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FREQUENCY OF MENINGOENCEPHALITIS IN CANCER PATIENTS

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Abstract

Objective: *To determine the frequency of meningoencephalitis in cancer patients*

Study Design: *Cross sectional study*

Study p1ace and period: *Department of Medicine, Shaukat Khanum Memorial Cancer Hospital & Research Center Lahore from 04 May 2025 till 04 August 2025.*

Methodology: *One hundred and sixty five patients were included from OPD and underwent plain MRI brain. Findings were recorded and if there was presence of leptomeningeal enhancement, along with distension of the subarachnoid space with widening of interhemispheric fissure, then meningoencephalitis was labeled. All data will be recorded in Performa and analyzed via SPSS.*

Results: *The mean age of cancer patients was 43.55 ± 14.59 years. There were about 86 (52.1%) male patients and 79 (47.9%) female patients. Mostly patients present during stage II and III [76 (46.1%) each], while 13 (7.9%) patients were diagnosed with cancer at stage I. Out of 165 patients, 45 (27.3%) were receiving chemotherapy, 49 (29.7%) were receiving radiotherapy and 71 (43.0%) were receiving combination of both. Out of 165 patients, 25 (15.15%) were diagnosed to have meningoencephalitis. It is significantly associated with age and type of cancer ($p<0.05$).*

Conclusion: *The frequency of meningoencephalitis is detected in significant number of cases and is associated with worsening of condition of cancer patient.*

INTRODUCTION

Numerous factors, such as local tumor effects, complicated cancer treatments, disruption of physical barriers, neutropenia, humoral and/or cellular malfunction, asplenia, and the presence of external devices, make cancer patients susceptible to infection.[1] It is important to understand that cancer patients may have various immunological abnormalities at the same time, as this can impact treatment and diagnosis decisions.[2, 3]

Despite the development of efficient preventative measures and improved antibiotics for active infection, central nervous system infections continue to be a major cause of morbidity and mortality among cancer patients.

Longer survival has been attained along with a shift in the spectrum of infections in an increasing number of vulnerable populations due to the introduction of more intensive immunosuppressive regimens over the past 20 years, including solid organ and hematopoietic cell transplantation, novel biologic response modifiers, and improved hematopoietic growth factor support of chemotherapy.[4, 5]

Meningoencephalitis is an infectious neurological emergency that is simply defined as inflammation of the meninges and brain. A patient's fever, altered sensorium, and seizures should raise the clinical suspicion of meningoencephalitis, and a CSF fluid investigation should be performed as soon as possible to confirm the diagnosis.[6, 7] To avoid long-term neurological consequences, acute meningoencephalitis must be diagnosed quickly and treated with antibiotics or antiviral medication. Making an appropriate decision is aided by a comprehensive history, examination, laboratory work, and neuroimaging.[8, 9] According to one study, 12% of cancer patients had meningoencephalitis.[10]

Rationale of this study was to determine the frequency of meningoencephalitis in cancer patients. Cancer patients are at high risk of adopting infections that can lead to hazardous consequences, especially brain infections. Literature showed that the risk of meningoencephalitis is not so high, however in routine, meningoencephalitis is commonly noticed but evidence lacks for local population. Therefore, it's important to confirm the extent of problem in cancer patient belong to local community. In order to decrease the risk of infections and improve the survival of patients, improved diagnostic and preventive plans would be adopted in future. This would help us to improve our practice and learn more effectively, and we would apply what we learn locally in the future.

METHODOLOGY:

After approval from ethical review board (ERB letter number with date), this cross-sectiona1 study was conducted at the Department of Medicine, Shaukat Khanum Memorial Cancer Hospital & Research Center Lahore from 04 May 2025 till 04 August 2025. By using WHO calculator, sample size of 165 cases is calculated with 95% confidence level, 5% margin of error and percentage of meningoencephalitis i.e. 12% in cancer patients.[10] Non-probability, consecutive samp1ing technique was applied to enroll the cancer patients in the study.

Inclusion Criteria: Patients of age 16-65 years, both genders, diagnosed with cancer receiving chemo- / radio- or receiving combination therapy for at least 1 month were recruited for the study.

