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Correlation between Different Type of Cancer and Allergies in Patients

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Abstract

Background: Both prevalence of the cancer and allergies cases are rising globally. Atopy has been speculated to have an impact on risk of various malignancies.

Methods: In current study, the presence of allergens was tested in 1525 cancer. On the basis of a retrospective study of the procedures of allergy diagnostic performed on individuals who has already received a cancer diagnosis, allergies were confirmed. In accordance with pertinent guidelines, bronchial asthma and allergic rhinitis were also assessed in all patients. For comparison of patients of a control group that does not have experience cancer diagnoses.

Results: In comparison to the control group, cancer patients had significantly less IgE-mediated allergy disorders. The ORs (odds ratios) for the allergic rhinitis, bronchial asthma, and atopic dermatitis for oncological group that is compared with non-cancer group of patients are 0.67 (95 percent confidence interval 0.52 to 0.81), 1.03 (95 percent CI 0.91 to 1.13), and 0.89 (95 percent CI 0.78 to 0.99) respectively. In comparison to patients in control group, the study population of patients of cancer had considerably lower mean concentrations of serum of the total IgE (45.98 14.9 verses 83.2 40.1 IU/l where the $p < 0.05$). The type of malignancy that was identified and the type of allergy did not significantly correlate.

Conclusion: The observed correlation might point to the link between the IgE-mediated allergies and a decreased incidence of specific malignancies. Patients in the oncological trial had a low prevalence of allergic rhinitis, in particular. Our findings need to be confirmed by further research. In addition, compared to people with allergies, cancer patients typically have a worse socioeconomic background.

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INTRODUCTION

The hunt for elements that might contribute to or guard against oncogenesis has been impacted by the rising incidence of cancer globally.[1] Attempts have been undertaken to look for connections between various chronic conditions, such as those between allergies and the development of cancer, among other strategies.[2] Throughout the years, there has been a lot of intriguing research on the potential promotion or prevention of cancer by allergies. Numerous theories have been put out regarding the connection between the IgE-mediated allergies and development of the cancer.[3] According to a theory, atopies can prevent cancer by using immunosurveillance. Certain IgE antibodies are produced when immunocompetent cells are overstimulated as a result of interaction with an allergen, and these antibodies might have a lethal effect on the cells of cancer.[4,5] According to second theory, atopy is associated with the higher risk of the developing cancer because persistent inflammation stimulates the immune system over an extended period of time. Free oxygen radicals can be produced as a result of an ongoing, chronic infection that is also allergic to things.[6] Prophylaxis is still another idea. Before malignant alterations may take place, physical impacts of the allergic reactions in the specific tissues might eliminate mutagenic causes. The possibility of incorrect T-helper 2 immunological skewing was also highlighted by a recent hypothesis.[7]

Despite numerous investigations, it has not been possible to definitively determine whether hypothesis is more valid. The literature is largely comprised of retrospective epidemiological observations.[8] Only the histories of the self-reported allergy and the cancer risk factors have been examined in the majority of prospective research.[9] On the basis of the results of the diagnosis of allergy (such as, the measurements of total IgE and the skin prick tests), only a small number of research have estimated allergies in cancer patients.[10]

To test one of the aforementioned theories, the prevalence of the allergies on the basis of documentation of the retrospective allergy diagnosis in the patients of cancer and comparisons with a normal population were investigated.

METHODS

Patients

Eight oncological outpatient clinics in Pakistan were used to source patients. Each site's patient datasets were examined. The total of the 9800 records of medical are pre-screened, and the 3200 individuals experience the confirmed diagnosis of the lung, breast, skin, or colon cancer were chosen at random from this group. The study of the sampled population was intended to be the representative of most prevalent malignancies in Pakistan in 2022 with regard to usual age and sex. Only 1856 of these patients must meet the following additional inclusion requirements: they must be over 35 and have completed the basic oncological treatment (such as radiation, chemotherapy, and the surgery) at least a year before the research. From this set of patients, 87 were omitted for not having consent, and 244 are excluded owing to the lack of the thorough documentation.

