NOXIOUS EFFECTS OF FORMALIN TREATED CADAVERS ON MEDICAL STUDENTS DURING DISSECTION

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ABSTRACT

BACKGROUND

A cadaver is preserved via the infusion of formalin, which contains formaldehyde. Formaldehyde is colourless and flammable gas, which has an irritating and pungent smell. Formalin after evaporation from the embalmed bodies turns into fumes and is responsible for health hazard for all medical students and faculties.

The aim of this study was to find out and quantify the noxious effects of formalin.

MATERIALS AND METHODS

The present study was conducted on 140 medical students, who were unconsciously routinely exposed to formaldehyde fumes for two hours daily (6 days in a week) during dissection. They were asked to fill up the questionnaires, which were related to symptoms arising due to inhalation of formaldehyde fumes within the dissection hall.

RESULTS

In our study, 79.28% students have reported excessive lacrimation and also felt that it was the most irritating and troublesome symptom (57.14%). The unpleasant smell was felt by 76.42% students and 63.57% students experienced that it was the first symptom to develop. Other symptoms reported were running nose (62.14%), itching sensation in eyes (68.57%), cough (18.57%), sore throat (20.71%), difficulty in breathing (24.28%) and headache (51.42%).

CONCLUSION

Medical students are exposed to formaldehyde during their dissection course and exposure to formaldehyde fumes is hazardous to the health of medical students. The harmful effects of formalin can be reduced by some preventive measures like good exhaust ventilation in dissection hall and by wearing protective devices like gloves, masks and aprons, etc.

KEYWORDS

Formalin, Formaldehyde, Toxicity, Medical Students, Cadaver Preservatives.

HOW TO CITE THIS ARTICLE: Jain R, Jain A, Marskole S. Noxious effects of formalin treated cadavers on medical students during dissection. J. Evolution Med. Dent. Sci. 2017;6(63):4584-4587, DOI: 10.14260/jemds/2017/992

BACKGROUND

Formalin is a colourless irritative liquid, which contains 37% - 50% of aqueous solution of dissolved formaldehyde. Noxious effect of formalin is principally because of the formaldehyde which is colourless, combustible gas and intensely soluble in water.^[1] Formalin is broadly utilised as a part of paint, textile, cosmetic, wood and plastic industries. It has likewise been extensively utilised as germicide, fungicide, disinfectant and preservative in Anatomical and Pathological gross specimens in Medical Institutes and Hospitals.^[2]

In Medical Colleges, dead bodies are preserved for routine dissection. Treating of the dead body is accomplished by infusion of chemical fluid in the body which contains formalin, glycerin, alcohol, carbolic acid and dye.^[3] Embalming fluid is generally infused via femoral arteries or internal carotid arteries.

Financial or Other, Competing Interest: None.

Submission 30-06-2017, Peer Review 24-07-2017,

Acceptance 31-07-2017, Published 07-08-2017.

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DOI: 10.14260/jemds/2017/992

These fluids have precise roles in preservation, fixation, denaturation, solidification of tissue protein and maintenance of the integrity of the anatomic relation.^[4] The dispersion of formaldehyde fumes from dead bodies during dissection can deliver high exposures among medical students and faculties. The level of exposure to formaldehyde depends on the time spent in dissection hall and furthermore the ventilation of the dissection hall.^[5-7]

The concentration of formaldehyde in the air is universally expressed in terms of Parts Per Million [PPM].^[8] The permissible exposure limit for formaldehyde in the working environment is 0.75 ppm measured as an 8-hour Time-Weighted Average (TWA). A second admissible exposure limit in the form of a Short-Term Exposure Limit (STEL) of 2 ppm, which is the highest exposure approved during a 15-minute period.^[9] Exposure of formalin above permissible limit may create physiological modifications of respiratory mucosa, which causes upper airway irritation, sore throat, tingling and burning sensations of the nose and nasal blockage. Antagonistic impacts of breathing in formaldehyde turn out to be more as the concentration level of formalin increases.^[10] Various investigations recommend that noteworthy changes may happen in lung and cardiac function after prolonged exposure to formalin.^[7,11,12]

The present study has been embraced to evaluate the dangerous impacts of formaldehyde vapour emerging from

embalming fluids over Indian medical students during routine dissection.

