Original Research Article

A study on the adverse effects of embalming fluid on medical students

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Abstract

Background-Formaldehyde used in the embalming fluid can be toxic, allergic & carcinogenic. Inhalation of vapours of formaldehyde from formalin treated cadavers in the anatomy dissection hall can produce many adverse effects in all those handling the cadaver. **Objectives-** This study was carried out among the medical students of Silchar Medical College & Hospital, Assam, to learn about the difficulties they experienced when they get exposed to the embalmed cadavers for the first time. **Materials & Methods-** To assess the acute & chronic toxic effects of formaldehyde, a set of questionnaires was given to the 125 first year MBBS students in which they were asked to grade their experience. The collected data was later analysed statistically by using Microsoft Excel sheet. **Results-** The commonest reported discomfort was unpleasant smell (91.2%) followed by excessive lacrimation (86.4%), burning in the eyes (76.8%), burning nasal cavity (74.4%),itching of hands (43.2%),nausea (7.2%), dizziness (5.6%), headache(4%) & dry nose (1.6%). **Conclusion**-Irritating toxic effects of formaldehyde on medical students cannot be denied. This calls for adopting better preventive measures & ensuring proper ventilation of the dissection halls so that the students can enjoy their dissection class.

Key Words- Formaldehyde, embalming fluid, dissection hall, cadaver

Introduction

In anatomy, teaching is mainly based on museum specimens, histology slides, bones & cadaveric dissection. Cadavers are normally preserved through the process of embalming in which embalming fluid is injected into the cadaver. The embalming fluid is a mixture of chemicals like formaldehyde, glycerine, spirit, phenol, turpentine oil, sodium borate, eosin & water combined in various proportions. Thus, the embalming fluid contains preservatives, germicide, wetting agents, buffers, dyes, perfuming agents, vehicle etc. The properties of embalming fluid is that- it ensures there is no risk or fear of infection on contact with the dead body, it ensures preservation of the dead body & it prevents contamination with maggots & insects**[1].**

Formaldehyde was discovered in 1867 by the British chemist, August Wilheld Von Hofmann. At room temperature, it is a colourless gas, has flammable properties & an irritating pungent odour. It is extremely soluble in water. It is commercially available as formalin, containing 37% by weight or 40% by volume of formaldehyde gas in water. This chemical is most commonly used for embalming though it is a known fact that it rapidly metabolizes to formic acid**[2].** Formalin is also used extensively in industries dealing with production of chemicals, paint, plastic, adhesive, textile, paper & cosmetics. The concentration of formaldehyde is usually expressed in terms of parts per million (1ppm=1.248 mg/cu m).

Since formaldehyde is the most commonly used preservative for embalming, this exposes the medical students, embalmers & faculty members of anatomy to the formaldehyde fumes that are proven to have adverse toxic effects**[3].** Studies suggests that exposure occur primarily by inhalation or via absorption of formaldehyde containing fluids through skin. Formaldehyde can be toxic, allergic & carcinogenic**[4-5].** Studies also suggest that evaporation of formaldehyde from formalin treated cadavers in the anatomy dissection halls can produce high exposure which may be due to poor ventilation, poor working practices leading to spillage of formaldehyde during embalming, using high concentration of embalming fluid & ignorance of consequences of formalin exposure**[6-7].**

Materials & methods

The study was carried out among the 125 newly admitted first year MBBS students of SMCH. Having explained to them about the aim of the present study, a set of questionnaire containing 14 symptoms was handed over to them 15 days after the beginning of dissection classes. They were asked to mark their response (only one per symptom) on the graded scale of 0 to C & return the questionnaire the next day. The data collected was analyzed statistically by using Microsoft Excel sheet.

Ethical clearance

Before persuing the study, ethical clearance from the Institutional Ethical Committee of Silchar Medical College was obtained as per the Ethical Guidance of 1975, Helsinki.