The 1525 patients between the ages of 35 and 80 were examined, including 754 women and 771 males. This group includes 199 skin cancer patients, 231 breast cancer patients, 247 lung cancer patients, and 211 colon cancer patients. The average length of the cancer sickness was 4.3 2.9 years, and the average period following the start of the basic treatment is 2.7 to 1.8 years. Clinical signs, imaging tests (such as the X-ray, MRI, CT, PET, USG, and endoscopy), serum measures, biopsies, ICD-10 code, and the cancer markers were previously used to identify all types of cancer.

Control group

The control group with the similar sex and age distribution to group of study was created by screening 10,200 records of medical from the GP database in the similar region of the Pakistan. To preserve comparable ratios to those found in group study, the control group were randomly selected. 3100 participants in total were chosen at random. Age over 35 and no cancer diagnosis or clinical suspicion were the prerequisites for inclusion in the control group.

The 1689 subjects are pre-enrolled in the total. The similar criteria of exclusion used in study group were used here: 42 cases of patient refusal and 103 cases

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of inadequately detailed data. 1544 patients were examined in total. Aged 35 to 82, the cohort included 754 women and 790 men. Table 1 provides the population statistics.

Table 1 Features of control group and study population

Features	Control group	Study group
	n = 1544	n = 1525
Mean age in years	50.5 ± 12.4	52.7 ± 11.9
Higher education	450 (29.1)	368 (24.1)
Percentage of the women	48.8	49.4
Living in the rural area	471 (30.5)	412 (27.1)
Smoking-past or current (%)	689 (44.6)	1115 (73.1)

Allergy data

Alternaria tennis, Aspergillus fumigatus, Cladosporium herbarum, cat, dog, grass mix, alder, birch, mugwort, and hazel were among the allergens that were examined for the total concentration of serum IgE and the specific concentration of the IgE. Positive IgE levels are defined as those above 0.35 kU/l.

Analyses of the skin prick tests were conducted against the aforementioned inhalant allergens. The tests are assessed in accordance with previously released standards.[11] Based on the following medical data, allergic rhinitis was determined to exist: laryngological exams and the clinical symptoms history in accordance with the ARIA recommendations.[12] Documentation of clinical symptoms in accordance with GINA recommendations, data of spirometry, or/and the positive results from the reversibility tests or the positive results of the methacholine tests according with the criteria of the ERS and ATS were used to confirm bronchial asthma.[13] Dermatological investigations and the Hanifin and Rajka criteria were used to diagnose atopic dermatitis.[14]

Statistical analysis

Each result is shown as the mean with standard deviation or as a percentage. The Kruskal-Wallis's test was used to evaluate group differences. The odds ratio indicating the likelihood of an illness was determined. For all analyses, a result of $p < 0.05$ was deemed significantly. Analysis is performed with Statistical data 8.1.

RESULTS

The probability of IgE-mediated allergy disorders was marginally, but significantly, lower in the patients having the types of cancer examined than in the control group. In patients with the investigated kinds of cancer, odds ratio of the manifestation of clinical of the allergy (including allergic rhinitis, atopic dermatitis, conjunctivitis, and the bronchial asthma) is 0.76 (95 percent confidence level 0.63 to 0.84) as compared to the patients of the non-cancer. Depending on the type of allergy condition, the risk varied. The odds ratios for the allergic rhinitis, bronchial asthma, and atopic dermatitis respectively, are 0.67 (95 percent confidence interval 0.52 to 0.81), 0.89 (95 percent confidence interval 0.78 to 0.99), and the 1.03 (95 percent confidence interval 0.91 to 1.13) for each type of allergy. With the exception of breast cancer, where the prevalence of all allergy disorders was similar as for controls, this tendency was regardless of the type of cancer that was being studied. The Figure 1 and the Table 2 provide the details. Existence of the allergy illness in patients of cancer. Atopic dermatitis, sporadic allergic rhinitis, and chronic allergic rhinitis (ANN, SAR, and AD, respectively) where the $*p < 0.05$.

