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Review article

URINARY BLADDER CANCER WITH FOCUS ON OCCUPATIONAL DYE WORKERS

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ABSTRACT: Benzidine based azo dyes are proven carcinogens, mutagens and have been linked to bladder cancer of human beings and laboratory animals. The textile and dyestuff manufacturing industry are the two major sources for releasing of azo dyes. Various research groups have started work on genotoxic effect of textile dyes in occupational workers of textile dye industry. Bladder cancer is the most common form of cancer in dye industries. Most of people between age 50 and 70 group of are diagnosed with bladder cancer. Men are more likely than the women to develop bladder cancer. Bladder cancer is a disease in which abnormal cells multiply without control in the bladder. The most common type of bladder cancer begins in cells lining the inside of the bladder and is called transitional cell carcinoma. Tumor markers are substances that can be found in the body when cancer is present. They are most often found in the blood or urine. The review deals about the impacts of the industry dyes on human health**.**

Key words: Azo dyes, carcinogen, genotoxic, urinary cancer, tumour markers.

INTRODUCTION

Increasing industrialization and urbanization has lead to environmental pollution. The textile industry which use a variety of synthetic fibers to produce various fabrics. The recent data published by Textile Commissions Officer, there are about 1569 cotton textile industry in India, 20% of which are located in Tirupur, an Indian town in Tamilnadu where thousands of workers were employed. India exports textiles to 162 countries, which accounts for 38 percent of India's export (35 billion dollars in 2000). During production the cloth has to pass through various process and chemical operation. Large number of dyes, chemicals and auxiliary chemicals which used in textile industry is very potent carcinogen. In particular benzene dyes have caused bladder cancer. It is common for workers to eat, drink and smoke during the job with dye stained hands and there by getting a inadvertent exposure to dyes by ingestion which leads to allergic reactions in lungs, skin, bladder and intestine cancer. Bladder cancer is amenable to biomarker development because they are secreted in urine.

IMPACT OF DYES

Various research groups have started work on genotoxic effect of textile dyes in occupational workers of textile industry. A wide variety of azo dyes are being increasingly used in textile dyeing and printing process. Azo dyes are very toxic and carcinogenic to human beings. The workers in the dye units are suffering from various disease like Dermatitis, Liver and kidney damage, itching, respiratory disorders, Bronchitis, cancer etc. Majority of human cancers are known to arise as a direct consequence of environmental exposure to mutagenic, carcinogenic agents mainly through diet, habit and occupation. Their toxicity studies diverge from test with the aquatic organism to test with mammals (Yasuhiko 2001). Bladder cancer is the most common form of cancer in United States, with more than 50,000 new bladder cancer cases diagnosed each year. Approximately 10,000 of the new bladder cancer cases diagnosed each year and the result of work place exposures to hazardous chemicals (Thomas et al., 1999) .Most people are between 50 and 70 years are diagnosed with bladder cancer. Men are three more likely than the women to develop bladder cancer (Thomas et al., 2001).The two major causes of bladder cancer have been recognized to be cigarette smoke and occupational exposure to aryl amines. These compounds are present both in tobacco smoke and in the dyes used in textile production.

Bladder cancer is a disease in which abnormal cells multiply without control in the bladder. The most common type of bladder cancer begins in cells lining the inside of the bladder and is called transitional cell carcinogen (WHO, 2001). Bladder cancer is the fourth most common type of cancer among men and the eighth most common among women (Arnulf Stenzl, 2005). Several bladder tumor markers show higher sensitivity than cytology. Proteomic and gene profiling approaches are being used to find new biomarkers to assist in the molecular profiling of bladder cancer (Lokeswar, 2011). Tumor markers are substances that can be found in the body when cancer is present. They are most often found in the blood or urine and most tumor markers are proteins. The marker is usually found by combining the blood or urine with man-made antibodies that react with the tumor marker protein (Harris, 2007).

Dye industry workers especially smokers suffered from chromosomal aberration and higher incidence of DNA damage (Natarajan, 2007). The rapid pace of technological development in textile industries and practice of bleaching of dyes have affected the ecological balance (Jeyapaul, 1998).Untreated effluents of industries induce Chromosomal abnormalities in bone marrow cells of mice, the frequency of abnormalities increased with increase of doses (Chaurasia, 2005). Reports are very rare by associated with tumour markers oriented research in India. Two textile dyes from Sanganer (Rajasthan) were tested for their genotoxicity, using an *in-vitro* Ames assay and results showed that the dyes being used in textile industries can induce genotoxic responses (Mathur, 2005).The possible genotoxic health risk and environmental genotoxicity due to the textile industry effluents made this study to be carried out using the Ames Salmonella/ Microsome mutagenicity assay. The results clearly indicated that the effluents and the surface water of Amani Shah Drainage have high mutagenic activity (Mathur, 2005).

Conducted a metal analysis of epidemiological studies for industry workers published after 1990 indicates that after inclusion of more recent studies, the proportion mortality rate (PMR) for bladder cancer remained significant only in dyers (Mastrangelo et al., 2002). IARC have concluded there is limited evidence that working in the textile manufacturing industry entails a carcinogenic risk, the elevation being based mainly on finding among dyers.

