Systemic effects of formalin on medical and dental students: A questionnaire study

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INTRODUCTION

Formalin is an extensively used preservative especially in the field of medicine for the preservation of the cadaver’s alias specimens for the study purpose. It is a colorless and irritative fluid that is composed of 37% formaldehyde in water, and it is widely used as a preserving agent in biological specimen.¹ The evaporated formalin from the embalmed cadavers turns into fumes and causes many harmful effects. August Van Hobman a British scientist discovered formalin in 1856.² Being a noxious flammable gas, it is also soluble in water and its health hazards are not secret.

The exposure is primarily through inhalation where the lungs absorb the formalin although it is also exposed to our body through the GIT and skin in a much lesser aspect comparatively.³ The formalin exposed is only a 10%–37% diluted fluid which causes much irritation. The level of exposure and formalin activity in an individual’s body depends on the time they are in contact with formalin be it touch or airborne. It also depends on the type of embalming done on the cadaver. The most reportable effects are irritation in the eye, headache, respiratory problems, and nausea. Formaldehyde is known to cause degenerative and inflammatory changes in the mucosa of the target organ. Formate is also responsible for linking of amino acids and nucleic acids that might proceed to cell death.⁴

When there is an increase in formaldehyde concentration, it leads to dose-related symptoms such as dryness in the nose, throat, and conjunctiva.⁵ However, there are some preventive measures through which the formalin exposure can be controlled such as good exhaust ventilation, thereby reducing the concentration of formalin in embalming fluid or using an alternative for formalin such as phenoxyethanol. Masks, gloves, and spectacles also prove to reduce the effect in some referred studies.⁶ Formalin being considered a carcinogen, cancer risk is expected to be more among embalmers and industrial workers exposed to formalin.⁷ Medical schools have to take more concrete measures to reduce student’s exposure to formalin. The main aim of the

ABSTRACT

Introduction: Formalin although having many adverse effects is the most widely accepted potent agent used in embalming fluid as it is economically an excellent preservative and fixative solution. The survey checks the effects and awareness with regard to formalin exposure among medical and dental students. The main aim of the study is to examine the effects and awareness of formalin on medical and dental students through a questionnaire-based survey. Materials and Methods: This was an e-survey carried out through a portal called SurveyPlanet. A questionnaire comprising 20 questions on the study topic and distributed among medical and dental students. Results: This study revealed that majority of students suffered from many side effects as well as requirement for awareness regarding formalin hazards and necessary measures to be undertaken to reduce its side effects. Conclusion: Formalin has adverse effects toward students and is believed to possess carcinogenic activities.

KEY WORDS: Awareness, Carcinogen, Dental students, Embalming, Formalin, Irritant, Medical

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study is to observe the health hazards of formalin as well as awareness on its exposure and control measures.

MATERIALS AND METHODS

A questionnaire-based survey was conducted using an e-survey-survey planet, among 171 students of age group 17-30 years. The questionnaire was based on the inclusion criteria of students who belonged to the professional course of MBBS and BDS. The first section of questions aimed at finding the exposure duration and levels of exposure to formalin for each individual. The second part of the questionnaire investigates the effects seen after contact with formalin, the duration of effect sustained, and allergies developed by the individual due to formalin. The third part concentrates on the individual being susceptible to any other such chemicals that they are exposed in due to their course. The survey then seeks to create awareness on the hazardous nature of formalin and possible measures that can be taken to reduce its effects. The data collected were statistically analyzed and interpreted.

RESULTS AND DISCUSSION

63.2% of the people responded that they are exposed to formalin through touch as well as airborne [Figure 1]. Inspecting their exposure duration to formalin revealed that a majority of them were exposed to formalin almost every day [Figure 2]. The survey analysis reports that most of them suffered from various side effects with irritation in the eye being the most commonly experienced effect. The effects were however seen to be subdued in majority of the participants in about an hour’s time [Figure 3].

The embalming of cadaver primarily involves the infusion of chemical substances into the body tissues that include formalin, alcohol, glycerine, carbolic acid, and dye.[8] Each of these substances has their specific roles of fixation, preservation, denaturalizing, disinfection, and maintenance of the integrity of an atomic relations required for dissection purposes.[9] These substances have specific roles, and they are usually infused through the femoral arteries or the internal carotid arteries.[10]

Among the participants, 135 were MBBS students and 36 were BDS students. The above study depicts the effects of formalin on students on a regular exposure basis. From the above study, about 13.2% of the sample population experienced respiratory problems with a majority of the population voting in irritation of the eye as the major issue faced [Figure 4]. Sensitive individuals may also experience asthma and dermatitis probably at low doses. This observation is in acceptance with reports from Japan.[11] However, as

Exposure at about 1–3 ppm levels may lead to eye and upper respiratory tract irritations.[12-14] Exposure of greater than 20 ppm concentration levels of formalin may lead to severe shortness of breath.[15,16] Excerpts also convey that exposure with masks, gloves, and spectacles put on to reduce the levels of being affected by formalin exposure. From the results, clearly a maximum of the participants have stated that they find reduction in the effect of formalin gradually with exposure and simultaneously they did not find

Figure 1: Conduct to formalin

Figure 2: Exposure duration to formalin

Figure 3: Spending time in a day

Figure 4: Side effects of formalin exposure
themselves developing any allergies due to continual exposure. However, in the long run, it may lead to some deformities as it is believed by some researchers to be a carcinogen.[17]

Since formalin is toxic, an alternative and a safer fixative detection are important. Frohlich et al. discovered, in 1984, the phenoxyethanol which is nontoxic. However, it turned out to have its own set of drawbacks as it approximately took 600 L for fixing a cadaver and it required continuous immersion for 5–10 months, thereby eliminating its practical use.[18]

The increase in levels of exposure of formalin says that >5 ppm is beyond tolerable capacity as its side effects increase. Increasing levels of formalin circulation may lead to chest tightness, pulmonary edema, nasal obstruction, etc.[19] The exact mechanism through which the formalin has exerted this irritant, corrosive and cytotoxic effect which remains a puzzle; however, it is known to readily combine with free unprotonated amino groups of amino acids and a protein, which is believed to be related to its germicidal properties. Higher concentration might precipitate proteins.[20,21]

CONCLUSION

Formalin has significantly affected the respiratory pathways as well as irritation in the eye. Precautionary measures such as no spillage of formalin, adequate ventilation, and exposure in controlled levels must be administered.

REFERENCES


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