Toxic Effects Of Formalin On Formalin Treated Cadavers On Undergraduate, Postgraduate Students And Other Staff In The Department Of Anatomy, Gmc Jammu

Dr. Bonita Gupte[1], Dr. Apurab Gupta[2*]

[1] Demonstrator, Department of Anatomy, GMC Jammu
[2*]Assistant Professor, Department of ENT, GMC Jammu

***Corresponding Author: -** Dr. Apurab Gupta

*Assistant Professor, Department of ENT, GMC Jammu
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Abstract

Introduction: Formaldehyde, which was discovered in 1867, has been used as a tissue fixative, preservative and the 1st choice as embalming agent. It has been used since20th century. However innumerable ill effects of Formalin have been observed, it affects the skin, eyes, nose and also causes general ill effects.

Methods: The study was done on 212 subjects, that included 183 undergraduates on 1st year MBBS, batch 2020-21. It also included few others like the postgraduates, the demonstrators, the faculty members and other dissection assisting staff. This crosssectional study was done for a period of 14 days, at the end of which, each subject was provided with a questionnaire that consisted of questions regarding the harmful effects of Formalin, using the Wats app class group and the responses were recorded and kept anonymous. The grading was done in such a way that Grade 0 (for no symptom), Grade1 (for barely felt symptoms), Grade 2 (for prominent symptoms felt) and grade 3 (for intolerable symptoms).

Results: The most common symptom which the students and other members complained off is the unpleasant odour, which was seen in 75.5%, excluding the 24.5% who didn't feel it at all. Dry or sore nose was seen in 63.7%, running nose was seen in 53.6%, unusual thirst in 52.4%. The symptoms related to eyes were redness, seen in 46.7%, itching in 48.4% and excessive lacrimation in 53.8%. Sore throat was felt in only59.9%. Itchy hand was least commonly felt symptom among our study group and was seen in only 19.6%. The other general symptoms included nausea felt in 73.6% and is thesecond commonest symptom felt, following the unpleasant odour. Headache felt by%. Tiredness was seen in 47.2% and an episode of syncope was also less common and was seen in 45.4%.

Conclusion: The research highlighted the irritating effects of formalin and thus emphasized the need for revaluation of the concentration of formalin in embalming fluidand stressed upon the availability of proper environment for work and ventilation.

INTRODUCTION

Humans are constantly exposed to chemicals from the environment, some of which are harmful to their health. [1] Formaldehyde was discovered in 1867 by the British chemist August Wilheld Von Hofmann. It is a simple aldehyde with the molecular formulae CH_2O. at room temperature,it is a colourless gas, has flammable properties and a pungent odour. [2]. the aqueous preparationof formaldehyde (37-40%)is commonly known as Formalin. Because of advantageous properties of fixation, it is the most widely and commonly used fixative.

HCHO has been identified as a potent cancer causing agent., however the degree of cancer threat due to presence of formaldehyde in people is yet to be defined. [3]. Formaldehyde has found its use in almost all sectors of medical sciences, it is used as fixative in forensic, pathology and most importantly anatomy. It is the main embalming agent since 20th century. [4]But formaldehyde has shown to cause mutation in various organism, whether primitive or advanced. [5] [6] Furthermore, inhaled formaldehyde caused nasal carcinoma in rats and mice and subcutaneously injected formaldehyde caused sarcoma in rats. [7] [8] recent epidemiological surveys among embalmers and industrial workers exposed to formaldehyde may indicate an increased risk of cancer. [9].

Formalin had an odour that many students and many faculty members find unpleasant. Chemical hypersensitivity has been attributed to exposure to formalin or other volatile compounds. Students develop many troublesome symptoms like

nausea, headaches and gastrointestinal symptoms during cadaveric dissection or complaint of disorders due to irritation of mucus membrane of both eyes and nose [10].

The anatomists, technicians and students in the laboratories are continually exposed to Formaldehyde during the dissection course. The level of exposure depends upon the duration of time spent in the dissection hall and the external environment [11].

The Occupational and Health Association (OSHA) recommended permissible exposure limit (PEL) of formaldehyde to be 0.75ppm, averaged over an 8-hour work shift and 2ppm not to beexceeded during any 15-minutes work period. The National Institute for Occupational Health and safety (NIOSH) recommended exposure limit (REL) of formaldehyde is 0.016ppm averaged over a b10-hour work shift and 0.1mm ppm not to be exceeded during any 15- min work shift. [12] [13]

Studies have shown that the evaporation of formaldehyde from formalin-treated cadavers in the anatomy dissection rooms can produce high exposures which may be due to poor ventilation, poor working practices, leak out of formalin from cadavers, spillage of formalin during embalming and no strict guidelines [14] [15].

