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Review

Work-Related and Occupational Liver Diseases

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Abstract

The liver is an organ responsible for the metabolism of drugs, many chemicals and various nutrients in the body. For this reason, it is inevitable that the liver will be affected by many factors that are exposed at work. Epidemiological data on occupational liver diseases are insufficient. It is always important to take an occupational anamnesis and evaluate the risks exposed while evaluating liver functions in periodic examinations at work, in hospital polyclinics.

Keywords: Chemicals at work, etc. factors, occupational disease, liver diseases

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Definition of occupational diseases in the legislation; are the cases of temporary or permanent illness, physical or mental disability, which the insured suffers due to a recurring reason due to the nature of the work or the performance of the work.[1] Occupational diseases are diseases in which many causative factors and other risk factors play a role in the workplace. Etiology is complex. The causative agent of the disease does not have to be in the workplace. Occupational diseases are diseases in which many causative factors and other risk factors play a role in the workplace. Etiology is complex. Occupation causes, aggravates, accelerates or exacerbates illness and may reduce working capacity. Occupational diseases are more common than occupational diseases. Even if they do not arise directly from the workplace, they are affected by factors in the workplace.[2]

The liver has many functions in the detoxification of toxins, alcohol and drugs in the blood, and in processing, synthesizing and storing various carbohydrates, lipids, proteins, vitamins and minerals.[3]

Many factors such as alcohol addiction, various drugs, diets and systemic diseases such as heart failure, viral hepatitis, industrial chemicals such as occupational vinyl chloride, fungi containing hepatotoxins (amatoxin) (Amanita phalloides and Amanita verna) cause liver damage.[4]

Occupational liver diseases may develop due to acute high dose and chronic low dose exposures in the workplace. While acute high-dose exposure is easy to define, the cause can be difficult to identify in low-dose chronic exposure. Epidemiological data in occupational liver diseases are insufficient. The limited awareness of hepatologists, the absence of pathognomonic findings for diagnosis, the absence of a sensitive biomarker, and the accompanying many other factors make it difficult to diagnose occupational liver disease.[5]

According to the factor causing occupational disease; chemical causes, physical causes, biological causes and dusts. According to the factor causing occupational disease; chemical causes, physical causes, biological causes and dusts. In this article; The aim is to draw attention to occupational factors in liver diseases by classifying them according to factors and examining various reviews, research and case reports. It is to evaluate whether people with liver disease are exposed to these factors, to prevent exposure if there is, and to protect healthy workers in the same environment from this exposure.

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Chemical Factors

Vinyl Chloride

Vinyl chloride monomer (VCM) is mostly used in the production of polyvinyl chloride (PVC), a widely used plastic material. Occupational exposure to VCM occurs primarily in the VCM/PVC manufacturing and processing industry. Occupational exposure to VCM causes liver disease. Studies reviewed by IARC and published after IARC evaluation confirm the association between occupational VCM exposure and chronic liver disease and HCC (Hepatocellular Cancer). More research is needed to assess disease risk in the lower cumulative exposure range and to explore the duration of exposure and risk. Programs aimed at reducing alcohol consumption and body weight among exposed workers and identifying and treating chronic viral infection should be implemented.[6]

The relationship between genetic polymorphisms and genetic susceptibility in liver lesions of workers exposed to VCM at a VC polymerization plant in China was investigated. As a result; The incidence of liver ultrasonography abnormalities increases significantly as the cumulative exposure dose increases. Genotypes of metabolic enzymes (CYP2E1 c1c2/c2c2, null GSTT1 and ADH2 1-1) play important roles in VCM metabolism. It has been thought that CYP 2E1, GSTT1 and ADH2 polymorphisms may be the main cause of genetic susceptibility in liver damage caused by VCM.[7]

One review noted that there was a causal link between high occupational exposure to VCM (among autoclave workers) and hepatic angiosarcoma, and that in a joint reanalysis of approximately 10,000 US workers exposed to VCM, 63 deaths from hepatic angiosarcoma were reported after an average follow-up of 40 years.[5]