Exclusion Criteria: Patients with history of CNS malignancy or had head surgery or with metastatic disease were not enrolled for the study sample.

Patients were recruited from outpatients department. Demographic details including name, age, gender, BMI, duration of cancer, type of cancer, stage of cancer, history of smoking (>5 pack years), alcoholism (>20 ml/day), diabetes (HbA1c>6.5%), hypertension (BP≥140/90mmHg), type of therapy receiving (chemotherapy or radiotherapy or combination) were noted. The patients then had a simple brain MRI. T1-weighted, T2-weighted, susceptibility-weighted, FLAIR, ADC, and DWI imaging sequences were noted using 1.5 Tesla MRI machines. Findings were recorded and if there was presence of leptomeningeal enhancement, along with distension of the subarachnoid space with widening of interhemispheric fissure, then meningoencephalitis was labeled. Patients with meningoencephalitis were managed as per standard hospital guidelines. All data was recorded in Performa.

SPSS v.25 was used to enter and analyze the data. For quantitative variables like age, BMI, duration of cancer, mean and standard deviation were calculated. For qualitative variable like gender, BMI, duration of cancer, type of cancer, stage of cancer, history of smoking, alcoholism, diabetes, hypertension, type of therapy receiving and meningoencephalitis were presented as frequency and percentage. Data was stratified for age, gender, BMI, duration of cancer, type of cancer, stage of cancer, history of smoking, alcoholism, diabetes, hypertension, duration

and type of therapy receiving. Chi-square test was applied to compare the frequency of meningoencephalitis in stratified groups. P-value≤0.05 was considered as significant.

RESULTS:

In this study, we enrolled total 165 cancer patients with mean age of 43.55 ± 14.59 years. Most of the patients fell in age above 40 years (60%). There were about 86 (52.1%) male patients and 79 (47.9%) female patients. The mean BMI was noted as 22.92 ± 4.26 kg/m^2. Among them, 33 (20%) were underweight, while 78 (47.3%) non-obese / normal BMI and 54 (32.7%) were obese. The mean duration of cancer and receiving treatment was 2.85 ± 1.42 years. There were 74 (44.8%) patients were receiving treatment from <3 years while 91 (55.2%) were receiving treatment for ≥3 years. Out of 165 patients, there were 40 (24.2%) smokers and mostly males, 8 (4.8%) had history of consuming alcohol, 74 (44.8%) were diabetic, 78 (47.3%) had hypertension and 122 (73.9%) had anemia. The most common type of cancer observed was colorectal cancer [26 (15.8%)], followed by breast cancer [25 (15.2%)] and prostate cancer [23 (13.9%)]. Details of other type of cancers is given in table below. Mostly patients present during stage II and III [76 (46.1%) each], while 13 (7.9%) patients were diagnosed with cancer at stage I. Out of 165 patients, 45 (27.3%) were receiving chemotherapy, 49 (29.7%) were receiving radiotherapy and 71 (43.0%) were receiving combination of both. Table-I

Table-I: Demographics and clinical profile of cancer patients (n = 165)

	Mean
Age, years	43.55 ± 14.59
16-40	66 (40%)
41-65	99 (60%)
Gender	
Male	86 (52.1%)
Female	79 (47.9%)
BMI, kg/m^2	22.92 ± 4.26
Underweight	33 (20%)
Non-obese	78 (47.3%)
Obese	54 (32.7%)
Duration of cancer, years	2.85 ± 1.42
<3 years	74 (44.8%)
≥3 years	91 (55.2%)
History of	
Smoking	40 (24.2%)
Alcoholism	8 (4.8%)
Diabetes	74 (44.8%)
Hypertension	78 (47.3%)
Anemia	122 (73.9%)
Type of cancer	
Breast	25 (15.2%)
Prostate	23 (13.9%)

Lung	20 (12.1%)
Hematological	17 (10.3%)
Colorectal	26 (15.8%)
Oral & Head and neck	16 (9.7%)
Hepatic	17 (10.3%)
Pancreatic	15 (9.1%)
Others	6 (3.6%)
Stage of cancer	
I	13 (7.9%)
II	76 (46.1%)
III	76 (46.1%)
Therapy receiving	
Chemotherapy	45 (27.3%)
Radiotherapy	49 (29.7%)
Combination therapy	71 (43.0%)

