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ORIGINAL ARTICLE

Smoking and Lung Cancer: A study of Lung Cancer Patients with Smoking Dependence and Radiation

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ABSTRACT

In the present study, total no. of the 50 Patients with carcinoma Lung with stages 3rd and 4thare treated with different modes of treatment like surgery, chemotherapy, and Radiation therapy and a combination of these modalities from the Delhi State Cancer Institute, New Delhi has been evaluated. According to EPA (Environmental Protocol Agency) Report 2009, Radon gas is the second leading cause of Lung Cancer after smoking. These patients are classified as a smoker, nonsmoker or ex-smoker depending on their smoking habits and amount of Radiation doses given to them has been studied. A correlation coefficient between smoking and nonsmoking has been found, which shows that there is a poor positive correlation between smoking and lung cancer. Based on the dose amount of Radiation Doses given for their treatment and consequences of those doses under the limit prescribed by Radiation Therapy Oncology Group (RTOG) 9410, dose evaluation has been studied. The study shows that smoking may be a cause of Lung cancer, but contributions of other scenarios cannot be neglected. Another possible significant reason has been also discussed in this paper. In this paper, the radiotherapy-related toxicities to these patients have also been discussed.

Keywords: *Radiation, Lung cancer, Dose, Smoking and Radon*

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INTRODUCTION

In present status, lung cancer is a leading cause of death in India. Nowadays, around one-third of adults are known to be smokers. Smoking rates are increasing among the female population also (Vanita *et al.* 2016). From studies, it is expected the death rate due to smoking and tobacco user will rise to 10 million by 2025 and more than one-third of the population above adult deaths are expected to be attributed to cigarette smoking (Gelband *et al.* 2015). Previously, the association between cigarettes and lung cancer has been proven by a large no. of studies (Jerome *et al.* 2009). It shows that the risk of lung cancer development is 20-40 times higher in lifelong smokers as compared to non-smokers (Ozlu *et al.* 2005). In recent decades, there has been a tremendous increase in squamous cell cancer and small cell lung cancer, adenocarcinoma of the lung due to increases in smoking rate. Since increasing rates of smoking among females increases usage of light cigarette smoking (Beate *et al.* 2011) bronchitis problems in the Lung increase the cumulative death rate, but after smoking cessation the risk of lung cancer decreases. Patients who continue smoking experience many difficulties during cancer treatment (Stephen *et al.* 1999). Stopping smoking may prolong survival in cancer patients, and also decreases the risk of recurrent pulmonary carcinoma. The effect of smokes appears not immediately, but as age increases, it appears with their negative

health effect (Peter *et al.* 2003). Over the last decade, smoking also has emerged as a strong prognostic and predictive patient characteristic with other variables. This article briefly reviews scientific facts about tobacco and the process and molecular pathways involved in lung carcinogenesis in smokers and never-smokers. The evidence from randomized trials about tobacco smoking's impact on lung cancer outcomes is also reviewed (Muhammad *et al.* 2013). Genetic mutations remain an underlying cause as we do encounter lung cancer at a relatively earlier age when it runs in families. Other factors that can cause Lung cancer are secondhand smoking, carcinogens at the workplace, air pollution and background radiation (Ahmad *et al.* 2008). In background radiation radon gas is an important cause of lung cancer among nonsmokers. The carcinogenetic effect of radiation on the lung may be synergistic with the carcinogenic effect of cigarette smoking (Anthony *et al.* 2013).

METHODS AND HISTORY

In the present study individuals smoking history, information has been given weightage as per the number of individuals belonging to the patient group, further radiation doses effects consequences have been studied. A total no. of 50 patients of a sample population of carcinoma lung from various states. Among which, most are from nearby states of Delhi like Haryana, Punjab, Uttar Pradesh and Rajasthan states been categorized. Among these 50 patients, 9 are female and 41 from male categories. Patients were divided into 5 categories as Nonsmoker (NS), Ex-smoker (SL), Light smoker (LS), Moderated smoker (MS), and Heavy smoker (HS). For this study, only those patients whose age is above 40 years are included as the effect of smoking usually appears at a later age. Classification of smoking category based on their smoking habit is shown in Table:1. In individuals classification as Nonsmoker (one who has never smoked), Former smoker (one who has quit smoking), Light smoker (one who smokes occasionally), moderated smoker (one who smoke more than 1 but less than 10 cigarettes), Heavy smoker (one who smoke 1 or more than 1 packet daily) with proper smoking weightage among the population based on percentage is given (William *et al.* 2012, Kom *et al.* 2013).

