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Epidemiology of lung cancer in a tertiary care centre - A retrospective observational study

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Abstract

Context: Lung cancer has varied epidemiology depending on the geographic region. Globally, there have been important changes in incidence trends amongst men and women. Indian epidemiological data on lung cancer is scarce.

Aims: To study the epidemiological patterns and clinical profile of lung cancer incidence in Gurugram, Haryana, India.

Materials and Methods: The time trend of lung cancer incidence was evaluated by using the Hospital Based Cancer Registry data from 2013-2020. Demographic data, place of residence, histology, laterality, clinical extent of disease and treatment details were collected. Data was entered on an Excel data sheet and analysed in SPSS.

Results: There were 1338 patients of which 1,000 (74.7%) were males and 338 (25.3%) were females with a median age of 61 years. The male-to-female ratio was 2.96:1. Majority of the patients were older than 40 years of age (94.7%) with majority in the age group 60-69 years (33.6%). Most of the patients were metastatic at the time of diagnosis (73.6%). The most common histology was non-small cell carcinoma lung (NSCLC) (59.2%) followed by small cell carcinoma lung (SCLC) (8.9%). The majority of the patients (77%) received chemotherapy with combination of radiation & surgery.

Conclusion: This study provides a framework for assessing the status and trends of lung cancer in the district of Gurugram (of state Haryana) & surrounding areas of NCR- Delhi, state of Haryana, Uttar Pradesh, Rajasthan & Punjab.

Keywords: Epidemiology, lung carcinoma, adenocarcinoma

Introduction

According to the GLOBOCAN 2022 estimates, there were 20.0 million new cases worldwide and 9.7 million cancer deaths in 2022 for both sexes combined. There are 59.2% of the world's population residing in Asia and almost one half of all cases (49.2%) and the majority (56.1%) of cancer deaths globally were estimated to occur. Among all cancers, lung cancer is the most common malignancy representing almost 2.5 million new cases, or one in eight cancers worldwide (12.4% of all cancers globally) and has been the leading cause of cancer related mortality worldwide being responsible for an estimated 1.8 million deaths (18.7%) in 2022 according to the International Agency for Research on Cancer (IARC)'s latest report [1]. Among lung cancers, non-small cell lung cancer constitutes the majority of cases with adenocarcinoma being the most common histological subtype [2].

In India, lung cancer is the 6th most common malignancy accounting for an incidence of 103,371 cases in 2022 as per the National Cancer Registry Programme (NRCP) ICMR data [3]. It is the most common cancer among males and fifth most common cancer among women. The number of lung cancer cases is expected to rise sharply to 81,219 cases among males and 30,109 in females by 2025 [3].

Non-small cell carcinoma lung is the most common subtype with adenocarcinoma being the most frequent histologic type (34.3% and 52.7%), followed by squamous cell carcinoma (23.4% and 11.5%) in males and females respectively [2]. Adenocarcinoma constituted the highest proportion of cancers in all the age groups up to 54 years in males and 74 years in females. The proportion of squamous cell carcinoma was higher beyond 75 years as compared to adenocarcinoma in both genders.

Globally, cancer registries are maintained to assess the prevalence and incidence of various types of cancer in different countries and among varied populations. In India, the National Cancer Registry Programme initiated by the Indian Council of Medical Research (ICMR) was instituted in 1982 at select hospitals across the country. This has expanded over the decades to its current network of 36 population-based cancer registries (PBCRs) and 236 hospital-based cancer registries, which is steered and coordinated by the ICMR's National Centre for Disease Informatics and Research, Bengaluru. And of note, lung cancer is the leading site of cancer for male individuals at several of the PBCRs in India. Lung cancer epidemiology in India has seen its evolution from being dominated by histologic types strongly associated with tobacco smoking (squamous and small cell) to an era where adenocarcinoma

became equi-prevalent and now ultimately to a time where it has become the dominant histologic type [4].