Out of 165 patients, 25 (15.15%) were diagnosed to have meningoencephalitis. Figure-1

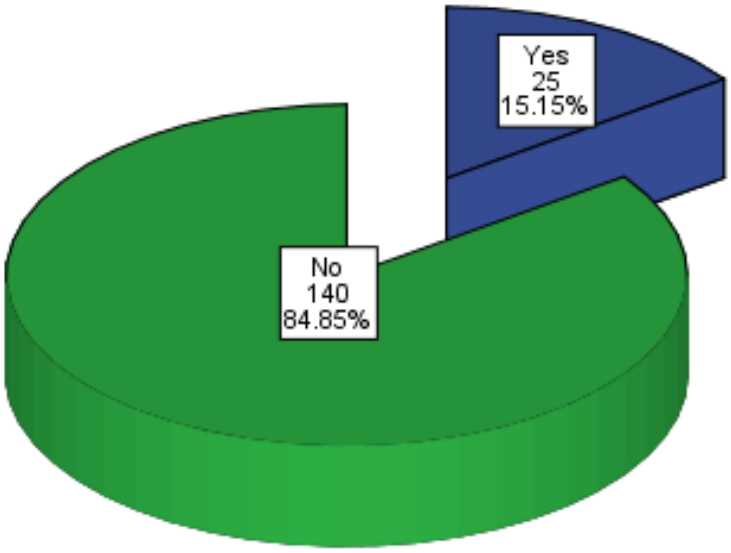

Figure-1: Meningoencephalitis

It has been observed that in patients with advanced age, the frequency of meningoencephalitis was significantly higher than young patients (21.2% vs. 6.1%, $p<0.05$), respectively. Among male patients, the meningoencephalitis was observed in 15 (17.4%) cases while 10 (12.7%) in female patients. Although the difference was insignificant ($p>0.05$). Similarly, BMI, duration of therapy, smoking, alcoholism, diabetes, hypertension and anemia had no association with meningoencephalitis. However, frequency of meningoencephalitis is higher among smokers, alcoholic, diabetics, hypertensive, and anemic patients ($p>0.05$). Among patients with oral and head & neck cancer, frequency of meningoencephalitis is highest (50%), followed by hepatic cancer (23.5%) and colorectal cancer (15.4%, $p<0.05$). Meningoencephalitis is also observed to be more common in patients of stage I (38.5%), followed by stage III (15.8%) and stage II (10.5%, $p<0.05$). Among patients

receiving chemotherapy, meningoencephalitis was detected in 6 (13.3%) cases, while in 10 (20.4%) receiving radiotherapy and in 9 (12.7%) patients receiving combination of both. (p>0.05). Table-II

Table-II: Association of meningoencephalitis with age, gender, BMI and different clinical parameters of cancer patients (n = 165)