Acrylonitrile, Butadiene and Styrene

Cytokeratin 18(CK18) and Cytokine Elevation in Serum is recommended in demonstrating the High Prevalence of Occupational Liver Disease in Elastomer/Polymer Workers with High Exposure to Acrylonitrile, Butadiene and Styrene. CK18 is a new serological biomarker for occupational liver disease. It has been shown that serum CK18 and proinflammatory cytokines are elevated in chemical workers with toxicant-associated steatohepatitis (TAH) due to exposure to high levels of vinyl chloride. 82 chemical workers were evaluated. CK18 was determined by ELISA and proinflammatory cytokines were measured by multianalyte chemiluminescent detection. Mean routine liver chemistries (aspartate aminotransferase, alanine aminotransferase, total bilirubin, albumin, and alkaline phosphatase) were within the normal range. Of the 82 total subjects, only 3 had any single laboratory abnormality detected by these tests. However, potentially out of 4 cases, 39% (32 out of 82) had elevated CK18 levels not explained by alcohol or obesity. The CK18 elevation pattern was consistent with TASH in most of the cases (78%). These workers had increased TNFα, IL-6, IL-8, MCP-1 and PAI-1 compared to those with normal CK18 levels. It has been shown that the prevalence of occupational liver disease and TASH is high in elastomer/polymer workers with high proinflammatory cytokines.[8]

Trichloroethylene (TCE)

It has been widely used for decades for degreasing and dry cleaning metal parts.[5]

Trichlorethylene (TCE) is a common environmental pollutant that is carcinogenic when administered in high, chronic doses to certain species of rats.[9]

Tetrachlorethylene and Perchlorethylene

Tetrachlorethylene or perchlorethylene (PCE), a common industrial solvent and environmental pollutant, is primarily used in the dry cleaning industry, metal degreasing processes, and the textile industry. They are chlorinated solvents. It is primarily taken into the body by inhalation and less frequently through the skin and ingestion.[10]

PCE is toxic to the liver, kidneys and central nervous system and may be carcinogenic to humans.[11]

A 39-year-old male patient who was admitted to the hospital with acute liver failure due to tetrachlorethylene exposure is mentioned. A patient working in a leather factory was cleaning animal hides using PCE. He mentioned that he doesn't use his protective equipment all the time and that the room is poorly ventilated. He was admitted to the hospital with complaints of nausea, vomiting, loss of appetite and jaundice. Hepatic necrosis was observed in the histological examination of the liver. After that; Liver biopsy showed postnecrotic cirrhosis. Physicians should be aware of the possibility of acute liver failure caused by tetrachlorethylene. Early plasmapheresis may be effective in individuals with sufficient capacity for hepatocyte regeneration.[12]

Dimethylformamide

N,N-dimethylformamide (DMF) is an organic solvent widely used in the manufacture of synthetic leathers, films, fibers, surface coatings and polyurethane materials.

A 35-year-old patient working in a glove manufacturing factory exposed to dimethylformamide solution with bare hands and developing autoimmune hepatitis was reported.[13]

In an experimental animal study, mice were given 1.26 g/kg DMF for 90 days. Pathological examinations on the livers of mice showed hypertrophy and swelling in their hepatocytes, and inflammatory cell infiltration in the liver was also demonstrated. An increase in serum AST and ALT levels was observed.[14]

Volatile Organic Compound (VOC) and Metal

Benzene, toluene, ethylbenzene, xylene, styrene (BTEXS) and metals were measured in blood samples collected between May 2012 and July 2013 from volunteers participating in home visits. Non-smoking adult men without liver disease or a history of heavy alcohol consumption were included. For the general sample, heavy metal exposures were associated with liver damage (lead only) and/or systemic inflammation (lead and cadmium). In the obesity subgroup, liver injury was positively associated with exposure to lead, cadmium, and benzene; increased systemic inflammation with exposures to lead, cadmium, benzene, and toluene; and leptin were found to be inversely proportional to lead exposure.[15]

Pesticide

Research on pesticides has been incoherent with the evidence, though associated with liver enzyme and functional impairment. A study of 15 studies on pesticide exposure and liver cancer (mostly HCC), particularly those based on self-reported exposure and occupation, work-exposure matrices, and rural location, found no associations.

Biomarker-based studies in Chinese populations suggested that certain organochlorine serum levels, particularly dichlorodiphenyl trichloroethane (DDT), may be associated with an increased risk of liver cancer.[5]

Metabolic activation of pesticides in the liver can result in highly reactive intermediates that can impair a variety of cellular functions. Information on the effect of pesticide exposure on liver function is limited.[16]

Herbicide; The Agricultural Health Study (AHS) was a prospective cohort study of licensed private and commercial pesticide applicators in Iowa and North Carolina registered between 1993 and 1997. A positive correlation was found with liver cancer in agricultural health workers who used metallochlor-containing herbicides.[17]

In a cohort study of 106 agricultural workers, pesticide exposure was found to be associated with increased AST levels.[18]