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Figure.1

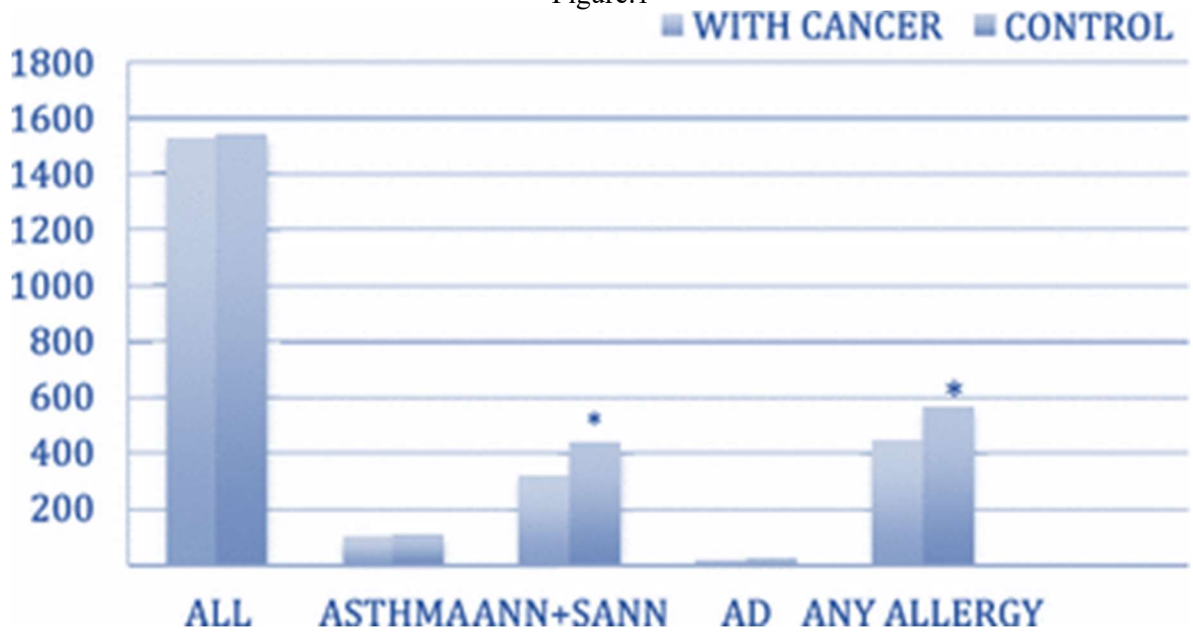

Table 2 Patients' percentage with the allergic diseases amongst the control and in cancer group

Type of disease	Control group n = 1544 (%)	Patients with cancer n = 1525 (%)	p
Bronchial asthma	6.1	5.9	NS
		4.7a	
		6.6b	
		7.9c	
		4.9d	
ANN + SANN	27.3	18.9	0.02
		15.4a	
		19.4b	
		23.9c	
		18.4d	
AD	2.3	1.9	NS
		2.4a	
		2.8b	
		1.7c	
		0.9d	
Any allergy	31.2	24.1	0.01
		19.1a	
		23.4b	
		28.9c	
		28.1d	

Dr. Zunaira Qayyum
Consultant Pathologist, Mohtarma Benazir Bhutto Shaheed Medical College/ Divisional Headquarters Teaching Hospital Mirpur Azad Kashmir

The examined allergy patients' allergen profiles did not significantly differ between control and cancer groups. Moreover, allergies to the D. pteronyssinus (38.5 percent of the study population having cancer verses 34.2 percent), the grass pollen (24.9 verses 22.1 percent) and the D. farinae (31.4 verses 30.4 percent) predominated in both groups.

An inverse connection with the incidence of cancer was found, and the mean concentration of serum of IgE was considerably lowers in population in the study than in control group (45.98 14.9 verses 83.2 40.1 IU/l where the $p < 0.05$). The analysis of specific to allergen IgEs in the patients of allergies produced good results that are comparable between control and study groups. The IgEs to the D. pteronyssinus, grass pollen, and D. farinae, predominated in the both groups, according to the results of skin testing.