Table 1: Classification of the Lung cancer patient and their smoking weightage

Category	Smoking Habits	Smoking Weightage
Non-Smoker (NS)	Never Smoked in Life	0.20
Former Smoker (SL)	Smoked at young age duration (Ex-smoker)	0.02
Light Smoker (LS)	Occasionally	0.12
Moderated smoker (MS)	1-10 Cigarette per day	0.42
Heavy Smoker (HS)	1 packet or more than 1 packet per day	0.24

CORRELATION BETWEEN SMOKING AND LUNG CANCER

In the United States, cigarette smoking is linked to about 80% to 90% of lung cancers. Using other tobacco products such as cigars or pipes also increases the risk for lung cancer. In the present study, using a sample size of 50patients, a correlation coefficient is measured between smoking and age using Karl Pearson's coefficient (Richard *et al.* 2012). By calculation, a value of 0.13 is observed between age and smoking weightage, which shows a very poor correlation between them. It shows that smoking is not only the reason for lung cancer, but various other factors are also responsible and among these various effects such as background radiation. Various aspects of carcinoma Lung and their causes are also responsible for Lung adenocarcinoma. According to Environmental Protocol Agency Report (EPA) report smoking is the second leading cause of cancer after Radon Gas (Bjartveit *et al.* 2005). The contribution of Radon gas in natural radiation sources is more than 55%. Fortunately; a very low level of contribution of Radon gas in the environment but coastal area places has been reported high. But studies on radon and

lung cancer risk coefficient data on the coastal area are not available (Paula *et al.* 2013, Charles *et al.* 2011). The highly carcinogenic alpha particle from radon during inhalation has a synergistic effect through chemical carcinogens in cigarette smoking, increasing the lifetime risk of lung cancer by a factor 8.3-25 compared with never smokers. Over time, these substances lead to lung cancer. According to WHO-based studies on thousands of scientific papers, outdoor air pollution is a carcinogen since India has a relatively high population index in the world; Biomass burning fuel wood and vehicular emissions is the major source of this air pollution (Pascale *et al.* 2017). In some cases, workplaces can be sources of exposure like diesel exhaust and asbestos. The international agency for research on Cancer (IARC) which is the daughter organization of WHO, classifies diesel engine exhaust as carcinogenic. A significant amount of time spending such a type of place leads to lung cancer risk. Second-hand smoking is also a factor of Lung cancer, so legislation and awareness about this factor of Lung cancer may be useful for reducing this problem (Furukawa *et al.* 2010). A bar diagram showing different age groups of Lung cancer patients versus no. of patients have been shown. It correlates that at the age is increasing, smoking effect has appeared lately (IARC report 2012).