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Results & observations

Table 1: Response of students to symptoms in the questionnaire

Symptoms on exposure to cadaver in the dissection hall	Grade 0 (no symptom)		Grade A (mild symptom)		Grade B (strong, irritating symptoms)		Grade C (intolerable)	
	No.	%	No.	%	No.	%	No.	%
Unpleasant smell	11	8.8	19	15.2	56	44.8	39	31.2
Itching & Burning eyes	29	23.2	57	45.6	33	26.4	6	4.8
Excessive lacrimation	17	13.6	23	18.4	42	33.6	43	34.4
Burning nasal cavities	32	25.6	16	12.8	49	39.2	28	22.4
Redness of eyes	68	54.4	24	19.2	23	18.4	10	8
Running/congested nose	39	31.2	53	42.4	26	20.8	7	5.6
Dry nose	46	36.8	56	44.8	19	15.2	4	3.2
Sneezing & coughing	53	42.4	57	45.6	12	9.6	3	2.4
Difficulty in breathing	76	60.8	46	36.8	2	1.6	1	0.8
Nausea	116	92.8	5	4	2	1.6	2	1.6
Headache	84	67.2	27	21.6	9	7.2	5	4
Dizziness	118	94.4	3	2.4	3	2.4	1	0.8
Sore throat	35	28	67	53.6	21	16.8	2	1.6
Itching of hands after doing dissection	71	56.8	23	18.4	24	19.2	7	5.6

Among the 125 students, the commonest symptom reported was unpleasant smell. For 114(91.2%) students, the smell of the cadaver was irritating & intolerable. 108 (86.4%) students complained of excessive lacrimation on exposure to formaldehyde while 96(76.8%) students reported of burning eyes. 93(74.4%) students had burning of nasal cavities & 90(72%) students complained of having sore throat after attending dissection classes. About 86(68.8%) students reported suffering from running nose and nasal congestion while 79(63.2%) students complained of dry nose. While 57(45.6%) students complained of itching & redness of the eyes, 54(43.2%) students complained of itching in the hands after handling the cadaver while doing dissection. Headache was complained by 41(32.8%) students & 49(39.2%) had some problem with breathing. 9(7.2%) students complained feeling of nausea, 7(5.6%) students complained of dizziness, which could be because of the pungent smell of formaldehyde.

Discussion

Following the dissection schedule, the first year MBBS students remain in the dissection hall for two hours daily or even more. As such, they are exposed to the toxic fumes of formaldehyde regularly. Though the main source of formaldehyde fumes in the dissection is from the embalmed cadavers, but added causes of toxicity could be coming from spillage of formaldehyde while handling by the dissection hall attendents or due to poor cross ventilation of the hall. Formaldehyde is mainly an upper respiratory tract irritant causing eye & nose burns, sneezing, coughing & headache**[8].** Studies also show that there is a high incidence of cancer and arteriosclerotic heart diseases among people engaged as embalmers**[9].** This could be because they are constantly exposed to the embalmed dead bodies. But still, irrespective of its adverse effects, formaldehyde is preferred over other tissue fixatives because of its efficacy and low cost. Its known toxic effects can be reduced by taking some preventive measures like wearing apron, face mask, spectacles and improving the ventilation of the dissection hall. In our study we found that first three reported symptoms of the students were unpleasant odour (91.2%), excessive lacrimation (86.4%) & burning eyes (76.8%). Our finding is similar to the findings of Dr D. Dixit et al (1) though in her study the second common symptom was itching of the eyes. Our findings regarding the first commonest reported symptom(unpleasant smell) to be 91.2% coincides with the findings of Noha Selim Mohamed Elshaer who also found the unpleasant smell to be 91.2%[**10].** Unlike us, their second reported symptom was dry or sore nose (74.2%) and third symptom was running or congested nose (69.5%). In our study, dry nose was found in (63.2%) and running or congested nose was found in (68.8%). However, for our students, the second symptom was excessive lacrimation (86.4%) and the third symptom was burning in the eyes (76.8%.)

In a similar study conducted on medical students in Nigeria by Emue et al**[11],** they found the most common symptoms to be general discomfort (81%), nasal irritation or itching (50%) and eye irritation or itching (48%). It should be remembered that the severity of symptoms depend on the concentration of of formaldehyde used in the embalming fluid. Proper cadaver handling instructions should be given to all the students at the beginning of the session. They should be encouraged to use the personal protective devices without fail. It has now become necessary to search for newer low concentration formalin solutions or formaldehyde substitutes. Several laboratories are now sticking to low formalin embalming fluid in order to lower the health hazards to its employees**[12-15].**

Conclusion

Embalmed cadavers are still the principal teaching tool in anatomy. Keeping in mind the toxic effects of formaldehyde, it is advisable that the students are made aware of its ill effects. They should be encouraged to follow the preventive measures such as wearing gloves, masks, goggles, aprons etc to minimize the degree of exposure. The dissection halls should be provided with exhaust fans so that the toxic vapours of formaldehyde is blown away constantly. The dissection hall attendents should also be taught about the hazards of formaldehyde so that they take utmost care while handling it.

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