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Editorial

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Formalin-The Pathologist Preservative

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Editorial

When I first began my Pathology residency, my then chairman joked that most Pathologists either died early from the toxic formaldehyde fumes or lived long, long lives from being so well preserved with formalin. Joking aside, formalin is the life blood, if you will, for the pathologist because it allows tissue to resemble as accurately as possible the form that it holds in vivo [1] but exposure to formalin is not without risk. And while I refer to the dangers for pathologists, formaldehyde exposure is not limited to this occupation. The US Department of Health and Human Services lists about 225 occupations which may be affected which include iron foundry workers, dye stuff operators, plywood industry workers, morticians, anatomists, and even sailors [1]. In the pathology laboratory, formalin is used to preserve tissue and exposure is not just from use as a preservative but also from accidental splashes and spills. In my own experience, I have spent many teary-eyed, nose-dripping episodes of cleaning up excess formalin splatters and overflows. The exposure time has ranged from minutes to hours.

Formaldehyde is a colorless gas and the concentrated water solution is called formalin [2]. Exposure is both local, at the site of initial contact (respiratory, skin, etc.) and general, resulting from absorption [2], Allergic and irrigative reactions may occur upon exposure [3], as short-term problems, but greater concerns are the long term risks. In April 1981, the US National Institute of Occupational Health and Safety recommended that formaldehyde in the workplace be handled as a potential occupational carcinogen [1], However, the data concerning formalin exposure and cancer is not consistent [3], There have been reported malignancies such as brain tumors, hematopoietic neoplasms, nasopharyngeal cancers, and pancreatic cancers [3], However, according to a Swiss study in 2012 on the health risks of pathologists, malignancies were very rare and no brain tumors or hematopoietic neoplasm's were reported [3], But even in that study it was cautioned that there may have been possible recall bias, selection bias, and small numbers [3], A report from the 1980s stated that formaldehyde at a level of 4 ppm was found to be mutagenic in diploid human lymphoblast's in culture [1], But in another study, no chromosome abnormalities were found in a group of 15 workers exposed to formaldehyde over an average of 28 years [1].

In review of the literature concerning exposure to formaldehyde, there is discrepancy between epidemiological statistic data and minimal clinical observation from physicians who observed patients or groups of patients [2]. In 1989, the American Medical Association summarized data on formaldehyde occupational exposure and stated, "There is a controversial opinion in the view of many industry and academic scientists" [2]. Despite what may not be definitive proof of carcinogenicity, however, the EPA and OSHA still assume formaldehyde to be a potential occupational carcinogen and have appropriate regulations [2], OSHA sets the limit for airborne exposure to formaldehyde to 0.75 ppm in an 8-hour time-weighted average (Officially 1 ppm) and 2 ppm for a 15-minute Short-Term Exposure Limit [2] OSHA also requires monitoring by an employer of exposure to formaldehyde. A passive badge device is worn to sample the formaldehyde content [2]. In addition; there are protocols for proper handling of spills and proper ventilation.

I believe that formalin exposure in pathologists (or other occupations) is a good example to exercise appropriate caution even when scientific proof of direct carcinogenicity is not present. Our regulatory agencies have obviously taken the matter very seriously. We have seen what happened with the tobacco industry. Over the years the link between smoking and lung cancer became well known and delay of the warning was a public health disaster. And while the occurrence of certain malignancies in pathologists does not mean causality because of formalin, we must not take exposure to this chemical lightly. It is well known, for example, that when formaldehyde reacts with hydrogen chloride it produces

Bis-Chlormethylether (BCME) which is a known carcinogen [1]. It is also known that formaldehyde is mutagenic from experiments with fruit flies, flowering plants, fungi, and bacteria [1].

There isn't much debate about the short-term irritation to the respiratory tract or skin from formaldehyde exposure. Eye irritation, tears, some sensations of irritants smell are common in most people [2], But the issue of greater concern is carcinogenicity. And while it's true that I know a lot of old pathologists, it still behooves us to err on the side of caution and treat formalin with the respect or, at least, concern of any potential bad actor.

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