The research was conducted on to assess the acute toxic effects of formalin treated toxic effectson the students and the staff working in the department of anatomy.

MATERIALS AND METHODS

The study was conducted on the batch 2020-21 of GMC Jammu, which included 183 1st profession MBBS students. The study was done in such a way that the old staff members werealso included like the regular staff members, the faculty members and the post-graduation students. In total the study group included 212 members.

In total there are three room for dissection in the post-graduation department of Anatomy. Oneof them has deep freezer, where the dead bodies are stored and the embalming procedures aredone. The same room has been installed with an embalming equipment. Another room is for the stored specimens which have been kept in glass beakers in 10% Formalin, these beakers have been kept since years and are covered. However, they are regularly cleaned and the preservatives are regularly changed. The third room is the actual dissection hall. It has 10 windows and three doors. It has five dissection tables, which have 5 bodies. Each table is allotted to a group of 38 students and they stand close to each other. The ventilation in the dissection hall is otherwise appropriate, however due to increase in the strength of undergraduates and postgraduates, it sometimes feels overcrowded.

The study was conducted for a period of 2 weeks from the start of exposure. As this batch hadjoint the institute after the 2nd wave of Covid, they were already used to wearing masks and gloves, unlike the previous batches, which in the name of protective gear, only wore a pair of gloves. The study was done for a period of 15 days, immediately after the start of offline classes. The total period of exposure was only 15 days. A questionnaire was prepared and wassent to each student over the class group, made on wats app during the online classes. The responses were then collected and were kept anonymous. Each and every undergraduate student was the part of the study. The same questionnaires were distributed amongst the technical staff, the faculty members, demonstrators and the post graduate scholars.

The questionnaire was very simple. It consisted of four gradation of responses, over each symptom the grading was Grade 0 (for no symptom), Grade 1 (for barely felt symptoms), Grade2 (for prominent symptoms felt) and grade 3 (for intolerable symptoms). It was a cross sectionalstudy and included various group which were exposed to Formalin for different durations. TheTable 1 can give the proper view in the groups, which were exposed to the Formalin, for different time spans.

Table 1: Showing the time duration of exposure of Formalin to different group of individuals:

S.NO.	Class Of Work in the Department	Number	Percentage	Average time of Exposure	Durationof workinghours with formalin /day
1.	Undergraduates	183	86.28%	15 days	1 hour
2.	Postgraduates (1st year)	4	1.88%	6 months	2 hours
3.	Postgraduates (2nd year)	2	0.94%	18 months	2 hours
4.	Postgraduates (3rd year)	4	1.88%	24 months	2 hours
5.	Demonstrators	6	0.28%	2 years	1 hour
6.	Lectures	2	0.94%	4 years	1 hour
7.	Assistant Professors	3	1.41%	6 years	1 hour
8.	Associate professors	1	0.47%	8 years	1 hour

9.	Professors	1	0.47%	11 years	1 hour
10.	Embalming injector	1	0.47%	10 years	6 hours
11.	Dissection assistance staff	5	2.35%	16 years	6 hours

The missing element is the above table is the type of exposure or the exact amount of time spent in the dissection hall or with the dissected specimens that have been kept in the storage containers for the teaching purpose. The undergraduates are in close contact with body for about a period of 40 min, for 6 days a week.

The post graduates are exposed to the body at different parts of the day as they are performingdissection regularly and are supervised by the demonstrators. The type of exposure is very closefor postgraduates and demonstrators. However, the higher faculty members have passive exposure. The dissection technicians and the embalming injectors are the group of workers thatare exposed to the formalin for the longest time.

RESULTS

Following is the table showing the result in the form, of gradation of the symptoms.