Hence, understanding the epidemiologic and clinical profile of lung cancer is of utmost importance in order to gauge the impact of prevention and treatment programmes. This helps in knowing the current status and changing prevalence of lung cancers thereby enabling us to enhance cancer care services, identify areas of need, screening programmes and implementation of preventive programs at areas and populations at risk.

Search and selection criteria

We searched PubMed, Scopus, Google Scholar, and references from relevant articles using the search terms "Lung Malignancies", 'India', 'epidemiology' and 'incidence'. We also accessed the website of the International Agency for Cancer Research and reviewed all the online databases 'GLOBOCAN', 'Cancer Incidence in Five Continents' and other publications containing information on cancer in India.

Methodology

Aim of study

The aim of this study was to ascertain the incidence and clinicopathological profile of lung carcinoma patients treated at Fortis Memorial Research Institute, Gurgaon over a period of 8 years (1st January 2013 to 31st December 2020).

Study design

Single centre retrospective observational analysis of histopathologically proven lung carcinoma over a period of 8 years (1st January 2013 to 31st December 2020).

Study setting

Hospital Based Cancer Registry (HBCR) functioning at Fortis Memorial Research Institute, Gurugram (Haryana).

Study population

1,338 consecutive patients with histopathological diagnosis as lung cancer, diagnosed at Pathology department or cases of lung cancer referred from elsewhere to the Department of Oncology, Fortis Memorial Research Institute, Gurugram (Haryana) over a period of 8 years (1st January 2013 to 31st December 2020).

Statistical analysis

Data was entered into windows excel sheet and the collected data was analysed using Statistical Package for Social Sciences (SPSS) version 23.0. For inferential statistics between groups, comparisons of qualitative variables were analysed by chi-square test. P value of less than 0.05 was considered as a level of significance.

Materials and methods

This was a cross-sectional, descriptive prevalence study conducted within the referral facility for this micro-region of the city of Gurugram, Haryana, India. Lung cancer was defined using code C33-C34- from the International Classification of Disease-Revision, 10th edition. The data with a primary tumor of the site lung (C33.0 – C34.9), whether still alive or deceased collected by the Hospital Based Cancer Registry (HBCR) was utilized for this study during the 8-year period beginning January 1, 2013 and ending December 31, 2020 were registered. All the recorded data details was entered in Microsoft Excel data sheet. The information collected was cross-checked for completeness. The data was checked and validated by using quality control programs/tools for cancer registries of International Agency for Research on Cancer (IARC) for avoiding duplication and any unlikely combination of age, sex, site and morphology and other factors in the database. All neoplasms with a behaviour code of 3 as defined by the International Classification of Diseases for Oncology, 3rd Edition, and the International Statistical Classification of Diseases and Related Health Problems (10th revision; ICD-10) were considered reportable and therefore registered. Information on other variables was coded according to the international guidance.

Results

Incidence and gender distribution

The incidence of lung malignancies increased yearly between 2013 and 2020. Table 1 & Fig.1 depicts the year-wise distribution of total number of new cancer cases versus all lung malignancies cases. Out of 1338 patients included in the study, 1000 (74.7%) were males and 338 (25.3%) were female. The male female ratio was 2.96:1.

Table 1: Year-wise distribution of total number of new cancer cases versus all lung malignancies cases including differences in gender

Year	All site cancer cases				Lung cancer cases			
	Male	Female	Total	%	Male	Female	Total	%
2013	832	658	1490	5.6	84	13	97	7.2
2014	1191	966	2157	8.1	87	31	118	8.8
2015	1888	1587	3475	13.0	145	40	185	13.8
2016	2013	1685	3698	13.9	109	52	161	12.0
2017	2381	1947	4328	16.2	136	42	178	13.3
2018	2351	1874	4225	15.9	184	49	233	17.4
2019	2324	1903	4227	15.9	156	58	214	16.0
2020*	1617	1417	3034	11.4	99	53	152	11.4
Total	14597	12037	26634	100.0	1000	338	1338	100.0
%	54.8	45.2	100.0		74.7	25.3	100.0	
Chi-square statistic is 205.1892; p-value is <.00001 and highly significant at 95% level (p<0.05).								

