

Effects of formalin exposure among students attending anatomy dissection in a rural medical college in Telangana state: A cross sectional study

Sreeharshika D¹, Kishore Yadav Jothula^{2*}, Roja Rani³, Sashi Preetham B⁴

^{1,3}Tutor, ⁴Student, Department of Forensic Medicine, ESIC Medical College, Sanath Nagar, Hyderabad, Telangana, INDIA.

²Associate Professor, Department of Community and Family Medicine, AIIMS, Bibinagar, Yadadri Bhuvanagiri, Telangana, INDIA.

Email: dr_kishore_2021@yahoo.com

Abstract

Background: Formalin is widely used in medical colleges as embalming solution and preservative as it is cheap and easily available. Formaldehyde can be toxic, allergic and carcinogenic. This study has been taken to find out the perceived symptoms of formalin exposure in first year MBBS and dental students. **Materials and Methods:** Institutional based Cross sectional study conducted with a sample size of 100 students. A predesigned, pretested semi structured questionnaire was used as study tool and data was collected by interview method. Data was analysed by using SPSS software ver.22. **Observations and Results:** Most (69%) of the study subjects were boys. The most troublesome symptom was unpleasant smell (72%) followed by excess lacrimation (56%), Headache (38%) and lack of concentration (25%). **Conclusion:** Formaldehyde present in formalin definitely has a toxic effect on various body tissues which can adversely affect the health of students who are exposed during their dissection period. So proper precautions should be taken to prevent formalin toxicity.

Keywords: Formaldehyde, Formalin, Lacrimation, Unpleasant smell

*Address for Correspondence:

Dr Kishore Yadav Jothula, Associate Professor, Department of Community and Family Medicine, AIIMS, Bibinagar, Yadadri Bhuvanagiri, Telangana, INDIA.

Email: dr_kishore_2021@yahoo.com

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INTRODUCTION

Formaldehyde (HCHO) was discovered in 1856 by August Wilhelm von Hofmann.¹ A solution of 35 to 40 per cent of water in formaldehyde is called formalin. It is widely used in medical colleges, hospitals, as preservative, disinfectant, embalming solution and in

different fields like wood and plastic industries.² In medical field formalin is mainly used as embalming solution and as a preservative as it is cheap and easily available. Formaldehyde can be toxic, allergic and carcinogenic. The primary route of exposure to formaldehyde is by inhalation, where it is absorbed by the lungs and gastro-intestinal tract and to a much lesser extent through the skin.³ It is quickly absorbed from nose and the upper part of lungs. Once absorbed, it is converted to a non-toxic chemical called formate, which is excreted in the urine and is converted to carbon dioxide and breathed out of the body. Formaldehyde has been reported to cause acute and chronic health-related problems. The most frequent symptoms are irritation of eyes, skin and upper respiratory tract, and headache which are associated with high concentration exposure.⁴ The safety of formaldehyde is very complicated. The main concerns are associated with chronic exposure by

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inhalation and skin contact. At concentrations above 0.1 ppm in air formaldehyde can irritate the eyes and mucous membranes, resulting in watery eyes.⁵ In medical practice, formalin exposure is mainly from aqueous formaldehyde solutions i.e. embalming fluids during the dissection period. The evaporation of formaldehyde from cadavers in gross anatomy laboratories can produce high exposures among 1st MBBS and Dental students. This exposure can adversely affect their health, hence it is essential to find out the toxicity of formalin and also possible ways to reduce the toxic effects. With this background, this study has been taken to find out the perceived symptoms of formalin exposure in first year MBBS and dental students who are exposed to it routinely during their anatomy dissection for at least two hours every day throughout the year.

MATERIALS AND METHODS

Study setting: A cross sectional study was undertaken after obtaining Institutional Ethical Clearance in a rural medical college, Telangana state. Study subjects: All first year students who were willing to participate in the study.

Sample size: Out of 120 students (medical- 100, dental-20) 20 had participated in the pilot study and 100 students were included after taking consent, hence sample size was 100.

Study tool: A pretested, semi-structured questionnaire which was standardized by conducting pilot study. The questionnaire includes demographic data of the students and side effects related to exposure to formalin.