MATERIALS AND METHODS

The present study was carried out in the Department of Anatomy, Gandhi Medical College, Bhopal (MP) over a period of two years (2014 - 2015). After the permission from the Institutional Ethics Committee, the cross-sectional study was conducted on 140 healthy medical students who were in the age group of 18 - 20 years with no history of previous exposure to formaldehyde fumes. The health status of the student was ascertained through history taking and medical examination. Students with present and/or past history of smoking; any history of cardiac, pulmonary, skin and other systemic diseases were excluded from the study. Written informed consent was taken from all the medical students who were included in this study.

The students were informed about the source of cadavers, a method of preservation of cadavers and preservative fluids. The students were unconsciously routinely exposed to formaldehyde fumes for two hours daily (6 days in a week), during dissection. They were asked to fill up the questionnaire, which included questions regarding symptoms arising due to inhalation of formaldehyde fumes within the dissection hall. These symptoms were graded on a scale of 0 - 2 as follows: Grade 0- Never experienced, Grade I- Experienced occasionally, Grade II- Strongly experienced. The students were also asked to clarify that among the symptoms which was first to develop and which was the most irritating and intolerable.

RESULTS

In the present study following exposure to formaldehyde fumes, excessive lacrimation was seen in 79.28% students, whereas 68.57% and 17.14% students felt itching sensation in eyes and blurring of vision respectively. Among the dermal symptoms, itching sensation in hands and burning sensation in skin were felt by 29.28% and 9.28% students respectively, whereas rashes and eruptions within the skin were seen in 7.86% and 23.57% students respectively [Table 1].

Among the GIT symptoms, post dissection nausea and vomiting was felt by 30.71% students, whereas disturbance in appetite was felt by 25.71% students following exposure to formaldehyde fumes. Among the pulmonary symptoms, unpleasant smell and tingling sensation were felt by 76.42% and 31.43% students respectively, whereas running nose and cough was seen in 62.14% and 18.57% students respectively. A sore throat and difficulty in breathing were complained by 20.71% and 24.28% students respectively [Table 2].

In this study, we found that 51.42% students complained of headache following exposure to formaldehyde fumes. Fainting episodes and restlessness were felt by 15% and 19.28% students respectively, whereas 17.85% students complained disturbance of sleep and lack of concentration following exposure to formaldehyde fumes [Table 3].

In the present study, 63.57% students experienced unpleasant smell as the first symptom, whereas excessive lacrimation was experienced as the first symptom in 19.85% students. Only 7.86% and 9.28% students experienced itching sensation in eyes and running nose as the first symptom respectively. Among all the symptoms, excessive lacrimation was experienced as the most irritable symptoms

in 57.14% students, whereas 27.14% students felt unpleasant smell as the most intolerable symptom. Only 2.14% and 7.86% students experienced itching sensation in eyes and running nose as the most irritating symptom respectively. Only one student felt a sore throat as the most intolerable symptom following exposure to formaldehyde fumes [Table 4].

Symptoms	Number of the Students Affected		
	Grade 0	Grade I	Grade II
Ocular Symptoms			
Excessive lacrimation	29 (20.71%)	99 (70.71%)	12 (8.57%)
Itching sensation in eyes	44 (31.43%)	87 (62.14%)	9 (6.43%)
Blurring of vision	116 (82.86%)	21 (15%)	3 (2.14%)
Dermal Symptoms			
Itching in hands	99 (70.71%)	36 (25.71%)	5 (3.57%)
Rashes	129 (92.14%)	11 (7.86%)	0
Burning sensation	127 (90.71%)	12 (8.57%)	1 (0.71%)
Skin eruptions	107 (76.42%)	30 (21.43%)	3 (2.14%)

Table 1. Ocular and Dermal Effects of Formalin on Medical Students (n= 140)