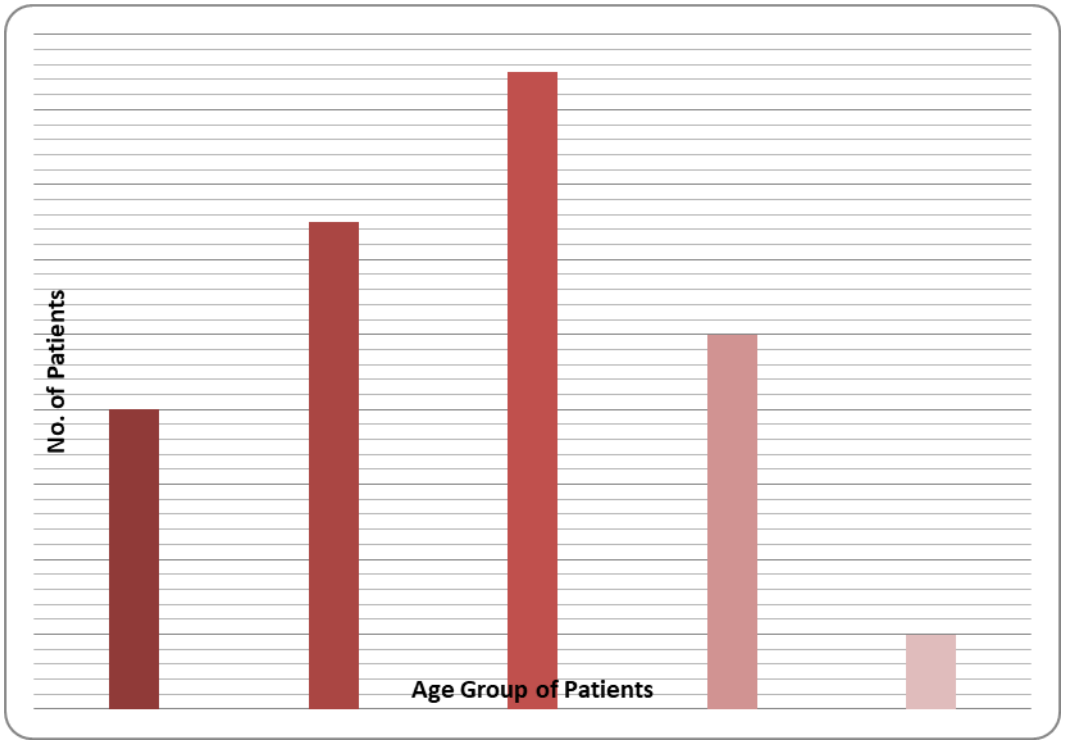

Fig. 1: Bar diagram of no. of Patients versus Age Group

RADIATION DOSES

For treatments of Lung cancer using radiation therapy, a dose of 60-62 Gy at 2# and the hyper fraction of 69.2Gy at 2# have given according to Radiation Therapy Organization Report (RTOG9410) and QUANTEC guidelines. The late effect of radiation among those patients appears monthly or yearly (Curran *et al.* 2011, Lawrence *et al.* 2013).

RADIATION DOSE EFFECT

Radiation doses amount given to patient creates some long term side effect. It appears as cough and breathlessness, narrowing of the food pipe, tiredness and weakness, inflammation of the lining of the heart, and so on. Most side effects gradually go away in the weeks or months after treatment, but some side effects can continue or may start some months or years later. Cough and breathlessness happen among 4% of patients who

have radiotherapy to the lung area (chest area). Esophageal dilation (narrowing of the food pipe) is also a long-term side effect. Earlier side effect includes chest pain, loss of neck and chest hair, reddening and darkness of skin, etc. Earlier side effects can lapse as time passes. The patient might also get slight redness or darkening on the other side of the body, where the radiotherapy beams leave the body. Radiotherapy to the chest area might cause some inflammation of a patient's lungs. Soon after treatment, patients may have a dry cough or shortness of breath. It is called acute radiation pneumonitis. Variation of side effects depends upon the amount of radiation dose-effect appear differently from person to person. Side effect tends to start a few days after the radiotherapy begins. They gradually get worse during the treatment and after 2-3 weeks after the treatment ends. But they usually begin to improve after around 2-3 weeks or so (Inskip *et al.* 1994, Wang *et al.* 2009).

RESULT AND CONCLUSIONS

This sample study of 50 lung cancer patients with a poor correlation coefficient of patient's age with smoking shows that it is not necessary smoking tobacco is only responsible for lung cancer. It may be one factor for lung cancer, but other factors such as depending on environmental conditions, working places area, and presence of the amount of background radiation level in those areas is also responsible. The bar diagram clearly shows that majority of Lung cancer patients are between the ages of 60 and 69, indicating that the late effect of smoking and other factors on the bronchus of the lung manifests itself in old age. The risk of Lung cancer can be reduced by avoiding secondhand smoking, avoid carcinogens at the workplace, bypassing minimum time of exposure in high-level environmental pollution a radiation (Radon) background area.

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