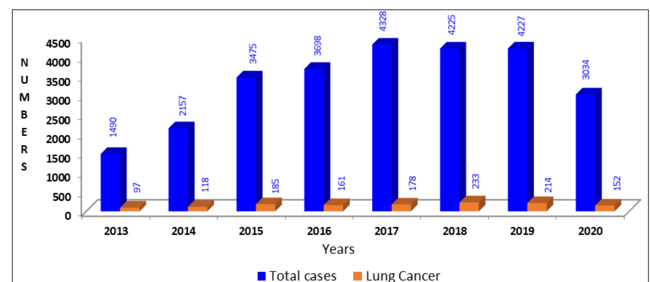

Fig 1: Number of new cancer patient registration v/s lung cancer cases, Years: 2013-2020

*In view of the COVID-19 pandemic, the central govt. imposed a strict countrywide lockdown, restrictions on international travel and several other strict measures; due to which registration of new cases declined during the year-2020.

Age distribution

Table 2 & Fig.2 depicts the number of new lung cancer cases by 10-year age groups and sex. The age group of study population ranged from 3 years to age 89 years. The mean age of lung cancer cases in this study was 61 years with standard deviation (σ) of 12.796. Majority of patients were older than 40 years of age (94.7%) among which, the majority were in the age group 60-69 years (33.6%).

Table 2: Number of new lung cancer cases by 10-year age groups and sex

Age groups	Male		Female		Both Sexes	
	#	%	#	%	#	%
00-09	1	0.1	0	0.0	1	0.1
10-19	2	0.2	0	0.0	2	0.1
20-29	3	0.3	7	2.1	10	0.7
30-39	41	4.1	18	5.3	59	4.4
40-49	118	11.8	65	19.2	183	13.7
50-59	218	21.8	66	19.5	284	21.2
60-69	336	33.6	113	33.4	449	33.6
70-79	228	22.8	53	15.7	281	21.0
80-89	53	5.3	16	4.7	69	5.2
Total	1000	100.0	338	100.0	1338	100.0
Mean:	61.0231	Standard deviation (σ):				12.7958

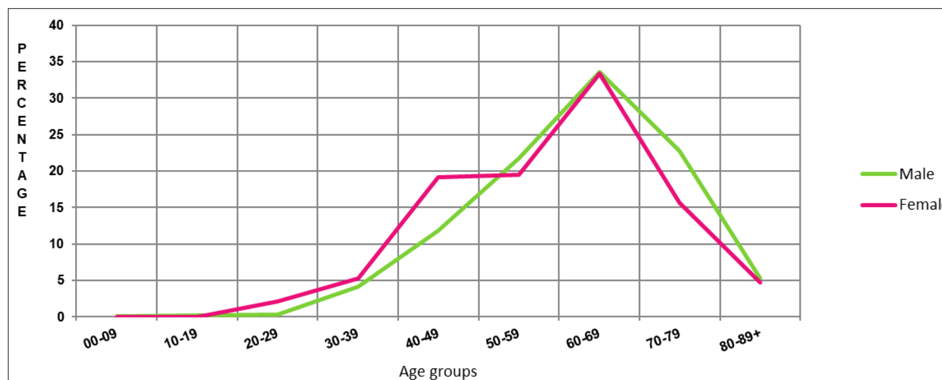

Fig 2: Age specific proportions for lung cancer by sex years: 2013-2020

Disease characteristics

Most of the lung cancer cases were metastatic at the time of diagnosis with 73.6% of cases metastatic vs 26.2% non-metastatic. Among the non-metastatic patients, 17.2% cases were right sided and 9.2% cases were left sided.

Among the histopathological types, non-small cell lung carcinoma (NSCLC) was the leading type in both males and females, comprising about 59.2 % of the total cases followed by small cell lung carcinoma (SCLC) – 8.9% (Table 3). Among all NSCLC, adenocarcinoma accounted for almost 2/3rds of cases (approx. 72%) and squamous cell carcinoma about 1/3rd of the cases (approx. 28%).

