An epidemiological survey in cancer hospital setup of Eastern Uttar Pradesh Region, India: A cross sectional study

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ABSTRACT:

Cancer is one of the leading causes of adult deaths worldwide. The Eastern Uttar Pradesh region of India lies on the Indo-Gangetic plain and together with western Bihar is the most-densely-populated area in the world. There is scarcity of data on epidemiological profile of cancer patients of this region. The objective of present study was to do an epidemiological survey in cancer hospital setup of this region. Data were collected from the Hospital Cancer Registry of Hanumaan Prasad Poddar Cancer Hospital and Research Institute, Gorakhpur. Results were expressed in the form of percentages and proportions. We have found that 750 cancer cases were registered during the study period (November 2018 to January 2019). Out of which, 404 cases were proven to having cancer of different sites. Oral cancer is on first position followed by bladder, cervix, and breast cancer respectively. As with the previous studies chewing tobacco is primary cause of most oral cancers. Additional research is needed to access the impact of diverse locality, food habit, religious practice, and lifestyle, on growth and prevention of different cancers.

Key-words: Epidemiological, Cancer registry, Lifestyle, Population, Tobacco

INTRODUCTION:

India is a developing country with one of the most diverse populations and diets in the world. In India, cancer rates are lower than those seen in Western Countries, but are rising with increasing migration of rural population to the cities, increase in life expectancy and changes in life styles. In spite of good advancements for diagnosis and treatment, cancer is still a big threat to our society (Kotnis et al., 2005). This is the second most common disease after cardiovascular disorders for maximum deaths in the world (Jemal et al., 2007). According to National Cancer Registry Program of the Indian Council of Medical Research (ICMR), India has recorded an estimated 3.9 million cancer cases in 2016. In this report the worst affected states are Uttar Pradesh with 674,386 cases, followed by Maharashtra with 364,997 and Bihar with 359,228 cases of cancer. It has been reported that incidence of cancer cases gradually increased in Uttar Pradesh (D'Souza et al., 2013)**.** Most of its populations reside in rural areas. In Indian population, all types of cancers including the cancers of skin, lungs, breast, rectum, stomach, prostate, liver, cervix, oesophagus, bladder, blood, mouth, etc. have been reported (Ali et al., 2011).

The causes of such high incidence rate of cancers may be internal (genetic, mutations, hormonal, poor immune conditions), external or environmental (food habits, industrialization, over growth of population, social etc.) factors. It is estimated that about 90% cancer is due to the environmental pollutants (Anandet al., 2008). Environmental Protection Agency (EPA) discovered that environmental pollutants are as much as five times more prevalent in indoors as compared to outdoors. It means inside the house also we are not safe to develop cancer.

Carcinogenesis is a multistage, multistep process which involves mutation and the subsequent selective clonal expansion of the mutated cell. The exact reasons for the development of cancer are still unknown. Cancer can affect all the living cells in the body at all ages and both genders are affected. Cancer patterns vary not only throughout the world but also between different population groups within the same country (Bal et al., 2015). Half of the newly diagnosed cases of cancer are from the developing countries. It is estimated that by the year 2020, over 10 million people worldwide would die of due to cancer every year and 70% of these would be from the developing countries (WHO, 1993). Study of the magnitude and pattern of cancer is the first step in determining clues to the cause(s) of cancer and in having a baseline to plan and assess control

measures. Epidemiological studies help in knowing what is happening and what can be done about it. In India, though infectious diseases continue to be a public health problem but an increase in the occurrence of non-communicable diseases has been noted particularly in urban areas and in economically advanced states (Murray and Lopez, 1996).

Rapid industrialization, urbanization and migration of population are responsible for crowed in Eastern Uttar Pradesh Region. Many epidemiological studies on the cancer have been done in the different parts of India, but no single studies were carried out in Eastern Uttar Pradesh region. A retrospective analysis of cancer patients has been done by Nandi and others in 2013. There is an essential need to collect information such as site, status, and age for cancer development for the comprehensive and effective cancer management policy. In the present study we have tried to unravel the above mentioned lacuna. Present study was planned to find out the types of cancer, the role of diet, addictions, body mass index, and age in onset of different types of cancer.