Impact of benzedrine

Toxicological studies reveal that benzidine has been the most important carcinogenic aromatic amine directed towards the human bladder (Golka et al., 2004). The benzidine has been produced on a very large scale and used primarily in dye production and to a much lesser extent as a hardener in rubber industry one of the most important industrial facilities in Europe for benzidine production before 1967 suffered from bladder cancer (Lewalter et al., 1992). In their cohort of workers potentially exposed to benzidine from a single chemical manufacturing facility, confirmed a high risk of bladder cancer among benzidine exposed workers even years after exposure had ceased (Rosenman and Reilly, 2004). High carcinogenic potential of benzidine to the urinary bladder is also fundamental to elevation of bladder cancer risks in workers exposed to benzidine – based dyes and colourants with much lower exposure (You et al., 1990). Tobacco smoking and occupational exposure to aromatic amines are the two major established environmental risk factors for bladder cancer. It has been suggested that up to 40 percent of all male and 10 percent of female cases might be a serious to this exposure (Cooper et al., 2005; Peluchchi et al., 2006).

Impact of aromatic amines

From Analyzes of 11 case control studies in six European countries, the results concluded that about 5-10% of bladder cancer in European men could be attributed to occupational exposure, including but no specifically aromatic amines and that the results indicated that improvement in working decades in Western Europe preventing a significant number of bladder cancer cases caused by exposure to occupational carcinogens, particularly aromatic amines (Kogevinas et al., 2003). Aromatic amines have been used as antioxidants in the production of rubber and in cutting oils, as intermediates in azo dye manufacturing and as pesticides. They are a common contaminant in several working environment including the chemical and mechanic industries and aluminum transformation. Aromatic amines are formed as combustion products and are present in both main stream and side stream tobacco smoke is the most common and widespread source of exposure to aromatic amine (Talaska et al., 1991).

Impact of aryl amines

Arylamine–basic dyes are used widely used in the textile industry. Arylamines contaminated the ambient air where smokers are present (Maclure et al.,1980). A cohort study by investigated a plant produced a variety of chemicals, including aryl amines the study reported at the observed association between bladder cancer cases and exposure to aryl amines increases with increasing exposure (Ouellet et al., 1996).

Impact of beta – napthalamine

Since 1970's health and safety measures have been widely applied in the rubber industry by substituting some chemical agents and controlling exposure to Beta naphthalamine and antioxidants containing 2 naphthalamine (Kromhout et al., 1994). Recent studies showed excess risk of bladders cancer in workers in the rubber industry with no recorded exposure to 2 naphthylamine. It has been assumed that exposure in manufacturing industry for chemicals not covered in CAREX ceased in 1962, when industrial use of benzidine was banned in the UK, So that the number exposed was estimated for 1955 – 1962 only 2 naphthylamine was banned in 1949. The beta – naphthalamine was also used in the British rubber industry up to the end of 1949, when it was withdrawn because it was deemed to have caused an excess of bladder tumors' both in product manufacture and use (Vineis et al., 1991). The increases risk of bladder cancer in workers exposed to 2 naphtha lamine benzidine and 4 aminobiphenyl, but found some were poorly designed and for based on very small numbers (Swerdlow et al., 2011). Exposure to carcinogenic intermediates in the dyestuffs industry decreased from 1935 and especially after 1945, and the use of 1 and 2 naphthalamine in the rubber industry stopped in 1949.

Impact of coal carbonates and tar

Studies that looked at eight gas boards in the UK, a two fold increased risk of bladders cancer was reported among workers employed in coal carbonization, while no such excess was reported among other groups of workers (Doll et al., 1952). Epidemiological studies have indicated an increased risk of urinary bladder cancer among workers exposed to coal tar pitch volatiles for long periods in the aluminum industry (Trenblay et al., 1995).

Impact of 4 chloro- o- toluidine

Studies reported that the 4 chloro -o- toluidine production is highly carcinogen and subsequent studies have shown increases in bladder cancer (Popp et al., 1992). Recent evidences suggest O-toluidine is a bladder carcinogen and Rubino et al. (1982) found a 62 fold increase in bladder cancer risk in workers exposed jointly to O toluidine and 4, 4' methylene (2-methylaniline). More recent study conducted by the National Institute for Occupation Safely and Health found high relative risks 4- Chloro -O- toluidine production is highly carcinogenic and is associated with increased bladder cancer risk 1988 (Stasik, 1998). Studies have found a positive association between exposure to PAHs and bladder cancer when the commutative exposure index restricted to exposure received thirty or more years before observation (Romundstad et al., 2000).

Impact of Urothelial Carcinogen

Urothelial carcinogens have been used in dye industries. It does not follow that they will have been used in all parts of this industry and investigated the role of occupation exposure in the risk of developing urothelial cancer in a hospital bases case – control study in the west midland (Sorahan et al., 1994).

