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A Review on "Origin of Occupational Cancers and their Prevention"

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Abstract
Applications of chemical compounds like Formaldehyde, benzene and ethylene oxide are truly evil to human beings. Other chemicals, such as chromium (VI), crystalline silica, benzidine salts, nickel, asbestos, radon, and polycyclic aromatic hydrocarbons (PAHs), are also very dangerous to health. Truck particles and UV radiation are becoming increasingly dangerous to our health each day, and they are known to cause different kinds of cancer. This paper targets to provide a brief account of some work on cancer and its prevention. Asbestos causes malignant mesothelioma and lung cancers, among other cancers. Jurisdiction over lung cancer within industries in India is widespread. People who work in construction areas involving asbestos compounds are at high risk of developing cancer in human mesothelial cells. Skin cancer is caused by continuous exposure to ultraviolet radiation. Occupational cancers include cancer in the lungs/breast, bladder, mesothelioma, leukaemia, larynx, skin cancer, sinonasal, nasopharyngeal, kidney and liver cancers. We have discussed some of them, such as mesothelioma, lung cancer, skin cancer, bladder cancer, and breast cancer, in this article. In the case of management guidelines, they must be instituted to prevent occupational cancers, given their long latency periods and the fact that these cancers are often diagnosed after employees retire. As a result of the above, education on occupational cancers needs to be enhanced, as do the measures taken to ensure employee safety.

Key terms: On occupational place Cancer, chemicals exposure, Precaution, asbestos, latency.

I. Introduction

Acquiring cancer results from exposure to carcinogens in the workplace. This happens because workers are often unaware of the potential dangers posed by those chemicals, leading to accidental exposure [1]. Workers are exposed to more carcinogens at work than in other settings [2]. However, despite a decrease, control and prohibition by many sectors of industry in the use of carcinogenic chemicals, cases of occupational cancer continue to increase owing to their lengthy latency period [3]. Table 1 presents carcinogens as classified by the first group by the International Agency for Research on Cancer (IARC). The first group is said to be an agent responsible for causing cancer in humans, while the second group has been labelled as a possible carcinogenic chemical to humans. For instance, it is estimated that almost 200 people exposures to cancer agents are either probable or certainly carcinogenic according to the IARC monographs. These are mostly within the work environment. Therefore, occupational influence on the burden of cancer has become a matter of grave concern in many countries [4-5]. Formaldehyde, benzene, ethylene oxide, and chromium (VI) were the most common agents that exceeded the Korean Occupational Exposure Limit (KOEL). These included formaldehyde, benzene, ethylene oxide, and asbestos, all of which were overexposed. Benzene, ethylene oxide, chromium (VI), asbestos, crystalline silica, radon, polycyclic aromatic hydrocarbons (PAHs), particles from truck exhausts, chromium, and nickel made up the list of the highest-level carcinogens [6].

Examples of numbers regarding occupational cancer include lung cancer due to the inhalation of asbestos, chromium, flu gases and tailpipe emissions. Cases of leukaemia due to exposure to an aromatic hydrocarbon or other solvents, silica and bladder cancer due to exposure to an aromatic amine salt [7]. In one study conducted in Canada, it was concluded that combined manufacturing, mining, and construction occupations had the greatest number of occupational cancer-related compensation cases, including lung cancer and mesothelioma [8]. It is, however, not the only one; LC, BC, LaC, PLC, and LeC constitute some of the 5 leading workplace cancers in the world. The institution of occupational safety and health (IOSH) [9-10], in Table 2)

Nurminen and Karjalainen revealed that occupationally caused cancers represented 8 per cent of cancers in Finland. It is higher among males

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at 14 per cent and lower among females at 2 per cent [11]. Kim et al. estimated that in 2005, about 1.2 per cent of all cancers and 1.8 per cent of all cancer deaths in Korea could be attributed to occupational carcinogens [12].

Table 1: Classification of carcinogens listed in the report of the International Agency for Research on Cancer [4-5].

Group	Classification	The Parameter	The Number of agents
1*	Most Likely Carcinogens to Humans	It has been proven to be a carcinogen to humans and experimental animals.	112
2A	Probably Carcinogens to Humans	Human carcinogenicity is well established, while experimental animal carcinogenicity is less well established.	65
2B	Probable Carcinogens to Humans	It is only slightly evidenced as a carcinogen to humans and experimental animals.	273
3	Most Likely Carcinogens to Humans	Insufficient evidence has been shown for carcinogenicity in experimental animals, but it is less proven in humans.	501
4	The agent is not likely to be a human carcinogen.	It is partially supported as an agent that does not cause carcinogenicity in humans or experimental animals.	1
Although it is not proven to be human carcinogenic, if it is strongly evidenced to be carcinogenic in experimental animals and known to cause similar human carcinogenic effects, then it can fall into category 1.			

Table 2: Most common forms of the cancer connected to workplace cancer [9-10].