Table 3: Demographic profile of the lung cancer patients

Metastatic status	#	%
▪ Metastatic disease	984	73.6
▪ Non-Metastatic disease	353	26.4
▪ Left	230	17.2
▪ Right	123	9.2
ICDO CODE & Histology	**#**	**%**
NSCLC (Non-Small Cell Lung Carcinoma)		59.2
8140 Adenocarcinoma, NOS	390	29.2
▪ 8070 Squamous cell carcinomas, NOS	204	15.1
▪ 8046 Non-small cell carcinomas	174	13.0
▪ 8560 Adenosquamous carcinoma	12	0.8
▪ 8480 Mucinous adenocarcinomas	5	0.4
▪ 8072 Squamous cell carcinomas, nonkeratinizing, NOS	4	0.3
▪ 8071 Squamous cell carcinomas, keratinizing, NOS	3	0.2
▪ 8073 Squamous cell carcinoma, small cell, nonkeratinizing	1	0.1
▪ 8075 Squamous cell carcinomas, adenoid	1	0.1
SCLC (Small Cell Lung Carcinoma)		8.9
▪ 8041 Small cell carcinomas	85	6.4
▪ 8246 Neuroendocrine carcinomas, NOS	33	2.5
Other subtypes		2.9
▪ 8240 Carcinoid tumor, NOS	8	0.6
▪ 9050 Mesothelioma, malignant	6	0.4
▪ 8249 Atypical carcinoid tumor	4	0.3
▪ 9040 Synovial sarcomas, NOS	4	0.3
▪ 8200 Adenoid cystic carcinomas	3	0.2
▪ 8254 Bronchiole-alveolar carcinomas, mixed	3	0.2
▪ 9133 Epithelioid hemangioendothelioma, malignant	3	0.2
▪ 8013 Large cell neuroendocrine carcinoma	1	0.1

▪ 8033 Pseudosarcomatous carcinoma	1	0.1
▪ 8250 Bronchiole-alveolar adenocarcinomas	1	0.1
▪ 8430 Mucoepidermoid tumor	1	0.1
▪ 8490 Signet ring cell carcinomas	1	0.1
▪ 8815 Solitary fibrous tumor, malignant	1	0.1
▪ 9473 Primitive neuroectodermal tumor, NOS	1	0.1
Unspecified		
▪ 8010 Carcinoma, NOS	325	24.2
▪ 8000 Neoplasm, Malignant	63	4.7
▪ Total	1338	100.0

Treatment details

Most patients underwent surgery, chemotherapy, radiation or immunotherapy. The vast majority of patients underwent chemotherapy alone (n= 285, 44.3%) and with combination (n=242, 37.6%), surgery alone (n= 33, 5.1%) and with combination (n=60, 9.3%) and radiation alone (n= 76, 11.8%) and with combination (n=194, 30.1%).

Treatment	#	%
▪ Chemotherapy alone	265	44.3
▪ Chemotherapy with combination (radiation and/or surgery)	242	37.6
▪ Radiation alone	76	11.8
▪ Radiation with combination (chemotherapy and/or surgery)	194	30.1
▪ Surgery alone	33	5.1
▪ Surgery with combination (chemotherapy and/or radiation)	60	9.3

Discussion

Lung cancer has varied epidemiology depending on the geographic region. Globally, there have been important changes in incidence trends amongst men and women, histology and incidence in non-smokers. Indian epidemiological data on lung cancer is scare [6]. This was a hospital-based study with data derived from the hospital cancer registry that has been consistently collecting cancer epidemiological data since 2013. As per the GLOBOCAN data, the incidence of cancer has been increasing globally [1]. In line with the GLOBOCAN data 2022, the number of lung cancer cases at FMRI have been steadily increasing at our institution as well since 2013, with 2018 having the highest number of recorded in 2018 with 233 new cases (17.4% of all new cases registered in FMRI, Gurugram). As for 2020, In view of the COVID-19 pandemic, the central govt. imposed a strict countrywide lockdown, restrictions on international travel and several other strict measures due to which registration of new cases declined during that year. Among our patients, as for the sex distribution, over the years, there were always more men than women at an average ratio of 3:1. Globally, the ratio of men to women with lung cancer is about 2:1. Other data from India also show an increased incidence and prevalence of lung cancer among Indian men compared to women with ratios ranging from 3:1 in places like Bangalore to 11.3:1 in places like Srinagar (5). This is owing to the prevalence of more cigarette/beedi smoking among the male population as compared with the female population across India and more in the northern states as compared to the southern states of India.