SUBJECTS AND METHODS:

The present cross-sectional study was carried out in registered cancer patients of Hanumaan Prasad Poddar Cancer Hospital and Research Institute, Gorakhpur, Uttar Pradesh, India. The study was carried out during the period of Nov 2018-Jan 2019. All the cases were reported to the outpatient department for the registration and treatment. Only histologically confirmed cases of cancer was included in the study. 750 patients were reported during the study period. Out of which, 404 cases were proven to having cancer of different types. Data were collected from the patients in the form of questionnaire. The questionnaire was piloted and modified as necessary and all its components were self-administered. It included the questions related to the age, marital status, and permanent residence, use of tobacco, consumption of alcohol, health status, and consumption of vegetarian/non vegetarian food. It was ensured that all questions were valid, non-ambiguous, and fair. This study was approved by the Institutional Ethics Committee, Hanumaan Prasad Poddar Cancer Hospital and Research Institute, Gorakhpur.

STATISTICAL ANALYSIS:

Statistical analysis part was done in Department of Biotechnology, Deen Dayal Upadhyay Gorakhpur University, Gorakhpur, and results were expressed in the form of percentages and proportions.

RESULTS:

Cancer patients included for the present study were subjected to analysis regarding their geographical distribution. It categorizes according to the districts of Eastern Uttar Pradesh region. The cancer patients belong to the following 14 district, i.e., Gorakhpur, Deoria, Kushinagar, Maharajganj, Siddarthnagar, Santkabir Nagar, Mau, Basti, Azamgarh, Gonda, Balia, Balrampur and the neighbhouring state Bihar. Among 404 patients 35.4% belongs to Gorakhpur district itself (both urban and rural). 13.4% from Kushinagar, 9.9% from Maharajganj and 8.2% are from nearby state Bihar. Less than 1% patients belong to Gonda, Azamgarh, Faizabad, and Baharaich district (Table 1).

20 different types of cancer were reported among the 404 cancer patients under study. 18.1% patients have mouth cancer, out of which the male patients are five times higher as compared to the female patients. About 17.8% patients have GB cancer and female's have two times more frequency as compared to the males. About 17.6% and 12% female patients develop cervix and breast cancer respectively. Blood cancer, lung cancer and intestine cancer constitute 6.2%, 5.4% and 5.2% respectively and frequency in male patients is thrice as compared to female patients. 17.7% cancer cases belong to eye, digestive system, excretory system, ear, prostate, skin and thyroid gland (Table 2).

In present study we have observed that most susceptible age for cancer occurrence is 41-60 years with 47.5% cases of cancer within these years. Less than 2% cancer cases occur in either early stage, i.e., <10 years or in late older age, i.e., 81-90 years (Table 3).

We have got the addiction profile of only 343 patients. Remaining patients have not provided their addiction habits. 49% patients are not witnessing any type of smoking addiction like cigarette, bidi or hukka. They are also not taking alcohol or taadi or any other type of beverages. These patients do not have chewing habit like tobacco/gutkha/zarda etc. Tobacco, alcohol and

bidi are taken by 25%, 14% and 10% patients respectively. 2% patients have cigarette smoking habit and 1% patients take ganja as a smoking habit (Table 4).

354 patients have provided their diet pattern. 153 patients are male and from them 85% are taking non-vegetarian diet. 201 patients are female of which 77% females are taking non vegetarian diet (Table 5). The habit of taking non-vegetarian diet is more in both male and female cancer patients.

Of the total 404 registered patients, 182 are male and 222 are female. Among the total patients, we have got the value of weight and height of 269 patients (124 males and 145 females) and calculated the Body Mass Index (BMI) of these cancer Patients. Remaining patients have not provided either the value of height or weight; therefore, BMI could not be calculated. 54% patients have BMI within 18.5-24.9 kg/m^{2}means they are healthy. About 28% patients are suffering from malnutrition and have BMI less than 18.5 kg/m^2. However only 19% patients have BMI greater than 24.9 kg/m^2 means they are in the category of obesity (Table 5).