Cancer, allergy and socioeconomic factors

Cancer diagnosis was associated with the lower socio-economic position (low education, financial difficulties, alcohol, and smoking usage). Allergies and high educational levels have been connected. For lung and colon cancer, identical SEP tendencies were seen ($p < 0.05$); however, smoking was the only factor associated with breast and skin cancer ($p < 0.05$). All cancer types had favourable relationships between patient age and diagnosis ($p < 0.05$). Table 3 shows the impact of the socio-economic factors on incidence of the cancer, allergies, or the combination of the both.

Table 3 Socioeconomic factors related with the diagnosis of cancer, allergy and also their combination— comparison of odds ratio to control patients without the diagnosis of the allergy and/or cancer

SEP	OR (95 % CI)		
	Cancer	Allergy	Cancer and allergy
	n = 1525	n = 921	n = 343
Education			
Low	*1.75 (0.89–1.32)*	0.99 (0.76–1.31)	1.17 (0.98–1.54)
Middle/high	1.23 (0.97–1.76)	*1.87 (0.66–2.03)*	1.34 (1.04–1.83)
Alcohol			
Never	1.37 (0.92–1.77)	0.93 (0.56–1.20)	0.73 (0.34–1.06)
Occasionally	1.28 (0.88–1.96)	1.14 (0.85–1.79)	1.06 (0.78–1.37)
Frequently	*1.94 (1.03–2.43)*	1.09 (0.78–1.53)	1.13 (0.67–1.54)
Smoking			
Never	0.76 (0.32–1.09)	1.06 (0.56–1.34)	0.81 (0.55–1.21)
Past	*1.97 (1.32–3.01)*	1.01 (0.49–1.46)	*1.64 (1.12–2.09)*
Current	*2.09 (1.78–3.54)*	1.27 (0.99–1.96)	*1.97 (1.88–2.87)*
Financial problems			
Yes	*1.66 (1.10–2.13)*	1.31 (0.84–1.81)	1.27 (0.97–1.66)
No	1.41 (1.22–1.73)	1.09 (0.82–1.65)	1.15 (0.69–1.41)
BMI			
<30 kg/m2	1.21 (0.78–1.79)	1.13 (0.55–1.63)	1.22 (0.87–1.45)
≥30 kg/m2	1.39 (0.89–1.87)	1.05 (0.67–1.32)	1.01 (0.67–1.33)
Sex			
Women	1.11 (0.71–1.38)	1.41 (1.21–1.58)	1.18 (0.82–1.88)
Men	1.28 (0.71–1.94)	*2.08 (1.88–2.73)*	1.41 (0.68–1.91)

Dr. Zunaira Qayyum
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DISCUSSION

The findings are consistent with the premise that there is a general inverse relationship between cancer diagnoses and an increased risk of allergies. This relationship, though, seems to be intricate. Cancer diagnoses had an adverse relationship with blood total IgE levels. The positive results for the inhalant specific to allergen IgEs did not, however, correlate with the overall risk of malignancy. Likewise, connection between serum IgE & the presence of cancer has been supported by cohort studies. These trials, however, looked at groups with slightly different characteristics, namely individuals without a prior cancer diagnosis and those who simply self-reported having allergies.[15] Cohorts undoubtedly offer more pertinent insights, but case control studies' smaller study populations enable them to analyse more data, such as the outcomes of diagnostic tests, than cohort studies do.[16] Due to the examined patients' varied lifestyles, which have an impact on the occurrence of allergies and malignancies, the current study was unique in the region European.

A study confirmed that IgE has a protective function in the fight against carcinogenesis.[17] On the other hand, on the basis of a study of the cancer and atopy prevalence in the almost 15 thousand individuals, Skaaby et al. did not support this notion.[18] Atopy has also been linked to the low risk of the dying from the cancer of breast, but did not from other types of cancer, according to a study. This study brought attention to the fact that there isn't a clear connection between atopy and the likelihood of developing neoplasms or other chronic disorders.[19] These findings provide more evidence of the complexity of this interaction. We verified that patients with breast, colon, lung, or skin cancer diagnoses had considerably lower rates of sporadic or chronic allergic rhinitis. Atopic dermatitis and asthma did not have any common trends. It is well recognised that different malignancies may display various relationships with atopic illness. Regarding the prevalence of allergic rhinitis, certain research has shown that there is rise in the rhinitis' allergic in the patients having the lung cancer but no relationship with haematological malignancies.[20] A study did note comparable decrease in incidence of the intermittent allergic rhinitis in colorectal cancer possessing patients, though, as was discovered in the current study.