		Meningoencephalitis		p-value
		Yes n = 25	No n = 140	
Age, years	16-40	4 (6.1%)	62 (93.9%)	0.008!
	41-65	21 (21.2%)	78 (78.8%)	
Gender	Male	15 (17.4%)	71 (82.6%)	0.392*
	Female	10 (12.7%)	69 (87.3%)	
BMI	Underweight	5 (15.2%)	28 (84.8%)	0.922*
	Non-obese	11 (14.1%)	67 (85.9%)	
	Obese	9 (16.7%)	45 (83.3%)	
Duration of cancer / therapy	<3 years	11 (14.9%)	63 (85.1%)	0.926*
	≥3 years	14 (15.4%)	77 (84.6%)	
History of smoking	Smoker	5 (12.5%)	35 (87.5%)	0.591*
	Non-smoker	20 (16.0%)	105 (84.0%)	
History of alcoholism	Alcoholic	2 (25.0%)	6 (75.0%)	0.348!
	Non-alcoholic	23 (14.6%)	134 (85.4%)	
History of diabetes	Diabetic	10 (13.5%)	64 (86.5%)	0.597*
	Non-diabetic	15 (16.5%)	76 (83.5%)	
History of hypertension	Hypertensive	9 (11.5%)	69 (88.5%)	0.220*
	Non-hypertensive	16 (18.4%)	71 (81.6%)	
History of anemia	Anemic	18 (14.8%)	104 (85.2%)	0.810*
	Non-anemic	7 (16.3%)	36 (83.7%)	
Type of cancer	Breast	2 (8.0%)	23 (92.0%)	0.004*
	Prostate	4 (17.4%)	19 (82.6%)	
	Lung	2 (10.0%)	18 (90.0%)	
	Hematological	1 (5.9%)	16 (94.1%)	
	Colorectal	4 (15.4%)	22 (84.6%)	
	Oral and head & Neck	8 (50.0%)	8 (50.0%)	
	Hepatic	4 (23.5%)	13 (76.5%)	
	Pancreatic	0 (0.0%)	15 (100%)	
	Others	0 (0.0%)	6 (100%)	
Stage of cancer	I	5 (38.5%)	8 (61.5%)	0.034*
	II	8 (10.5%)	68 (89.5%)	
	III	12 (15.8%)	64 (84.2%)	
Therapy receiving	Chemotherapy	6 (13.3%)	39 (86.7%)	0.471*
	Radiotherapy	10 (20.4%)	39 (79.6%)	
	Combination therapy	9 (12.7%)	62 (87.3%)	

Note: * = Chi-square test; ! = Fischer Exact test

DISCUSSION:

In our study, we observed that out of 165 patients, 25 (15.15%) were diagnosed to have meningoencephalitis. Costerus et al., conducted a study in 2016 and found that percentage of meningoencephalitis was 12% in cancer patients. In comparison to the general population, cancer patients had an annual incidence of bacterial meningitis that was 2.71 times higher in 2010 and 3.52 times higher in 2013. Listeria monocytogenes (21%) and Streptococcus pneumoniae (63%) were the most prevalent bacterial meningitis pathogens in cancer patients.[10]

High rates of morbidity and mortality are linked to CNS infections. Timely diagnosis and appropriate treatment are critical to the result. Patients with impaired immune systems are more susceptible to CNS infections, which can manifest abnormally in this group and be brought on by rare or opportunistic microorganisms.[11, 12] Additionally, in immunocompromised patients, non-infectious diseases such as CNS symptoms of the underlying cancer may mimic CNS illnesses. For epidemiological monitoring, clinical research, and outbreak investigations, a uniform case definition for several suspected CNS infections (such as encephalitis, encephalopathy, and myelitis) is crucial.[13, 14]

In a recent case study, Sun et al. described a patient who had invasive ductal carcinoma-related encephalitis. But in an investigation by Sun et al., the neurological problems appeared after the tumor was removed.[15] On the other hand, in our situation, neurological symptoms started to manifest before the diagnosis was made. In patients with hematological malignancies, the diagnostic use of MRI for meningoencephalitis is particularly restricted. Leptomeningeal involvement from solid tumors was more accurately identified by MRI than from leukemia or lymphoma. The tumor subtype determines the PPV to identify malignant meningitis.[16, 17]

It has been amply proven that brain MRI is helpful in the diagnostic workup of patients with infectious encephalitis.[18] Based on the main signal abnormalities in the mesial temporal lobes, inferior frontal lobes, and insula in nearly all affected individuals, it is especially useful in making an early diagnosis in patients with HSV encephalitis.[19, 20] On the other hand, only 9–33% of TBE patients have been reported to have aberrant MRI findings, but 58% of the most severely affected individuals with a meningoencephaloradiculitic course of disease had them. The most commonly affected areas include the cerebellum, anterior horns of the spinal cord, thalamus, and basal ganglia.[21, 22]

CONCLUSION:

The frequency of meningoencephalitis is detected in significant number of cases and is associated with worsening of condition of cancer patient. This indicates that cancer patients was more prone to infectious diseases and infectious disease of central nervous system can lead to more hazardous consequences. Now, in order to decrease the risk of infections and improve the survival of patients, improved diagnostic and preventive plans would be adopted in future.

CONFLICT OF INTEREST:

None.

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