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Original Research Article

A study of allergic responses of formaldehyde in first year MBBS students

Shreyans D. Singhvi, Preksha T. Singh*

Department of Anatomy, Smt N. H. L Municipal Medical College, Ahmedabad, Gujarat, India

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***Correspondence:**
Dr. Preksha T. Singh,
E-mail: prekshasingh@icloud.com

ABSTRACT

Background: Formaldehyde has been used as embalming fluid for cadavers 'in various medical colleges since decades, often alone but sometimes also with methyl alcohol, thymol crystals, glycerin and water. During dissection hours (average 6 hours per week), formaldehyde being an irritant can cause severe allergic responses in students of first year. Majorly the allergic symptoms are related to eyes, respiratory tract and skin.
Methods: A case control study of 400 MBBS students was performed in Gujarat from April 2017-June 2017. The study included 200 case students who had been exposed to formaldehyde on 3 days of the week during anatomy dissection hours, also 200 final year students who were not exposed to formaldehyde regularly.
Results: In our study, we have found the following positive responses to formaldehyde- general discomfort, sneezing, redness of eyes, itching of nostrils, irritation and itching of eyes, tears, blurring of vision, discharge from nostrils, and itching of skin while the following factors were found negative-vomiting, giddiness, drowsiness, nausea and difficulty in breathing.
Conclusions: As, formaldehyde is commonly used and students are frequently exposed to it, it can be a cause of major concern and an alternative less toxic solution for embalming should be researched for.

Keywords: Allergy, Formaldehyde, Students, Toxicity

INTRODUCTION

Formaldehyde has been used as embalming fluid for cadavers 'in various medical colleges since decades, often alone but sometimes also with methyl alcohol, thymol crystals, glycerin and water. During dissection hours (average 6 hours per week), formaldehyde being an irritant can cause severe allergic responses in students of first year. Majorly the allergic symptoms are related to eyes, respiratory tract and skin. Formalin (commercial name) is CH_2 $(OH)_2$ and $HO(CH_20)$ N.H is 37%-50% aqueous solution. It is a potent irritant, a noxious and flammable gas, also used as fungicide, disinfectant, germicide and preservative. It gives out powerful irritant vapors 'that are majorly responsible for its allergic responses.

A cadaver in a medical college is embalmed via femoral arteries or internal carotid arteries for preservation of normal anatomical structures for study during dissection hours. Although formaldehyde is very often used in various fields, it alter-sides are mostly ignored. It causes various symptoms and the severity of each symptom varies person to person, relating it to their immune system.

The concentration of formaldehyde can be measured relatively easily by calibrated sampling pumps.[1,3] There are major differences depending on whether air concentrations are measured above the floor or in the breathing zone. Several studies have reported doses ranging from 0.3 to 0.6 ppm, 0.3 to 2.63 ppm, 0.9 to 4.5 ppm, up to 20 mg/m^3, 1.5 mg/m^3, and 0.31-6.77 ppm.[2,4-7]

As in the department of anatomy, there is a continuous chronic exposure to formaldehyde, this study is extremely important to access the hazard caused by it.

METHODS

A case control study of 400 MBBS students was performed in Gujarat from April 2017 to June 2017. The study included 200 case students who had been exposed to formaldehyde on 3 days of the week during anatomy dissection hours, also 200 final year students who were not exposed to formaldehyde every day. The students were amongst a similar age group and having similar socioeconomic and developmental history.

Inclusion criteria

This was included first year students exposed to formaldehyde minimum of 3 days a week, and final year students not exposed to formaldehyde in the past 6 months. Students who provided well verbal consent to participate in the study and did not have previous allergic history, of any form, also students who were present during the study.

Exclusion criteria

This was included first year students not exposed to formaldehyde minimum of 3 days a week, and final year students exposed to formaldehyde in the past 6 months. Students who did not provide well verbal consent to participate in the study and did have previous allergic history, of any form, also students who were not present during the study.

A structural self-constructed questionnaire was used in the study. A well-informed verbal consent was taken by the participants of the study. It had open and closed ended questions. The questionnaire included Socio-demographic information in the form of age, sex, history of previous illness, a complete history of any previous history of allergies, students who had history of allergies were excluded from the study. The use of gloves and masks in the dissection hall was also studied. Multiple factors to assess the allergic responses were studied. The sampling technique used was purposive.

The data was compiled and analyzed using Google Spreadsheets. To find the association between different factors- the statistical method of chi-square test and p value was taken. A null hypothesis was formed with no association taken into consideration and chi-square values and P- value was calculated to find the possible association between the decided factors. The confidence interval taken for p-value is 95% with 0.05 level of significance. Values corresponding <0.05 are found significant, the null hypothesis stands void and the factors are found to be associated for 95% confidence level.