The collected data show no conclusive link between the incidence of atopic dermatitis and any of the examined cancer types. However, several researches have corroborated atopic dermatitis patients' decreased or increased risk of the non-melanoma and melanoma cancer.[21] Despite having higher IgE levels than the allergic rhinitis, atopic dermatitis had the non-allergic connections and is a more heterogenous illness. Eczema was discovered to be less common in cancer patients in the case-controlled study having 3300 cancer diagnoses in the males Canadian. A few other studies supported these findings, but they tended to concentrate on just one type of cancer, like gliomas.[22] Unfortunately, the current study did not evaluate these cancer forms.

In relation to cancer, bronchial asthma is frequently seen as a disease. In comparison to patients in group of control, the population of patients having lung cancer didn't had higher incidence of the asthma. But according to a few research asthma is either positively or adversely linked with the occurrence of cancer.[23] Most research on this connection have only examined one form of cancer and have involved small numbers of participants. The findings presented here did not investigate whether a particular form of inhalation allergy would be more or less likely to cause cancer. IgE overproduction, however, can signify an undetermined link. The final OR for the asthma in study subjects may have been impacted by the potential misclassification of the COPD or the overlap syndrome (asthma and COPD) during the data processing.

The analysis of socioeconomic (SEP) characteristics again supported past findings that cancer patients have the lower SEP, and presence of the allergies didn't change pattern in the study. According to findings from the recent study on the population of Danish, male sex and higher education were associated with presence of the atopic disease.[16] Our findings did not support associations between atopy and drinking, smoking, or a high body mass index. These variations may be explained by the unusual makeup and lower size of examined study group having the allergies (less than 35 years old).

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Unfortunately, the age constraints in place prevent a proper evaluation of the correlation between atopy and age. As a result of their higher predisposition for cancer, the cancer patients in this study had a much larger percentage of the current or the former smokers than control group. This conclusion has been validated numerous times.[21,22]

The small sample size and analysis of only a few different cancer types in this study were limitations. Due to the exclusion of individuals receiving cancer therapy, the total number of patients studied was also significantly decreased. However, as IgE was only measured once, this probably led to more accurate allergy diagnostic results. Because of the immunosuppressive effect of oncological therapy, we were concerned that quantities of specific and total IgE in serum's patient would be underestimated. However, this influence cannot be fully ruled out. In these patients, no correlation between the oncological and IgE therapy were found.

The evaluation of the allergies in the individuals who have been diagnosed with cancer is challenging and influenced by a variety of variables. The primary ailment, in this case cancer, is often the focus of both patients and medical professionals. Because of additional clinical signs, the diagnosis of allergy was thus missed in some of the individuals examined.

In addition, we looked carefully at the most common malignancies in the nation in addition to skin cancers. As documented in the literature, skin malignancies were frequently observed to co-occur with atopic dermatitis, therefore we decided to include them in our analysis. Weak, inverse, proportional dependence was found by our research.[16,20]

It was impossible to rule out the possibility that oncologic treatments like chemotherapy and radiation therapy influenced the outcomes of allergy tests (such as false negatives). Due to the relative rarity of IgE-mediated food allergies in adults, no analyses were performed. The treatment groups were excluded from the final analysis due to the lower number of the results of skin-prick test to be positive and specific to allergen IgEs to the foods. Lastly, although distributions of sex and age were alike across the 2 groups, the research patients were collected from outpatient oncology clinics, whereas control group was attained from the GP locations. This variation in the source might be a significant confounder (lack of the uniform data, the richer medical documentation due to the greater attention to the cancer patients).

CONCLUSION

The observed correlation might point to the link between the IgE-mediated allergies and a decreased incidence of specific malignancies. Patients in the oncological trial had a low prevalence of allergic rhinitis, in particular. Our findings need to be confirmed by further research. In addition, compared to people with allergies, cancer patients typically have a worse socioeconomic background.

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Dr. Zunaira Qayyum
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