Study period: This study was carried out for 2 months from July 2019 to August 2019

Method of data collection: Questionnaire was administered to the students after explaining them the importance of study and the questionnaire. Confidentiality regarding the participant response for the questions was ensured.

Statistical analysis: Data was entered in Microsoft excel and analysis was done using SPSS statistical package version 22

OBSERVATIONS AND RESULTS

Table 1: Distribution of study subjects according to their age and gender (n=100)

Age (Years)	No. of students	Percentage (%)
17 – 18	26	26
18 – 19	58	58
19 – 20	16	16
Sex	No. of students	Percentage (%)
Male	69	69
Female	31	31

Out of 100 participants, 69(69%) were boys and 31 (31%) were girls, with majority (58%) of participants falling between age of 18–19 years.

Table 2: Distribution of subjects according to symptoms experienced on exposure to formalin (n=100)

S.No	Effects of formalin	No. of students	%
1	Unpleasant smell	72	72
2	Excess lacrimation	56	56
3	Sore throat	20	20
4	Running nose	39	39
5	Skin problems	07	07
6	Lack of concentration	25	25
7	Headache	38	38
8	Disturbance of sleep	06	06
9	Disturbance of sight	18	18
10	Unusual tiredness	12	12
11	Nausea	23	23
12	Gastro intestinal problems	01	01
13	Others	02	02

Unpleasant smell (72%) was the most commonly experienced symptom followed by Excess lacrimation (56%). Other symptoms being Running nose (39%), Headache (38%), Lack of concentration (25%) and Nausea (23%).

DISCUSSION

In the current study 69(69%) were boys and 31 (31%) were girls, with majority (58%) of participants falling between age of 18–19 years. In our study the most troublesome symptom was unpleasant smell (72%) due to which students cannot concentrate properly during the dissection time, followed by excess lacrimation (56%) which was the most common(74.8%) symptom to develop in a study done by Nisa *et al.*⁴ Excess lacrimation is due to presence of formaldehyde in formalin. Formaldehyde is a flammable, colorless and readily polymerized gas at ambient temperature and is one of the major pollutants of indoor air. The primary routes of human exposure to formaldehyde are inhalation, eye and dermal contact. Formaldehyde being water soluble gets dissolved in the mucosa. It then causes degenerative, inflammatory and hyperplastic changes in the mucosa of the target organ. The absorbed formaldehyde is then converted to formate by enzymes present in erythrocytes. Formate can cause crosslinking of nucleic acids and amino acids causing cell death which is the main factor making formalin carcinogenic. The other symptoms seen are running nose (39%) which was about 69.5% in a study done by Elshaer *et al.*⁶ Headache (38%), lack of concentration (25%) and sore throat (20%) are the other main symptoms in our study. In a study done by Koirala *et al* Nausea was found to be about 69.8% contrary to our study which was 23%.⁷

Formaldehyde may also affect assimilation during dissection because when one is tired, dizzy, and has headache little or nothing can be grasped while dissecting.⁸ Chronic exposure to formalin has been associated with immunological hypersensitivity as measured by elevated circulating IgG and IgE autoantibodies to human serum albumin. Histopathological effects and an increase in cell proliferation have been observed in the nasal and respiratory tracts of laboratory animals repeatedly exposed by inhalation to formaldehyde for up to 13 weeks.⁹ These changes may cause carcinomas in the exposed persons. Formalin being toxic, allergic and carcinogenic still used widely because it is easily available and cheap and can be used in large quantities. So measures are to be taken to prevent the toxic effects of formalin such as wearing gloves and mask maintaining the required concentration of formalin i.e., 1 ppm or less over a period of 8 hours and no more than 2 ppm over a period of 15 mins.¹⁰

CONCLUSION

Formaldehyde present in formalin definitely has a toxic effect on various body tissues which can adversely affect the health of first year medical and dental students who are exposed during their dissection period. So proper precautions should be taken to prevent formalin toxicity. Phenoxylethanol, an alternative to formalin can be used. Measures such as maintaining proper ventilation, minimising direct skin contact with formalin

by using gloves, masks and aprons etc., will help in minimising the toxic effects of formalin.

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