Impact of diesel engines

A case control study showed an elevated risk for bladder cancer for male drivers of tractors/trucks typically fueled by diesel with a significant positive trend in risk with increasing duration of employment. This was higher than among drivers of other types of trucks and there were no increases for taxicab or bus drivers (Colt et al. 2004). Elevated risk is observed only after exposures to diesel engine exhaust one or more than l20 years (Olsen et al., 1987). A case study from reported that mortality from bladder cancer does not increase in studies of railroad workers and no pattern of excess of bladder cancer risk emerges from cohorts studies of workers exposed to diesel engine exhaust. Workers exposed to coal tars and related products which included tar distillation shale oil extraction, creosote exposure, carbon black manufactures carbon and graphite electrode manufacture, chimney sweeps and calcium carbide production (Boffetta et al., 1997).

Impact of rubber

Elevated bladder cancer risks, adjusted for smoking for rubber manufacturing and curing (Bolm-Audorff et al., 1997). Similar type of results was observed and there is a link between urothelial tract cancer and the UK rubber industry (Case and Hosker 1954). Occupational health Decinnial Supplement which examined mortality (1979-1989) (1982-1990) and cancer incidence (1981-1987) in men and women aged 20-74 years in England and Wales. It concluded for many diseases, difference in mortality between job groups appeared to be determined mainly by non-occupational influences. Occupations that had a high proportion mortality rate (PMR) for bladder cancer generally entailed exposure to known bladder carcinogens (Drever, 1995). The rubber manufacturing has the highest proportional registration rate (PRR) of all job groups in men and brewery workers manufactures. The proportional registration rate for men and women are 226 (58 registrations) and 350 (7 registrations) respectively other occupational potentially exposes to chemical compounds, such as aromatic amines (used in the manufacture of dyes, pigment rubber etc) may also be at increases risk. The risk for men described as plastic goods makers, which is nearly twice that expected at 187 (19 registrations) is particularly not worthy.

Impact of hair dressers and hair dyes

Elevated risk of bladder cancer has been observed among occupation exposed to hair dressers. Since early 20^{th} century, hair dressers have made use of a wide range of products, including hair colorants and bleeches, shampoos and conditions several thousand chemicals are found in formulation of these products.

Hair colorants are classified as permanent (Primarily aromatic amines and aminophenol with hydrogen peroxide) Semi-permanent (nitro substituted aromatic amines, aminophenol, amino anthraquinones and azo dyes, and temporary (high molecular - weight or insoluble complexes and metal salts, such as lead acetate (La Vecchia et al., 1995). The numerous industrial chemicals used in hair colorant have varied overtime, only permanent and semi permanent hair, colorants are used to significant extent by hairdressers (IARC, 1986). Conducted a follow up study of a cohort of 45,690 hairdressers from Sweden and analyzed all of their malignancies over a period of 39 years. In their study, Czene reports that the highest risk was an SIR of 2.56 for urinary bladder cancer in male hairdressers working in 1960 and followed up during 1960 to 1969. The risk decreased to 1.25 when these hair dressers were followed for the whole period of 1960 to 1968 (Czene et al., 2003).

Impact of paints

The study analysis of more than 42000 American painters bases on union records, confirmed that risks of bladder cancer which were high comported to US population in metal analysis of 13 case control studies found a standardized mortality ratios of 1.3. The study has used of more than 42,000 American painters bases on Union records, confirmed that risks of bladder cancer was high compared with more than 14000 organized non painters (Chen et al., 1998).

Impact of plastics

There is an independent support for the hypothesis that working with plastics may present excess risks of bladder cancers as the plastic industry covers a wide range of chemical process (Najem et al.,1982). A case – control study using data from the National Bladder cancer study then found that women who had worked in plastics industry has a 3.3 fold increases bladder cancer risk, with plastics and rubber industries, increases risk for bladder cancer was found for men in mixing filtering, grinding and other dusty operations (Zahm et al., 1987).

Impact of smoking

Analyzed the in US cigarette smoking has been estimated to account for about 40% of bladder cancer deaths each year about 50% male deaths and 28% of female deaths. IARC in 1986 stated that, the proportion of bladder cancer cases attributable in most countries with a history of prolonged cigarette is of the order of 50% in men and 25% in women (Fellows et al., 2002). Found excess risk of bladder cancer in seven cohort studies. Risk of workers first employed after the 1960s was examined in three studies. A twofold excess risk was found the largest study. Excess risks with odd rations ranging from 1.5 to 5.7 after adjusted for potential confounding factors such as smoking were found in 11 care control studies (Weiland et al., 1996).

CONCLUSION

In conclusion, textile, rubber, hair dressers, workers are among the major occupations contributing to occupational bladder cancer in men. Smoking in particular cigarette smoking is a well known risk for diseases including bladder cancer. Identifying and estimating exposed workers in emerging high risk occupations and industries are of primary importance in order to periodically reconsider risk assessments.

Conflict of interest statement:

We declare that we have no conflict of interest.

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