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A MINI-REVIEW ON TOBACCO AS A POTENT CARCINOGEN

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Abstract: Tobacco smoking is a significant cause of healthy lung development into lung cancers. Cigarette smoking is an easy habit. The addiction to cigarettes is due to nicotine present in cigarettes. Nicotine directly does not cause cancer, but the remaining particles except nicotine and water are called tar, containing more than 3500 different types of compounds, which causes significant cancer. This paper provides a mini-review on tobacco as a potent carcinogen.

Index Terms **- Tobacco, cancer, cigarette, nicotine, carcinogen.**

I. INTRODUCTION

Currently, cancer is causing a large number of deaths around the globe (Parkin et al., 1994; Siegel et al., 2011). Past years have shown a drastic increase in female smokers, considering female bodies are more prone to the adverse effects of hormonal influence (Hitchman et al., 2011; Rivera et al., 2009). In recent years, many cases reported lung cancer, making it the second most deadly cancer, while breast cancer in females and prostate cancer in males being on top (Society, A.C. et al., 2016). Molecular and epigenetic levels in cancer both defer when compared among smokers and non-smokers (Subramanian et al., 2013).

Lung cancer starts with accumulating toxic substances in the lungs (Anirban et al., 2020), causing cell growth beyond the level of control. If not observed at the right time, it may spread to other tissues and organs in the body (Siegel et al., 2016). Most of these carcinomas are derived from epithelial cells, including small cell lung carcinoma (SCLC) (Nicholson et al., 2002). This type is mainly derived from cells with neuroendocrine characteristics, and it comprises only 15% of total lung cancer cases and non-small cell lung carcinoma (NSCLC), which comprises 85% of the total cases presented (Marchand et al., 1998).

Polycyclic aromatic hydrocarbons are compounds with a light molecular weight that enter the body due to tobacco smoking, and the accumulation of these low molecular weight compounds on the central bronchi causes small cell lung carcinomas. Tobacco smoking can expose the peripheral lung tissues to nitrosamines to be the primary cause of adenocarcinoma in the lungs (Marchand et al., 1998).. Women and people who do not smoke are majorly affected by adenocarcinoma. On the contrary male smokers are dominantly prone to squamous cell carcinoma (Pesch et al., 2012; Subramanian et al., 2013). K-ras gene mutation type of secondary subtype and point mutations are common in the tobacco smokers and rarely seen in never smokers. A comparative study of the difference in cancer types, pathways, and mutating genes in smokers and never smokers may further help treat these patients (Govindan et al., 2012; Rudin et al., 2009).

II. TOBACCO AND CANCER

The tobacco smoke contains a large number of particulate matter which can be broadly classified into particulates of polycyclic aromatic hydrocarbons, particulates of N-nitrosamines, aromatic amines, heterocyclic aromatic amines, large compounds aldehydes, compounds of inorganic matter metals like arsenic, nickel, chromium, cadmium etc. (Smith et al., 2001; Talhout et al., 2011). These compounds need to be metabolically activated to result in cancer (Johnson et al., 2017) and operate with molecular oxygen and form hydrogen peroxide and hydroxyl radical (Armstrong et al., 1997). These species are also highly reactive; they create nicks and single-strand breaks in DNA on which DNA repair mechanisms acts but cannot permanently repair and sometimes fail (Fielding et al., 1989).

DNA repair mechanisms mainly treat the DNA adducts (Mattern et al., 1998), and the remaining which cannot be treated by these mechanisms further interact with the p53 tumor suppressor gene, playing a significant role in cell death and proliferation and Kirsten-ras (Kras) oncogene, which is vital in signal transduction (Olshan et al., 1997). Mutations in codon 12 of the KRAS gene were observed in the smoker leading to the development of lung cancer (Westra et al., 1993).

The nicotine molecules are responsible for addiction and the reoccurrence of tobacco dependence (Jacob et al., 2013). The mechanism behind nicotine addiction lies in the release of dopamine triggered by the binding of the nicotine to nicotinic acetylcholine receptors (nAChRs), which creates a rewarding effect in the brain after cigarette smoking (Benowitz et al., 2009). In the initial assessment & diagnosis, half of the patients who quit smoking were not ready to terminate smoking, highlighting the importance of tobacco treatment that worked without the motivation of smoking cessation (Lewis et al., 2018).

III. Cigarette smoking, second hand smoking and E-cigarettes

Among various factors related to causing cancer, cigarette smoking is the wide-ranged one. Active smokers in America 52% men and 35% women (Brawley et al., 2014). Though nicotine itself is not carcinogenic, there are 55 other substances in cigarette smoke that have been named highly carcinogenic by the International Agency for Cancer Research (Hecht et al., 1999). Cigar and pipe tobacco smoking are also associated with alarming lung cancer rates (Boffetta et al., 1999). E-cigarettes have sparked much recent controversy over potential risks from long-term use and their role in smoking initiation and potentially cessation (Abrams et al., 2014). Alternately, with the high use of cigarettes (about 18% of adults), the incidence of e-cigarette use is increasing and has been correlated with higher odds of cigarette smoking and lower odds of abstinence (Dutra et al., 2014). Even more concerning, a recent study has shown that e-cigarette vapor-conditioned media-induced expression patterns of the gene in human bronchial epithelial cells consistent with that of cells exposed to a cigarette smoke-conditioned media (Park et al., 2014).

IV. Innovative approaches to reduce tobacco use

The use of these electronic devices is still the subject of debate. Third and fourth gentration electronic devices like JULU, hookah, and IQOS (I quit original smoking) in the market. However, the data on the effectiveness of e-cigarette is still less due to limited trials (Ghosh et al., 2017). Carcinogens such as formaldehyde can damage DNA in a more incredible amount in e-cigarette solution (Korfei et al., 2018; Lee et al., 2018). In addition to it, nicotine is still not considered a carcinogen based on animal model studies (Stepanov et al., 2009). It is very astonishing from the recent study that found an equal level of induction of tumor-promoting cascades by cigarette smoke and e-cigarette extracts (Schaal et al., 2018). The nicotine content in combustible cigarettes can be reduced to become less addictive (Hatsukami et al., 2013). The composition of cigarettes can also be changed to create a healthier product (Benowitz et al., 2013).

IV. Conclusion

Various factors seem to be interdependent in successful smoking termination. Right from the feelings like self-blame, socio-economic pressure, and various types of stigma need to be eradicated, which can only be achieved by increasing awareness and education. Once the factors mentioned above are removed, and the patient is diagnosed, the further steps right from the counseling and interaction of the patient with clinicians up to the final measures, plans, and alternatives can help complete smoking cessation.

If smoking is not terminated, it can result in tumors that get resistant to therapies & increase the death rate. Cardiovascular status is improved by smoking cessation. A very detailed history is required for future clinical assessment in NSCLC. Along with these three levels of smoking status like never smoker, former smoker & current smoker should be given & several pack years should be thoroughly calculated (Tsao et al., 2016).

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