RESULTS

Initially, the use of gloves and mask in the dissection hall was studied (Table 1). Further, multiple factors were used to assess the allergic responses in the students were studied (Table 2). A null hypothesis was formed indicating no association between the chosen allergic response and formaldehyde, further chi square values and p values were calculated to find any association. In the following, p-values were found significant- general discomfort, sneezing, itching/irritation of the eye, tears, redness, itching of nostrils, blurring of vision, discharge from nostrils and itching of skin while in the following, p values were not found significant - vomiting, giddiness, drowsiness, nausea and difficulty in breathing (Table 2).

Table 1: The use of mask and gloves in the anatomy hall.

Use of	Always (%)	Mostly (%)	Rarely (%)
Gloves	82 (164/200)	12 (24/200)	6 (12/200)
Mask	1 (2/200)	0 (0/200)	99 (198/200)

DISCUSSION

In our study, we have found the following positive responses to formaldehyde- general discomfort, sneezing, redness of eyes, itching of nostrils, irritation and itching of eyes, tears, blurring of vision, discharge from nostrils, and itching of skin, while the following factors were found negative-vomiting, giddiness, drowsiness, nausea and difficulty in breathing. These well-documented and probable health hazards from formaldehyde are so grave that a number of precautions are recommended to reduce occupational formaldehyde exposure to the lowest feasible level. [8]

In the dissection halls, the following methods can be followed for prevention of severe toxicity. For this, initially, it is important to find the concentration of formaldehyde in the anatomy dissection hall and laboratories. There are many methods available for the same. After determining the levels, further steps to reduce the levels can be taken. There should be effective ventilation in the dissection hall as it would reduce density of formaldehyde and have better air currents in the hall. Clark et al, gives details of how formaldehyde concentrations can be reduced by using fume cupboards for handling large volumes of formaldehyde and for mixing embalming solutions. [8]Additionally, an alternative solution for embalming can be used in the department. However, toxicity for the alternative has to be studied as well. More education and training towards teaching the students to use gloves and masks should be provided before the start of the term. As, formaldehyde is commonly used and students are frequently exposed to it, it can be a cause of major concern and an alternative less toxic solution for embalming should be researched for.

Table 2: Association of multiple factors of allergic responses to formaldehyde.

Symptom	Case/ control	Never	Moderate	Mild	Severe	Chi square value	P-value	Association
General discomfort	Case Control	86/200 100/200	62/200 74/200	34/200 23/200	10/200 3/200	7.8446	0.049334	Yes
Sneezing	Case Control	149/200 56/200	37/200 84/200	8/200 12/200	6/200 4/200	12.9347	0.00478	Yes
Vomiting	Case Control	183/200 174/200	15/200 23/200	1/200 2/00	1/200 1/200	2.2444	0.523249	No
Giddiness	Case Control	156/200 164/200	36/200 29/200	7/200 5/00	1/200 2/200	1.6205	0.654748	No
Drowsiness	Case Control	132/200 147/200	49/200 43/200	10/200 7/200	9/100 3/200	4.7272	0.192901	No
Itching/Irritation of eyes	Case Control	32/200 157/200	63/200 21/200	65/200 7/200	40/200 1/200	138.0417	<0.00001	Yes
Tears	Case Control	36/200 167/200	77/200 12/200	66/200 6/200	21/200 1/200	30/200 35/200	<0.00001	Yes
Redness of eyes	Case Control	119/200 148/200	56/200 42/200	13/200 9/200	12/200 1/200	15.1848	0.001665	Yes
Itching of nostrils	Case Control	75/200 132/200	70/200 53/200	40/200 14/200	15/200 1/200	42.81838	<0.00001	Yes
Blurring of vision	Case Control	153/200 138/200	31/200 48/200	15/200 2/200	1/200 2/200	14.459	0.002342	Yes
Discharge from nostrils	Case Control	118/200 78/200	57/200 62/200	18/200 39/200	7/200 21/200	23.1102	0.000038	Yes
Nausea	Case Control	120/200 94/200	57/200 79/200	17/200 22/200	6/200 5/200	7.4496	0.58867	No
Itching of Skin	Case Control	173/200 156	21/200 112/200	5/200 2/200	1/200 1/200	106.1378	0.00001	Yes
Difficulty in breathing	Case Control	148/200 150/200	36/200 24/200	10/200 22/200	6/200 4/200	7.3134	0.062551	No

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