DISCUSSION:

The epidemiology of a disease is an integral part of its basic description. A key feature of it is the measurement of disease outcomes in relation to population at risk and help to take decisions for benefit of community. Gorakhpur is a big city of Eastern Uttar Pradesh region having more than 12 lakh population. According to convenience cancer patients of this city mostly visit Hanumaan Prasad Poddar Cancer Hospital and Research centre for their treatment, which is a charity, funded Cancer Hospital in Gorakhpur district. Cancer patients from nearby district may visit BHU, Varanasi or KGMU, Lucknow for the treatment. The distance of Maharajganj district from Gorakhpur district is only 55Km and is on way of Lucknow. It can be the possible reason that most of the patients belong to Gorakhpur and Maharajganj district. In the present study we have found that patients of Eastern Uttar Pradesh regions are affected by 20 different types of cancer and the reason can be demographical, environmental or genetic. Other researchers have reported that the type of cancer varies between different populations, and every type is rare in some part of the world. Many specific causes are now known (to explain these differences), but a large proportion of global variation for common cancers remains unexplained (Bal et al., 2015). The

variation in the occurrence of different types of cancer across different parts of the world gives some indication of the proportion of cancers that could be prevented by modifying specific harmful lifestyle or environmental factors. Like removal of human papilloma virus (HPV) infection would substantially reduce the burden of cervical cancer, smoking and indoor and outdoor air pollution explain over two-thirds of lung cancer incidence. Yet, for many cancers, the causes remain largely unknown. Only 5–20% of all prostate, colorectal and breast cancers could be prevented by better diet, increased physical activity, or reduced alcohol consumption.

Gender differences in susceptibility to a disease are a very useful piece of information that can be used to develop a causal hypothesis for the disease, or to define subgroups at highest risk for preventive action (Zahm and Fraumeni, 1995). The gender differences in cancer incidence rates is comparable to ethnic and racial disparity in magnitude, and yet, most studies fail to look for it. In genetic epidemiologic studies, it is common that genders do not have equal susceptibility to diseases. Exploration of gender disparity in disease susceptibility has not become common practice even in diseases that show sex differential in their incidence rates (Tevfikdorak and Karpuzoglu, 2012). In present study we have noticed that the occurrence of cancer in females is more as compared to that in males. The study is in accordance with the previous study done by on the agricultural community of Punjab in North India (Thakur et al., 2008). This study has also found that females are more affected by cancer as compared to males. The gender difference in cancer susceptibility is one of the most consistent findings in cancer epidemiology. In cancer susceptibility, the role played by the environment is much greater than that of genetics (Hemminki et al., 2006). Genetic factors are more likely to be modifiers of susceptibility rather than primary determinants of susceptibility (Le Marchand, 2005). It has been suggested that genetic susceptibility studies in cancer would yield more meaningful results if performed in high risk subpopulations (Patel et al., 2013).

Scientist have known for years that age is a leading factor for the development of many types of cancer, but why aging increases cancer risk remains unclear. Higher incidence of non-communicable diseases, especially cancer is positively associated with increase of aged population of a country (Siegel et al., 2016). Researchers suspect that DNA methylation or the binding of chemical tags called methyl groups onto DNA may be involve over time the cells in our