Recent exposure to the organochlorine pesticide, dichlorodiphenyltrichloroethane (p,p'-DDT), has been considered to increase the risk of HCC. The study included 473 HCC cases and 492 controls. We evaluated the risks of HCC associated with serum p,p'-DDT and p,p'-DDE in a population at high risk of developing HCC. The results suggest that high p,p'-DDT levels, especially among men, may be associated with an increased risk of HCC. There was little evidence of association between p,p'-DDE and HCC in men or women.[19]

An increased risk of developing liver cancer was observed with increasing serum DDT concentration.[20]

Biological Factors

Viral Hepatitis

Hepatitis B (HBV) and Hepatitis C virus (HCV) infections are important health problems with high morbidity and mortality, which are common all over the world.[21]

Currently, there are effective treatments for curing hepatitis C and suppressing viremia in patients with chronic hepatitis B. However, residual lesions (fibrosis, steatosis) may persist in patients with eradicated or controlled liver infection.[5]

One of the most important ways of transmission of HBV and HCV infections is blood and blood products. Healthcare workers are also at risk in terms of many infectious diseases that can be transmitted from patients and the physical environment in their daily work environment. The importance of hand washing, using gloves, disinfection and serological tests, and the adequacy of their knowledge and practices in the disposal of infected wastes are very important.[21]

Viral hepatitis; work accident, needle stick etc. result develops. In the list of occupational diseases; It is included in Group D Occupational Infectious Diseases (D-4, Infectious diseases in people who are especially exposed to infectious diseases due to occupation).[22]

The hepatitis A virus (HAV) should be considered an occupational hazard. Few studies have been done. In a study conducted in Romania, hepatitis A was found to be a significant hazard for sewer workers.[23]

Dusts

Asbestos

It is known by everyone that asbestos generally causes asbestosis and mesothelioma, lung cancer. It has been stated that asbestos may be a risk factor for intrahepatic cholangiocarcinoma (ICCA).[24]

BRCA1-associated protein-1 (BAP1) mutations are associated with increased susceptibility to developing different types of cancer, such as mesothelioma, renal cell carcinoma. Occupational asbestos exposure was reported in a female patient who developed ICCA at the age of 47 and was

found to have a mutation in the BAP1 gene. His anamnesis revealed no risk factors associated with the development of iCCA, except for low occupational asbestos exposure, which was assessed by a standard questionnaire during his work in industrial kitchens (approximately 15 years). In this article, it was pointed out that further studies are needed to confirm whether iCCA can be included in BAP1-TPDS cancer phenotypes and whether minimal asbestos exposure can facilitate the development of this malignancy in individuals carrying BAP1 germline mutations.[25]

In case-control analysis; It was aimed to determine the relationship between occupational asbestos exposure and the risk of developing hepatic cholangiocarcinoma (CC). 100 patients with CC (41 ICC (intrahepatic) and 59 ECC (extrahepatic)) were studied in a cohort with control groups between January 2006 and December 2010. In the study population, 54 subjects were classified as having been previously exposed to asbestos. The study found that exposure to asbestos increased the risk of ICC in workers, regardless of socioeconomic status and smoking history. In addition, there was significant evidence of an increased risk of ECC among workers exposed to asbestos. These findings suggested that asbestos has a role in the pathogenesis and possibly increased incidence of ICC.[26]

In a case-control study; 1458 cases of intrahepatic CC (ICC) and 3972 extrahepatic CC (ECC) occurring among subjects born in 1920 or later in Finland, Iceland, Norway, and Sweden were studied. Asbestos exposure for each subject was estimated by applying the NOCCA occupational exposure matrix (JEM) to current occupational codes. The study found an increased risk of ICC among subjects with past occupational exposure to asbestos, and no association was observed between occupational exposure to asbestos and ECC.[27]

Conclusion

Due to insufficient epidemiology data, the number of articles and publications is insufficient. Particularly, physicians who are involved in the diagnosis and treatment of liver diseases have a great responsibility. Each patient's work history, habits and drug history should be taken. When exposure to factors affecting liver functions directly or indirectly in the workplace are observed, they should be referred to an occupational diseases specialist. Occupational physicians, as always, have great responsibilities. The person should be followed carefully during employment and periodic examinations. The habits of the workers, the drugs they use, their hobbies, and their chronic diseases should be well researched. Work environment risks should be well evaluated and necessary precautions should be taken. A surveillance system should be developed to identify occupational agents of liver diseases. Data must be constantly collected and analysed. It should be distributed to those who need and notify for health promotion, improvement and/or disease control.

Disclosures

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