the chances of risk in the patients diagnosed group, Odds ratio is greater than 1in the blood groups B+ and AB+ in the above **table.8,** this would recommend that there are increase the risk in the patients diagnosed group and odds ratio is equal to 1in the blood group A+, it recommends that there is no difference or little difference in risk. It means the incidences in both groups patient diagnosed and benign lesion are equal.

From the above results that indicated a risk ratio of 1 with a 95% confidence interval of 0.45 – 2.94, this would indicate an increase in less risk and p-value is greater than 0.05, thus the result is will not be statistically significant in the blood group A+. Similarly the risk ratio lies with the 95% confidence interval in the each blood groups A-, B+, B-, AB+, AB-, O+, and O-. And the P-value is greater than 0.05 then the result will not be statistically significant for the blood groups all the blood groups.

Table 9: Chi-square for different blood groups of female patients

Pearson's Chi-squared test		
Chi-square	**Degree of freedom**	**p-value**
7.7136	7	0.3585

Null hypothesis (H_0): The blood groups are in risk of equal proportions for patient diagnosed and benign lesion for female patients. Alternative hypothesis (H_A): The blood groups are in risk of different proportions for patient diagnosed and benign lesion for female patients **(Table 9).** The statistical analysis revealed a p-value of 0.3585, with a level of significance of 0.05 and 7 degrees of freedom. As the p-value is greater than the level of significance, the observed data is not considered statistically significant when compared to the expected values. As a result, the null hypothesis is not rejected.

Further frequency distribution study was conducted in present study for 600 cases of oral lesion. Comprising of 203 oral cancer cases, 71 (35%) had blood group A positive, 2 (0.9%) had blood group A negative, 68 (33%) had blood group B positive, 17 (8%) had blood group AB positive,2 (0.9%) had blood group AB negative, 42 (20%) had blood group O positive and 1 (0.4%) had blood group O negative. The relative frequency (%) of blood group A positive (35%) higher in oral cancer group.

The distribution of ABO-Rh blood group among oral cancer according to gender shows that out of 463 male oral cases, 13% had blood group A positive with oral cancer, 12% had blood group B positive with oral cancer, 13% had blood group AB positive with oral cancer, 30% had blood group O positive with oral cancer. Among 137 female oral lesion cases, 9% had blood group A positive, 9% had blood group B positive, 3% had blood group AB positive, 9% had blood group O positive. Age wise distribution of patients shows that patients belonging to 41-50 years of age group have higher chances of developing oral lesion.

DISCUSSION

Previous research has demonstrated that glycolipids or glycoproteins, which are carbohydrates bound to lipids or proteins, are present on the cell membrane[57, 58]. These molecules may undergo modifications during cell maturation or malignant transformation. Carbohydrates such as ABO and Lewis blood group antigens are typically found on the external portion of glycol-conjugates[19]. Parents with A/B blood groups have been observed to have an elevated occurrence of various carcinomas, possibly due to a greater affinity of these antigens to certain microorganisms that are associated with the development of cancer[14]. There are several mechanisms that have been proposed to explain the potential correlation between ABO blood groups and cancer risk[20]. The correlation between ABO blood groups and cancer risk has been attributed to various mechanismsincludingimmune response, intercellular adhesion, inflammation, and membrane signaling. Down regulation of glycosy ltransferase, which is responsible for producing A and B antigens, and linkage disequilibrium between ABO genes may also contribute to carcinogenesis[21]. The presence of ABO antigens on receptors that play crucial roles in regulating cell adhesion, proliferation, and motility, such as EGF receptors, integrins, cadherins, and CD-44, has also been suggested as a potential mechanism underlying the association between ABO blood groups and cancer risk.[11]. The impact of ABO antigens on tumorigenesis could differ depending on the variation in expression of these receptors between cancerous and normal cells[59].

Present study discusses the risk and odds ratios for different blood groups in patients diagnosed with a particular condition compared to those with a benign lesion[22]. The risk ratio is less than 1 for A- and AB- blood groups, indicating a lower risk for patients diagnosed with the condition, while it is greater than 1 for B+, B-, AB+, O+, and O- blood groups, indicating a higher risk[23]. The risk ratio is equal to 1 for A+ blood group, indicating no difference or little difference in risk. Similarly, the odds ratio is less than 1 for A- and AB- blood groups, indicating reduced chances of risk in the diagnosed group, and greater than 1 for B+, B-, AB+, O+, and O- blood groups, indicating increased risk[24]. For males, the risk and odds ratios are similar to those of the overall population, with a reduced risk in A- and AB- blood groups and an increased risk in other blood groups. For females, the risk and odds ratios are also similar to those of the overall population, with reduced risk in

AB- and O+ blood groups and an increased risk in other blood groups.The blood group A+ has little or no difference in risk between the two groups.