body can become damaged. This can happen by chance or be caused by things such as cigarette smoke or UV rays from the sun. Sometimes this damage can be fixed by our body. But sometimes this damage builds up and can cause cells to grow and multiply more than usual causing cancer. As our age increases, there's more time for damage in our cells to build-up and more chance that some of this damage might eventually lead to cancer. Cancer can develop at any age. But cancer is much more common in older people. This is because our cells can get damaged over time. It has been found in the studies that, 43% of men and 38% of women will develop cancer over the course of their lives. Almost two-thirds of all new cancer diagnoses are made in persons over the age of 65 years, thus aging is making a larger proportion of people more susceptible to cancer (Hsu, 2016). Biochemical mechanisms such as genomic instability, telomere attrition, epigenetic changes, and loss of proteostasis, decreased nutrient sensing and altered metabolism are the known cause of cancer development. In the present study we have found that person's in the age of 41-60 years are more vulnerable to develop cancer. Cellular reprogramming is another mechanism of aging and cancer. The reason for the early development of cancer in patients may be environmental or genetic. It may possible that environmental contaminants such as daily exposure to toxic gases in the form of cigarette, bidi, or industrial exhaust disturb the biochemical pathways involved in suppression of cancer. Along with the gases particulate matter such as pesticides, dust etc. may pose genotoxic effect which leads to cancer. It has been reported that some pesticides have genotoxic potential and have capacity to build DNA protein crosslink and DNA inter-strand break leads to prevention of replication, transcription and translation (Ojha and Gupta, 2017; Su et al., 1998).

Now-a-day's drastic change has been reported in the lifestyle of the population. In the population of Eastern Uttar Pradesh region oral cancer is predominant. Populations of these regions are mostly illiterate or have only primary education. We have found that most of the oral cancer patients were habitual to different addiction. They are taking alcohol, cigarette/bidi, tobacco etc. regularly, although they are aware of the possible risk. It may be because of their illiteracy towards the magnitude of health effect so they are not paying much attention towards this problem. Several epidemiological studies suggesting that bidi or cigarette smoking increases the risk of oral cancer (Sankaranarayanan et al., 1989). In the present study tobacco and alcohol use

was a significant risk factor for oral cancer. Alcohol is thought to play a direct causal role in the development of oral cancer by affecting oncogenes that play a role in the initiation and progression stages of oral cancer. This is carried out by impairing DNA damage repair mechanisms and by over expression of certain oncogenes, which trigger cancer progression. The dehydrating effect of alcohol on cell wall enhances the ability of tobacco carcinogens to permeate mouth tissues. The nutritional deficiencies associated with heavy drinking can lower the body's natural ability to use antioxidants to prevent the formation of cancer. The combination of bidi and the alcohol was the strongest risk factor for oral cancer which is in line with other studies (Znaor et al., 2003). However, the evidence for the interaction of bidi and alcohol in causing oral cancer is inconsistent (Balaram et al., 2002; Rogers et al., 1995).

In the present epidemiological study we have found that most of the cancer patients are taking non-vegetarian diet. So we have also reviewed the relationship between vegetarian eating patterns and cancer risk. A vegetarian diet is full of vitamins, minerals, fibre, magnesium, unsaturated fat and folic acid. Such diet protects us from various diseases like diabetes, heart diseases, controls blood pressure, and prevents us from cancer and lower cholesterol levels. Although plant-based diets including vegetarian and vegan diets are generally considered to be cancer protective, very few studies have directly addressed this question. The direct and indirect evidence taken together suggests that vegetarian diets are a useful strategy for reducing risk of cancer (Key et al., 2009a). Relatively few prospective studies have investigated the relationship between vegetarian diets and cancer risk. Overall meat-free diets appear to be at least modestly cancer protective (10%–12% reduction in risk) in most cases (Fraser, 1999; Key et al., 2009b; Amy and Barbara, 2011).

Body mass index (BMI) is a major assessment of patients' nutrition and metabolic state. Body mass index (BMI) and simple counts of weight are easy and available tools in the clinic and in research. The relations and effects of these indices on cancer patients' remain controversial and unclear (Wu et al., 2016). Disorder of energy metabolism is a common phenomenon in cancer patients. The energy metabolic status among different cancers may not be the same. Recent studies have shown that cancer patients with low-normal BMI (or those with weight loss) have

worse outcomes than obese patients. These results suggest that obesity has a protective effect and has been termed the 'obesity paradox' (Strulov and Williams, 2017).