Type of Cancer	Related to Occupational Exposure Estimated % (USA)
Lung	6.3-13%
Bladder	3-19%
Mesothelioma	85-90%(men); 23-90% (women*)
Leukemia	0.8-2.8%
Laryngeal	1-20% (men)
Skin Cancer (non-melanoma)	1.5-6% (men)
Sinonasal and nasopharyngeal	31-43% (men)
Kidney	0-2.3%
Liver	0.4-1.1 (vinyl chloride only; men)

II. Methodology

The literature review was conducted by reviewing the literature. Some of the subjects under study included hygiene, laboratory investigations, animal testing, and human studies. Internet sources and databases such as Google Scholar, Science Direct, and PubMed have been major sources for the literature review.These websites are http://scholar.google.com , www.sciencedirect.com and http://www.ncbi.nlm.nih.gov/pubmed/. We also looked at the databases:

Types of occupational cancer

Malignant mesothelioma: Malignant mesothelioma: The first study on asbestos as an occupational agent causing mesothelioma was conducted by the Korea Workers Compensation & Welfare Service (KCOMWEL) in 1993 [14]. There

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are two types of mesothelioma: pleural mesothelioma and Peritoneal mesothelioma [15]. 60 to 70 per cent of mesothelioma cases occur in the pleura, 30 per cent in the peritoneum, and 1 to 2 per cent in the pericardium. A man is more at risk of being affected by mesothelioma than women, and this makes mesothelioma a rare type of cancer. Cells lining the sperm tunica vaginalis, peritoneum, pleura, and pericardium can cause mesothelioma [16]. Cases of mesothelioma and lung cancers have been reported among people exposed to mineral particles and asbestos fibres [17]. Asbestos is a term used to refer to silicate minerals with fibres, mostly used in various industrial products such as asbestos-cement plates, brake pads for automobiles, electrical parts, and even amphibole asbestos (crocidolite, amosite, and chrysotile; Table 3). During the centenary period, these two types of asbestos were extensively used in commercial products. Human beings cannot tolerate any asbestos, and all the varieties of asbestos are said to cause carcinogenesis and fibrosis [18]. Asbestos causes tumour growth by promoting the development of cancer cells. It is also said to promote the production of growth factors, such as TNF and cytokines. Additionally, it damages DNA. Asbestos effects prove to be destructive in nature at the cellular level, and they also lead to cancer development. Health complications arising from asbestos exposure include damage to cells. Asbestos promotes cell proliferation via reactive oxygen and nitrogen species and cytokines.

Lung cancer: The information obtained through the data shows that one of the common benign tumours in the living system, and the reason for high cancer-related death rates in both genders, contributes up to almost 26% of deaths resulting from cancers in the United States and about 21% in the European Union in 2015 [21]. Based on statistics from the Canadian Cancer Society, 30,000 Canadians are reported to suffer from lung cancer. In contrast, 20,700 deaths have been reported, which is equivalent to 24% of all deaths occurring due to cancer in 2022 [22]. As shown in Table 3 [23], some specific carcinogens include asbestos, silica crystals, chromium hexavalent, and PAHs.

Skin cancer: Skin cancer is a common type of cancer worldwide. Melanoma, BCC (basal cell carcinoma) and SCC (squamous cell carcinoma) are the three major types of skin cancer. Both BC CELLs and SCCs are slightly more common than melanoma, but do not proliferate as much as the latter. However, the most serious and dangerous form of skin cancer is melanoma, which may contribute to a significant number of skin cancer deaths. The U.S. estimates for 2023 are that 58,120 men and 39,490 women will be diagnosed with melanoma. The overambitious threat is too much exposure to the sun's ultraviolet radiation (UV). People who work outside, or do outdoor activities, like farmers and construction workers, are especially at risk for developing skin cancer. Please refer to Table 3 below [25].

Bladder Cancer: Urinary bladder cancer is the most prevalent urinary bladder cancer, and the tenth most common cancer in the world. Among males, it is the sixth most frequent cancer and among females, it is the 17th most frequent cancer [26]. Several factors are associated with bladder cancer, including aromatic amines, petroleum products, herbicides, insecticides, and car exhaust emissions [27]. Bladder cancer incidence is estimated to be over 575,000 people in the world per year in 2020. Table 4 below depicts trends in countries with the highest mortality rates from bladder cancer [28].

Table-4: Showing total global bladder cancer mortality in 2021, Egypt and Tunisia had the highest total bladder cancer death rates in 2021. [27-28].

Ranking	**Nationalities**	**Nos.**	
	Globally	*213,635*	*2.1*
1.	Egyptians	7,120	8.7
2.	Tunisians	823	6.8
3.	Libyan	243	5.9
4.	Polish	5,043	5.5
5.	Malian	437	5.0
6.	Slovenian	642	4.9
7.	Latvians	282	4.4
8.	Sao Tome and Principe	6	4.2
9.	Algerian	1,881	4.1
10.	Serbian	961	4.1

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Breast Cancer: Breast Cancer is one of the deadliest forms of cancer in the world and the second most common cause of cancer mortalities after lung cancer. Remaining as one of the leading forms of cancer among females [29]. The number of new cases is estimated to be around 2.3 million people worldwide with breast cancer diagnosis in the year 2020, and the number of deaths due to breast cancer is estimated at 685,000 people worldwide in the year 2020. However, on her credit, not all these danger factors relate to breast cancer, and to her great credit. Male breast cancer is rarely diagnosed and accounts for approximately 0.5 – 1% of all breast cancer cases [30]. Some occupational groups, such as firefighters and police officers, may be at higher risk due to occupational exposure, as the authors noted in their studies. Studies reported in France suggest a link between phenols and breast cancer in females [31], and some association with breast cancer risk has been reported for various phenols while in the automotive repair industry [31]. Women may have a higher risk of breast cancer if they work at night, are exposed to radiation, or are exposed to toxic chemicals in the workplace at high temperatures. Some other studies also indicate that the breast cancer risk is comparatively low among women who are blind.