Lung cancer is generally diagnosed in adulthood as per our data with most of the cases being over 40 years of age (94.7%). Among them, most patients with lung cancer belonged to the age group of 60-69 years (33.6% men and 33.4% women). Comparing the global data, majority of lung cancer cases were 60 years and above [2]. Among varied data from Indian studies, there is also a majority of cases of lung cancer over the age of 50 and majority of cases in the 55-64 years (36.5% men and 37.1% women) [3]. With tobacco use as one of the leading causes of lung cancer, this can be explained with the fact that most Indian men and women start smoking at around the age of 20 to 30 and with cumulative pack years tend to develop lung cancer 30-40 years later at the age of 60-65. Among the Indian population however, with the prevalence of smoking among Indian women being significantly lesser than men, they tend to arise from other factors such as passive smoking, choola use and probable environmental pollution [6, 7, 8].

Carcinoma lung is broadly divided into two categories, Non-small cell carcinoma lung (NSCLC) and Small cell carcinoma lung (SCLC). SCLC is the more aggressive variant which usually accounts for about 15-20% of the cases and the remaining 80-85% of the cases are made of NSCLC (2,7). This was similar to our patients where majority of the cases fall into the NSCLC category – 59.2% followed by SCLC 9.2% with 2.9% rarer subtypes. There were 28.9% of patients in whom data was not available to differentiate between NSCLC and SCLC. Most carcinoma lung patients present with metastatic disease due to its indolent disease course and symptoms presentation only when the disease has spread to other sites. In our study, 73.6% were metastatic at presentation and the remaining were non-metastatic at presentation which is consistent with the findings globally [2].

Treatment of lung cancer has undergone drastic changes over the last couple of decades. With the advancement of molecular diagnostic techniques and the advent of immunotherapy, the overall prognosis of lung cancer patients has improved significantly [4, 7]. In general, early stage, non-metastatic patients are treated by surgery followed by observation or maintenance targeted therapy or immunotherapy. Stage III patients are usually treated with chemo-radiotherapy followed by maintenance immunotherapy or targeted therapy. Metastatic patients usually undergo chemotherapy, but with the discovery of driver mutations such as EGFR and ALK, these patients now undergo targeted therapy with tyrosine kinase inhibitors (TKIs) and chemotherapy is reserved for patients who progress after targeted therapy [9]. Also with the advent of immunotherapy including PD-1 and PDL-1 inhibitors such as Nivolumab, Pembrolizumab, Atezolizumab and Durvalumab, patients with a high PDL-1 TPS score (Tumor Proportion Score) are offered immunotherapy alone or immunotherapy in combination with chemotherapy [4]. Among our patients, most of our patients underwent chemotherapy alone (44.3%) this was followed by patients who underwent multimodality treatment with chemotherapy and radiation or surgery (37.6%). There was a cohort of

patients who underwent radiation therapy alone (11.8%) and about 30.1% who underwent radiation in combination with surgery or chemotherapy. There was a small number of patients who underwent surgery alone (5.1%) who were early, non-metastatic lung cancer patients. Surgery with combination radiation and/or chemotherapy (9.2%). This highlights the multimodality treatment options for lung carcinoma patients.

All patients in our study underwent molecular analysis, data for the same are being analysed and the molecular landscape shall be presented in our subsequent paper.

Conclusion

In conclusions, lung cancer is a major health problem in India and also worldwide. This study provides a framework for assessing the status and trends of lung cancer in the district of Gurugram of State Haryana, India. This shall guide appropriate support for action to strengthen efforts to improve lung cancer prevention and control to achieve the targets and the sustainable development goals.

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Conflict of interest: None

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