CONCLUSION:

On the basis of demographical profile and occurrence of different types of cancer, we can conclude that a lot of factors are responsible for variation in different types of cancer. Both the environmental, life style and genetic factors are responsible for it. Restriction to smoking of cigarette or bidi, drinking of alcohol, and chewing of tobacco may prove preventive measures for the risk of cancer. Involvement of vegetarian diet improves our body immune system and helps in removal of reactive oxygen species and prevents cancer development. Regular health check-up will help in early diagnosis and thus early treatment in cancer management. But still a lot of facts are unexplained like region specificity of some cancers, exact molecular mechanism of cancer development, and effect of different environmental pollutants on different biochemical mechanism. However, before concluding any region specific variation in cancer type we should extend our size of population to explain it well. These profiles help us to decide the screening protocols for vulnerable population that needs lifestyle modification.

CONFLICT OF INTEREST: There is no potential conflict of interests in this study.

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Table 1: Geographical distribution of Cancer in Eastern Uttar Pradesh

District Name	No. of cases	Percentage (%)
Gorakhpur	143	35.4
Kushinagar	54	13.4
Maharajganj	40	9.9
Deoria	38	9.4
Santkabir Nagar	34	8.4
Basti	23	5.7
Siddharthnagar	16	3.96
Balia and Balrampur	7	1.73
Mau	7	1.73
Gonda	3	0.73
Azamgarh	2	0.50
Faizabad	2	0.50
Baharaich	1	0.25
Bihar (Neighbour State attached to Gorakhpur)	**34**	**8.4**
Total	404	100.0

Table 2: Occurrence of different types of cancer

Types of cancer	Male (%)	Female (%)	Total	Percentage (%)
Rectum	4(0.99)	2(0.50)	6	1.48
Brain	5(1.23)	2(0.49)	7	1.73
Bladder	24(5.69)	48(11.88)	72	17.82
Blood	19(4.70)	6(1.48)	25	6.18
Cervix	0	71(17.57)	71	17.57
Mouth	61(15.09)	12(2.97)	73	18.06
Breast	0	48(11.88)	48	11.88
Excretory System	6(1.48)	2(0.50)	8	1.98
Digestive system	26(6.43)	10(2.47)	36	8.91
Ovary	0	15(3.71)	15	3.71
Lungs	16(3.96)	6(1.48)	22	5.48
Prostate and penis	9(2.22)	0	9	2.22
Skin	4(0.99)	2(0.50)	6	1.48
ENT	4(0.99)	2(0.50)	6	1.48
Total	176	226	404	100.0

Table 3: Age Distribution of cancer patients.

Age Group(in year)	Male%	Female%	Total	Percentage (%)
<10	6(1.48)	2(0.50)	8	2
11-20	0	3(0.74)	3	0.7
21-30	19(4.70)	11(2.72)	30	7.4
31-40	30(7.42)	39(9.65)	69	17.1
41-50	32(7.9)	59(14.60)	91	22.5
51-60	33(8.16)	68(16.83)	101	25
61-70	47(11.63)	29(7.17)	76	18.8
71-80	12(2.97)	8(1.98)	20	5.0
81-90	3(0.74)	3(0.74)	6	1.5
Total	182	222	404	100

Table 4: Addiction pattern in cancer patients.

Type of addiction	No. of Patients	Percentage (%)
No addiction	168	41.58
Tobacco	85	21.01
Alcohol	49	12.13
Bidi	33	8.16
Cigarette	6	1.5
Ganja	2	0.5
Information not provided	61	15.1
Total	404	100.0

Table 5: Diet pattern and Body Mass Index (BMI) of Cancer Patients.

Diet Pattern/BMI	Male%	Female%	Total	Percentage (%)
Vegetarian	23(15.03)	47(23.38)	70	19.77
Non-Vegetarian	130(84.97)	154(76.62)	284	80.22
BMI (18.5-24.9)	70(56.45)	74(51.03)	144	53.53
BMI (<18.5)	33(26.61)	42(28.97)	75	27.88
BMI (>24.9)	21(16.93)	29(20.00)	50	18.58