Prevention:

According to WHO, programs that target the elimination or reduction of known neoplasia hazards, such as occupational vulnerability, have proved to be the most effective way to combat the global health challenge of cancer [34]. To effectively tackle this global health challenge, more information on cases of occupational cancers that were exposed to the hazard factors responsible for neoplasms is required. Such information will help in the fight against occupational cancers globally [35]. Primary prevention, which has successfully prevented occupational cancers, entails minimising exposure to carcinogens in individuals and promoting the consumption of chemopreventive factors through dietary supplements [36]. Below are some of the most effective strategies to prevent occupational mesothelioma and lung cancer. This involves reducing exposure to carcinogens. Below are some simple tips on how to save lives from the unnecessary deaths associated with occupational cancer. Avoid smoking cigarettes in the workplace and asbestos in the environment. Produce benzene-free alternatives to organic solvents and develop technologies to convert carcinogenic chromium compounds into non-carcinogenic forms [37].Among the most effective approaches to minimising sun tans and maximising sun protection practices in the workplace, it is possible to distinguish three approaches: educational measures, behavioural measures, environmental measures, and providing workers with proper sun-protective clothing [38]. As stated in a study analysing construction workers' responses, educating these workers about sun exposure may be beneficial [39-40]. All these measures are an administrative approach that will help reduce occupational cancers caused by sunlight exposure. Timely diagnosis is significant for the treatment of any disease; hence, it increases the likelihood of successful treatment and improved survival. In this case, not only are survival rates enhanced, but the quality of life is also considerably improved. Bladder cancer, in turn, can be avoided by ensuring certain behaviours and lifestyle habits are excluded from a person's everyday routine. Here, it is necessary to highlight smoking cessation. Other measures include limiting contact with chemicals and drinking enough water.The breast cancer prevention program needs to include programs aimed at changing people's lifestyles, such assuch as exercise and fitness.

The use of preventive medicines like tamoxifen is recommended in cases of breast cancer prevention among some of the high-risk individuals. These are rare cases in which individuals have risk factors and have received the necessary counselling.

III. Results

The burden of occupational diseases in the present and future is obvious enough. Hence, it is quite certain that the problem of occupational cancer, too, will arise in the future due to exposures to cancer-causing agents. Lung carcinoma is a cause of lung cancer fatality and an anticipation of an increase in mesothelioma in the years to come. Malignant mesothelioma is known to be caused by mineral particles, and asbestos fibre is known to cause lung cancer. Skin carcinoma, the most serious cancer of the skin, has an important role in skin UV radiation, and malignant melanoma is the most serious type of skin cancer. Cutting oil is a cause of bladder cancer, and aromatic amines, herbicides, and insecticides are causes of breast cancer because of disturbance in the circadian rhythm.

The global chemical industry is one of the most complex industries in the contemporary era. It involves the production of chemicals by processing primary resources such as fossil fuels, water, minerals, metals, and other materials to produce various commodities in large quantities necessary to

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ensure the survival of our civilisation. According to statistics, the industry's global revenue in 2022 was around $ 5.7 trillion.

Among all industrial sectors worldwide, the Indian chemical industry tops the charts as the number one industry. According to statistics, this industry ranked fifth in 2023 in terms of income generated. Moreover, this industry is considered the most diversified, producing more than 80,000 varieties of goods. Additionally, this industry provides raw materials to other industries and serves as the foundation for the country's economic development. Annual investment in this industry has exceeded one billion US dollars since 2016, except in 2021, 2022, and 2024.

Thus, it has now become increasingly difficult to stop industrialisation due to chemicals, further raising the risk of occupational cancer. This means that the problem of prevention is equally important to both the pharmaceutical and chemical industries.

IV. Conclusions

The effects of occupational cancer can be felt among various sectors of people in relation to their gender and age group. Occupational cancers like mesothelioma, lung cancer, skin cancer, bladder tumours, and breast sarcoma are some of these quite hazardous cancer diseases. There exists a correlation between each type of cancer disease with chemicals, industrial occupation, exposure period and nature of job shift.

Through this study, we shall gain a better understanding of how cancers occur due to different occupations, chemicals, and job shifts. People should be made aware of the scientific approach to curing and preventing cancer. Impacts associated with various types of cancer, about age, gender, and racial differences, shall also be examined in this paper.

Through this study, workers across industries will be made aware of the types of chemicals present in their workplaces that are known to cause cancer.

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