

# Study of Formalin Toxicity in I MBBS Students

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**Abstract:** Formalin is used as a preservative for human cadaver. The present study was conducted in 250 I MBBS students to find out and quantify the toxic effects of formalin. In our study 87.2% students have reported watering of eyes. Others reported symptoms includes tingling sensation in nose (30.8%), irritation of throat (34.4%), cough (20%), headache (6.4%), skin problems (10.8%) & other like giddiness, lack of concentration (31.2%). 74.8 percent students said that the watering through eyes was first to be developed. While 62 percent felt that it was also the most troublesome symptom.

**Keywords:** Formalin toxicity, MBBS students

## 1. Introduction

Formalin CH<sub>2</sub>(OH)<sub>2</sub> & HO(CH<sub>2</sub>O)N.H is 37-50% aqueous solution of dissolved formaldehyde CH<sub>2</sub>O. It is widely used in medical colleges, hospitals, as preservative, disinfectant, embalming solution and in different fields like wood & plastic industries. Although formalin is extensively used in different fields, its toxicity is frequently ignored. Some of toxic effects include irritation of eyes, nose, throat, and airway. Its toxicity is of concern to all who work closely with it. Embalmers, anatomist, medical students are among people who are at an increase risk of developing its toxicity. The common symptoms from acute exposure to formalin manifest as irritation of the throat, nose, eyes, and skin. It can also cause irritation of upper respiratory tract which can potentially exacerbate asthma symptoms and other respiratory illnesses.<sup>1, 2</sup> while chronic exposure of formalin can cause bronchitis and pneumonia.<sup>3</sup>

It has also been found that when formalin is swallowed, it can result in sudden death. Some researcher also believe that formaldehyde is a human carcinogen.<sup>4</sup> Thus though formalin has serious adverse effects on health none of the study had extensively revealed the detail toxic effects in terms of incidence, order of occurrence and severity of each symptom. So in the present study we studied the toxic effects of formalin in terms of their incidences, severity and chronological order in I MBBS students. We also did an intergroup analysis in order to find out high risk students, who were easily susceptible for formalin toxicity

## 2. Literature Survey

Study conducted by Farah et al <sup>5</sup> have reported symptoms like irritation of the throat, nose, eyes, and skin in the

expose group .They also concluded that this toxic effect of formalin can cause exacerbation of asthma and other respiratory illnesses. While Anderson and Molhave <sup>6</sup> concluded that, increase formaldehyde concentration causes dose related symptoms like dryness in the nose, throat and conjunctiva.

Quantification of formalin toxicity was given by Farah et al in 2007, <sup>5</sup> their study revealed that 88 percent subjects suffers from irritation of eye, 74 percent suffers from irritation of nose, while irritation of throat and airways and 29 and 21 percent respectively.

## 3. Previous work

Though Farah et al and Molhave have tried to study the toxic effect of formalin, there is lack of uniformity of data and no one has define the severity of each symptom and chronological order of occurrence.

## 4. Problem definition

I MBBS students are routinely exposed to formalin in anatomy dissection hall. This exposure can adversely affect their health. So it is the need of time to find out the toxicity of formalin and also possible ways to reduce the toxic effects.

## 5. Aims & Objectives

To study acute toxicity of formalin in I MBBS students in terms of incidence, severity and chronological order of occurrence.

- To explain possible patho physiology for its toxicity
- To suggest possible preventive measures to reduce its toxicity

## 6. Materials and Method

The present study was a cross sectional study conducted in Department of Anatomy at VMMC, Solapur and BJMC, Pune. The synopsis of the study protocol was submitted to institutional ethical committee and approval was obtained. 250 subjects (I MBBS students) who were routinely exposed to formalin during dissection for at least 2 hrs a day and at least 3 days a week were selected. Written informed consent was taken from all of them. They were asked to fill up the questionnaire which included questions regarding basic demographic profile and toxic effects of formalin. They were also asked to answer which was the most troublesome symptom and which one was the first to develop. All the data were entered in excel sheet. The data was further analyzed by using SPSS software version 11.0. Intergroup analysis was carried out by using unpaired t test.