Further the study also demonstrates that people with blood group A were affected by oral cancer accounting for 35%, followed by blood group B, O and AB. The most common age group affected was 41-50 years accounting for 29%, followed by least percentage in 81-90 years age group. Males are at greater risk to develop oral cancer compared with female [25].

The results are in agreement with Jaleel and Nagarajappa's (2012) research, which showed that oral cancer is mostly associated with aging, with 98% of cases occurring in individuals aged 40 and above.[11]. Nevertheless, Fazeli et al. (2011) have pointed out that the occurrence of oral cancer is progressively increasing among younger age groups and women, indicating that the risk factors and mechanisms underlying this condition might be changing over time[11].

Gender-wise distribution in our study showed male predominance. This may be due to easy access of tobacco and alcohol to males than females in the society. Our study's findings align with those of Mortazavi et al., who reported a higher incidence of squamous cell cancer in individuals over 50 years of age and in men [26]. In contrast to the findings of Jaleel et al., it has been suggested that females tend to keep tobacco in their mouth for longer periods than males, which might contribute to the increased occurrence of oral cancer in females[27].

Our study revealed that oral cancer was more prevalent in patients with blood group A, accounting for 35% of cases, followed by blood group B, while blood group AB was the least affected[28]. Our study's outcomes were consistent with previous research, such as the study conducted by Jaleel et al., which found that people with blood group A have a 1.46 times higher risk of developing oral cancer than those with blood groups B, AB, and O. To target individuals at a higher risk of developing oral cancer, a simple blood grouping test could be implemented during community field programs. This would enable us to educate people with blood group A who are aged between 40 and 59 and have a habit of chewing tobacco about their increased risk of developing oral cancer. Furthermore, Saxena et al. reported that blood group A has the highest association with oral cavity cancers, followed by O, B, and blood group AB having the least association[29]. The incidence of oral cavity cancers was higher in males than females. Additionally, Jacobina et al. demonstrated that individuals with blood group A are more susceptible to developing oral cancer, highlighting the importance of raising awareness about this risk among the general population[30]. The study showed that individuals with blood group A+ were more likely to develop oral cancer, while those with blood group O had the lowest likelihood[31]. The age group predominantly affected by oral cancer was between 41-50 years, with a higher prevalence among males. A significant number of patients had multiple habits such as tobacco chewing, smoking, consumption of betel nut, and alcohol use [32].Studies have shown that certain blood groups are more commonly associated with oral cancer, with blood group A having a higher predilection for developing this type of cancer[33].Gaurav I et al. reported a significant correlation between blood group A and the incidence of certain diseases. In terms of oral cancer, the most common age group affected was 51-60 years, with a higher prevalence among males[34]. The study revealed that oral submucous fibrosis was the most common precancerous disorder, with smokeless tobacco being identified as its primary cause [35].

According to some research, oral cancer is more frequently found in individuals with blood groups other than A, with blood group A being the next most commonly affected. [11, 60].The correlation between ABO blood types and cancer risk differs based on geographic locations, races, and ethnicities[10]. Hamed et al. reported that blood group B was significantly more prevalent in individuals with oral cancer than in the control group[36]. In addition, Logistic Regression analysis revealed that individuals with blood group B and those aged 50 or older had a 3.5-fold and 19.4-fold increased risk of developing oral cancer, respectively. [11].Jalili L et al. found that the presence of A and B antigens on cells may heighten the risk of oral squamous cell carcinoma (OSCC)[52]. Blood type O was found to be significantly less frequent, while blood type AB was significantly more frequent among OSCC patients. In a study conducted by Mortazavi et al., it was observed that the frequency of blood type O was significantly lower among individuals with oral cancer compared to the control group. Conversely, there was a higher frequency of blood type B among those with oral cancer[37].

CONCLUSION

The study found that individuals with A+ve blood type have a higher tendency to develop oral cancer. The age group most commonly affected by oral cancer was 41-50 years, followed by 31-40 years, with a higher incidence among males. Additionally, many patients had multiple habits, such as tobacco chewing, smoking, betel nut consumption, and alcohol use.Considering the study finding, blood typing can be used as a routine method to identify the individuals and counsel them about the chances of developing oral cancer and precautions to be taken to minimize the risk factor for oral cancer.

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CONFLICT OF INTEREST

All the authors declare that they have no conflict of interest.

ETHICAL STATEMENT

All necessary permissions are obtained from the institution**.** Prior to the study, each subject provided written and informed consent in both the local language and English.

AUTHOR'S CONTRIBUTION

Dr. Aditi Pal conceptualized and gathered the data with regard to this work. Dr.Soniverma and Jyotsna analysed these data and necessary inputs were given towards the designing of the manuscript. All Authors discussed the methodology and results and contributed to the final manuscript.

ABBREVIATIONS

OPMD-oral potentially malignant disorders, OSMF-oral submucous fibrosis, WHO- world health organization, OSCC-oral squamous cell carcinoma, EGFR-epidermal growth factor receptor

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