

Occupational Hazards in Histopathological Labs due to Xylene

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Abstract: *Haematoxylin and Eosin form the backbone of everyday pathological diagnosis. It is the most common staining technique used in histology. H and E plays a key role in the recognition of the tissue types and the morphological changes if any that form the contemporary of cancer diagnosis. The diagnosis of most malignancies is based largely on this procedure. Due to its high efficiency the staining procedure has been unchanged for over 150 years.(1) Apart from haematoxylin and eosin, the components in the staining procedure include xylene and other graded alcohols. These chemicals are used to carry out steps like rehydration and dehydration during the staining procedures. Xylene forms an inseparable part of a pathology laboratory. The historical use of xylene in the histology laboratory is an example of a failed substitution. The major drawback in histopathological labs is the toxicity caused by the chemicals used, problem of disposal of the hazardous chemicals used , which in turn lead to hazards to the workers in the histopathological laboratory.*

Keywords: xylene, histopathology

1. Introduction

Haematoxylin and Eosin form the backbone of everyday pathological diagnosis. It is the most common staining technique used in histology. H and E plays a key role in the recognition of the tissue types and the morphological changes if any that form the contemporary of cancer diagnosis. The diagnosis of most malignancies is based largely on this procedure. Due to its high efficiency the staining procedure has been unchanged for over 150 years.(1) Apart from haematoxylin and eosin, the components in the staining procedure include xylene and other graded alcohols. These chemicals are used to carry out steps like rehydration and dehydration during the staining procedures. Xylene forms an inseparable part of a pathology laboratory. The historical use of xylene in the histology laboratory is an example of a failed substitution. The major drawback in histopathological labs is the toxicity caused by the chemicals used, problem of disposal of the hazardous chemicals used, which in turn lead to hazards to the workers in the histopathological laboratory.

2. Exposure to the Xylene

Exposure to various chemicals that lead to ill-health of the workers occur in histopathological labs. Exposure to xylene in a laboratory occurs during tissue processing, deparaffinization of tissue sections, cover slipping, cleaning tissue processors and recycling. (2) Exposure to xylene can occur via inhalation, ingestion, eye or skin contact. It is primarily metabolized in the liver by oxidation of a methyl group and conjugation with glycine to yield methyl hippuric acid, which is excreted in the urine. Smaller amounts are eliminated unchanged in the exhaled air. There is a low potential for accumulation.(3,4) Xylene causes health effects from both acute and chronic exposure. The type and severity of the health effect varies with different individuals depending upon the amount of chemical exposed to and the time of exposure. Individuals also react differently to different levels of exposure.(5)

3. Effects on the Nervous System

The main effect that results from inhalation of xylene vapor, when the exposure is limited to 100-200 ppm is depression of the central nervous system, with symptoms such as headache, dizziness, nausea and vomiting. These effects are reversible and become more serious and noticeable as the length of time of exposure increases.(5) Xylene impairs development of adaptation and tolerance during the exposure.(6) Xylene, like most organic solvents, affects the central nervous system, the same way drinking alcohol does. Exposure between 800-1000 ppm may lead to symptoms such as giddiness, confusion, clumsiness, slurred speech, loss of balance, ringing in the ears. When exposure exceeds 1000ppm, it may lead to sleepiness, loss of consciousness and finally death. Changes in the levels of various neurotransmitters and lipid composition have also been observed in several brain areas following acute and intermediate duration exposure to xylene. It is unclear whether these represent direct effects of xylene or are secondary changes resulting from nonspecific central nervous system depression. (8,9)

4. Exposure to the Eyes, Nose and Throat

The most common form of xylene exposure is eye exposure to xylene vapour. People who are exposed may experience pain, redness, swelling, tearing and hazy vision due to damage to the surface of the eye after exposure to the vapor. Irritation of the nose and throat can occur at approximately 200 ppm exposure after 3-5 min.(5) These are reversible, which may heal within a few days.

5. Effects on the Skin

Skin exposure to xylene may cause minor skin irritation. If xylene is absorbed into the skin, effects such as dermatitis, flaking, cracking, redness, swelling, pain, itching and dryness may occur. Damaged skin may allow greater absorption of chemicals.(10,11) Xylene easily penetrates

most ordinary clothing and can become trapped in ordinary gloves and boots. Xylene trapped in the clothing can cause burns and blistering.

6. Effects on Lungs, Liver and Kidney

Exposure to xylene at levels of 200 ppm or greater can irritate the lungs, which causes chest pain and shortness of breath. Extreme overexposure, in a confined space can result in pulmonary edema, a potentially life-threatening condition in which the lungs fill with fluid. However, there is no evidence that repeated, low-level exposure has any long-term effects on the lung.(5) At very high level of exposure, xylene can cause injury to liver and kidneys, which normally follows damaged CNS. Low-level occupational exposure does not affect the liver and the kidneys.(12)

7. Effects on Git and Musculoskeletal System

Symptoms of nausea, vomiting and gastric discomfort are observed, which are reversible. It was observed that workers exposed to xylenes (TWA 14 ppm) reported reduced grasping power and reduced muscle power in the extremities more frequently than the unexposed controls. This is due to the neurological effect rather than a direct effect on the muscles.(12)

8. Effects on Reproductive System

Xylene inhaled by a woman can reach a developing fetus and can contaminate her breast milk.

9. Raynaud's Phenomenon

Study identifies increased incidence of Raynaud's phenomenon among histopathological laboratory workers. Scientists who work with toluene and xylene double their chances of developing a vascular condition known as Raynaud's phenomenon.(13)

10. Preventive Measures:

- Substitution
- Local exhaust ventilation
- Proper protective equipment (14)

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