## 7. Results

**Table 1:** Table showing percentage distribution of different toxic effects of formalin in terms of incidence of occurrence, severity and chronological order

<i>Symptoms</i>	<i>Incidence of</i>	<i>First</i>	<i>Most</i>
Watering through eyes	87.2	74.8	62
Tingling sensation in nose or	30.8	14.4	11
Irritation /dryness of throat	34.4	3.6	9
Cough	20	0.8	
Difficulty in breathing	5.2	-	
Skin problems	10.8	-	5
Headache	6.4	6.4	13
Others	31.2	-	

Table 1 shows percentage distribution of incidence of toxic effects of formalin which showed 87.2% students have reported watering of eyes. Others reported symptoms includes tingling sensation in nose (30.8%), irritation of throat (34.4%), cough (20%), headache (6.4%), skin problems (10.8%) & other like giddiness, lack of concentration (31.2%).

74.8 percent students said that the watering through eyes was first to be developed. While 62 percent felt that it was also the most troublesome symptom.

Surprisingly, only 12% of subjects have sought medical treatment for the toxic effects of formalin. Also, when we enquired about the awareness of formalin toxicity, only 31% of subjects were aware of its toxicity.

In intergroup analysis between students with spectacles and students with normal eye sight, we do not found any

statistically significant difference related to toxic effect of formalin.

But the intergroup analysis between students who regularly use mask and gloves for dissection and students who do not, there was statistically significant difference in terms of both incidence of occurrence and severity of symptoms.

## 8. Discussion

In the present study we have quantified the different toxic effects of formalin in terms of their incidence of occurrence, their chronological order and their severity in 250 I MBBS students. The reported symptoms included watering through eyes, tingling sensation in nose, irritation of throat, cough, headache, skin problems & other like giddiness, lack of concentration. The most troublesome and first to develop was watering through eyes. We also found students who does not use mask and gloves regularly for dissection are at a high of developing these symptoms.

## 9. Mechanism of action of formalin toxicity

The toxicity of formalin is mainly due to the formaldehyde present in the formalin. And the primary routes of human exposure to formaldehyde are inhalation, eye and dermal contact with target organs being the eyes, nose, throat and skin. Formaldehyde being water soluble gets dissolved in the mucosa. It then causes degenerative, inflammatory and hyper plastic changes in the mucosa of the target organ.

The absorbed formaldehyde is then converted to formate by the enzymes present in erythrocytes. Formate can cause cross linking of nucleic acids and amino acids causing cell death. Finally formate is oxidized to carbon dioxide and is excreted via exhalation.

Sometimes binding of formaldehyde to endogenous proteins may result in formation of neoantigens. Such neoantigens may elicit an immune response that might account for the occurrence of asthma and other respiratory symptoms. Thus formaldehyde present in formalin definitely has a toxic effect on various body tissue which can adversely affect the health of I MBBS students. So, proper precautions should be taken to prevent formalin toxicity. Considering this issue World Health Organization (WHO) has developed a guideline for formaldehyde in non-occupational settings at 100 ppb (0.1 mg/m<sup>3</sup>) for 30 minutes. This guideline was developed to protect against sensory irritation in the general population, but WHO states that it also represents an exposure level at which there is negligible risk of upper respiratory tract cancer in humans.

In addition to this some simple measures such as increasing airflow in the affected area by opening windows and doors, by using special local exhaust ventilators in dissection hall, by minimizing direct skin contact with formalin by using protective equipments such as rubber gloves, mask & aprons, exposing only the part of the body that is being dissected and periodical removal

of fluid dripping collected in the body trays will help in minimizing the toxic effect of formalin.

It has also been proved that arterial injection is the lowest exposure procedure in the embalming operation and has the least impact on total overall exposure values, so these should be practice during embalming. Some researcher also believes that ethanol glycerin fixation with thymol conservation can be a potential alternative to formaldehyde and phenol embalming.<sup>7</sup>

## 10. Conclusion

In the present study we found I MBBS students are at a high risk of developing formalin toxicity and they suffers from various symptoms which includes watering through eyes, tingling sensation in nose, irritation of throat , cough, headache, skin problems & other like giddiness, lack of concentration. Some of them are really troublesome and can adversely affect their health. So, proper precautions such as increase ventilation in the affected area, use of local exhaust fans and wearing apron, mask and gloves can help in minimizing the toxicity of formalin.

## 11. Future scope

The present study shows that I MBBS students are at high risk of developing formalin toxicity. So they should be advised to take precautions to minimize the toxic effect of formalin on them. Also further study with large sample size and precautionary intervention will definitely address the problem with more weightage.

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