Symptoms	Number of the Students Affected		
	Grade 0	Grade I	Grade II
GIT Symptoms			
Post dissection nausea and vomiting	97 (69.28%)	40 (28.57%)	3 (2.14%)
Disturbed appetite	104 (74.28%)	25 (17.85%)	11 (7.86%)
Respiratory Tract Symptoms			
Unpleasant smell	33 (23.57%)	80 (57.14%)	27 (19.28%)
Tingling sensation in nose	96 (68.57%)	37 (26.43%)	7 (5%)
Running nose	53 (37.85%)	74 (52.85%)	13 (9.28%)
Cough	114 (81.42%)	23 (16.43%)	3 (2.14%)
Sore throat	111 (79.28%)	28 (20%)	1 (0.71%)
Difficulty in breathing	106 (75.71%)	29 (20.71%)	5 (3.57%)

Table 2. Effects of Formalin on GIT and Respiratory Tract in Medical Students (n= 140)

Symptoms	Number of the Students Affected		
	Grade 0	Grade I	Grade II
Headache	68 (48.57%)	58 (41.43%)	14 (10%)
Lack of concentration	115 (82.14%)	23 (16.43%)	2 (1.43%)
Restlessness	113 (80.71%)	26 (18.57%)	1 (0.71%)
Disturbance of sleep	115 (82.14%)	21 (15%)	4 (2.86%)
Fainting episodes	119 (85%)	17 (12.14%)	4 (2.86%)

Table 3. Neurobehavioural Effects of Formalin on Medical Students (n= 140)

Symptoms	Symptom Appearing First	Most Irritable Symptoms
Unpleasant smell	89 (63.57%)	38 (27.14%)
Running nose	13 (9.28%)	11 (7.86%)
Itching sensation in eyes	11 (7.86%)	3 (2.14%)
Excessive lacrimation	27 (19.85%)	80 (57.14%)
Headache	0	7 (5%)
Sore throat	0	1 (0.71%)
Total	140 (100%)	140 (100%)
Table 4. Incidence of Occurrence and Severity of the Symptoms of Formaldehyde Inhalation (n= 140)		

DISCUSSION

It is noted that formaldehyde can cause sick house syndrome (sick building syndrome), which is represented by a headache, nausea, mucosal irritation and chest symptoms.^[13] Breathing is the most prevalent way of exposure to formaldehyde. Other courses of human introduction to formaldehyde are by eye and dermal contact. Along these lines skin, eyes and upper respiratory tract are most influenced parts of the body after formaldehyde presentation. Since formaldehyde is water solvent, it gets broken up in the mucosa and causes inflammatory, hyperplastic and degenerative changes in the mucosa of the objective organ. The broke down formaldehyde is converted into formate by the erythrocytic enzymes. Formate causes cross-linking of nucleic acids and amino acids that outcome in cell demise. At long last, formate is oxidised to carbon dioxide and is discharged through exhalation.^[14]

Jain SR et al found that 74.8% understudies experienced excessive lacrimation as the first occurring symptom.^[14] In contrast to above, we observed that 63.57% understudies experienced unpleasant smell as the first occurring symptom, whereas 57.14% understudies experienced excessive lacrimation as the most irritating and troublesome symptom [Table 4], which is similar to the findings reported by Kundu S et al.^[15]

Various studies showed that intense presentation of formalin was altering the cardiac and pulmonary functions.^[7] In the present study, tingling sensation in the nose and unpleasant smell were felt after exposure to formaldehyde fumes, which prompt a headache, rhinitis and dyspnoea [Table 2]. Wei CN et al observed that manifestations because of formalin presentation were subject to time spent in dissection hall and proposed that lessening time spent while dissection could reduce symptoms.^[16] Finding an alternative for formalin is likewise a decent choice to avert unsafe impacts of formaldehyde. Glutaraldehyde would be a reasonable option with similar fixation qualities. It is likewise trusted that ethanol glycerine fixation with thymol conservation can be a potential option to formaldehyde and phenol embalming.^[17]

CONCLUSION

Formaldehyde can cause deleterious effects on the health of medical students and medical professionals during dissection. In this way, legitimate security measures should be taken by medical experts to counteract formalin poisonous quality. Some basic strategies, for example (a) Expanding wind current in the dissection hall by opening windows and doors, or by utilising unique nearby fumes ventilators in dissection halls, (b) By limiting direct skin contact with

formalin by utilising defensive equipment, for example elastic gloves, masks and aprons, (c) Uncovering only the part of the dead body that is being dissected and periodic removal of fluid dripping collected in the body trays will help in diminishing the dangerous impacts of formalin.

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