Table 2: Showing the symptoms as perceived by the members of the study group and their classification in to four groups as mentioned:

Symptoms of acute exposure of formalintreated cadavers	Grade 0 (Barely felt)		Grade 1(Mild felt symptoms)		Grade 2 (Moderatelyfelt)		Grade 3 (unpleasant and severe)	
Unpleasant smell	52	24.5%	112	52.8%	40	18.8%	8	3.7%
Dry or sore nose	77	36.3%	99	46.6%	32	15.1%	4	1.8%
Running nose	98	46.2%	81	38.2%	30	14.1%	3	1.4%
Unusual thirst	101	47.6%	67	31.6%	42	19.8%	2	0.9%
Redness in the eyes	113	53.3%	53	25%	44	20.7%	2	0.9%
Itching in the eyes	110	51.6%	64	30.2%	31	14.6%	7	3.3%
Excessive lacrimation	98	46.2%	74	34.9%	36	16.9%	4	1.8%
Sore throat	87	41.1%	78	36.7%	41	19.3%	3	1.4%
Itchy hands	171	80.6%	54	25.4%	11	5.18%	2	0.9%
Nausea	56	26.4%	99	46.6%	50	23/5%	7	3.3%
Headache	99	46.6%	100	47.1%	10	4.7%	3	1.4%
Tiredness/ dizziness	112	52.8%	87	41.1%	11	5.1%	2	0.9%
Syncope	118	55.6%	78	36.7%	11	5.1%	5	2.3%

The most common symptom which the students and other members complained off is the unpleasant odour, which was seen in 75.5%, excluding the 24.5% who didn't feel it at all. Dryor sore nose was seen in 63.7%, running nose was seen in 53.6%, unusual thirst in 52.4%. the symptoms related to eyes were redness, seen in 46.7%, itching in 48.4% and excessive lacrimation in 53.8%. Sore throat was felt in only 59.9%. itchy hand was least commonly felt symptom among our study group and was seen in only 19.6%. the other general symptoms included nausea felt in 73.6% and is the second commonest symptom felt, following the unpleasant odour. Headache felt by%. Tiredness was seen in 47.2% and an episode of syncopewas also less common and was seen in 45.4%.

DISCUSSION

In this study which was conducted on 212 members in the department of anatomy, it was observed that the most common symptom that was felt by most of the study group was the unpleasant odour of the formalin., which was reported in about 75.5% of the study group. Thisis in accordance to the study done by Dixit [15] in 2005, were it was seen that the most commonside effects of formalin seen in the study group were unpleasant odour and irritation of eyes and nose. Another study done by Emule, et al. in Nigeria also revealed similar results where itwas observed that the most common symptoms seen in students exposed to cadaveric exposedformalin are general discomfort (81%), eye irritation (48%) and nasal irritation (50%).

The least common symptom that was observed in this study was the itching of hands which was seen in <20%. This is also in accordance to the study done by Emule, [16] where only 1% of the students had reported with itching or irritation like symptoms.

In this study, around 53.3% of the students reported to redness in eyes and approximately 51.6% of them reported to itching and 46.2% to excessive lacrimation. This is in contrast to the study done by Dixit, [15] where the 2nd most commonly occurred symptom was excessive lacrimation followed by redness and irritation of eyes. This contrast could be due to the fact that the students were using protective eye gears, as this batch was the post covid batch and were used to wearing protective equipment's, in contrast to the previous batches.

However, in the study done by Emule [16] in 2011, as many as 47% and 88% of the students didn't report to nasal and eye symptoms respectively. This is closely resembling the figures inour study in which the nasal symptoms were not seen in >40%. However, the eye related symptoms were much more that is >45% reported to have either redness or lacrimation.

On an average, 3.7% of them had been severely affected by bad odour which may have resultedin either nausea. Few of them also reported to have severe syncope attack or fainting. However,the severity of this is less. Moreover, the syncope's could also be due to long hours of standingin the dissection hall for the purpose of teaching and learning.

LIMITATIONS OF THE STUDY

The study was done on a very small scale and there was random inclusion of the subjects as they were not critically characterized. There was also unequal exposure of formalin to each group and also the duration of the subjects exposed to formalin was different for each. The study can be done as a cross sectional study on a larger scale. The study didn't include a comparison group, thus excluding the fact that there was no one to be compared to.

CONCLUSION

The current study evaluates the harmful effects of formalin on the medical students who are continuously exposed to the formalin throughout their anatomy learning tenure. Plus, there is another group of people like the staff working in the department of Anatomy who are always at the risk of developing one thing or this other.
This emphasize the fact that there is a need to scrutinize the concentration of formalin in the embalming fluid. Also other environmental factors like the ventilation of the dissection hall, the total duration of exposure and proper assessment of the workplace.

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