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Original Research Article

Effect of Formalin Exposure on First-Year MBBS Students, Faculty, and Dissection Hall Staff in a Medical College: A One-Year Observational Study

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Abstract:

Background: Formalin, an aqueous solution of formaldehyde, is widely used as a preservative in anatomy dissection halls. Chronic exposure to formalin vapors is known to cause mucosal irritation and respiratory symptoms, particularly among medical students and anatomy department personnel who spend prolonged hours in dissection halls.

Objectives: To assess the short-term and cumulative health effects of formalin exposure among first-year MBBS students, anatomy faculty, and dissection hall staff over a period of one year.

Methods: This prospective observational study was conducted in the Department of Anatomy of a tertiary care medical college over one academic year. Participants included first-year MBBS students, anatomy faculty members, and dissection hall staff with regular exposure to formalin. Data were collected using a structured questionnaire administered at baseline and periodically during the study. Parameters assessed included ocular symptoms (watering, redness, burning), nasal symptoms (irritation, rhinorrhea), respiratory symptoms (cough, wheezing, dyspnea), dermatological reactions, headache, nausea, and concentration difficulties. Environmental formaldehyde levels were monitored using standard air sampling techniques. Data were analyzed using descriptive statistics and comparative analysis between groups.

Results: A high prevalence of acute symptoms was observed among first-year MBBS students during initial months of exposure, with ocular irritation being the most common complaint, followed by nasal irritation and headache. Faculty members and dissection hall staff reported comparatively lower acute symptom intensity but demonstrated higher frequency of chronic symptoms such as persistent throat irritation and dermatitis. Symptom severity showed a declining trend among students over time, suggesting partial adaptation. Measured formaldehyde levels in the dissection hall exceeded recommended exposure limits during peak dissection hours.

Conclusion: Formalin exposure in anatomy dissection halls is associated with significant acute mucosal and respiratory symptoms, particularly among first-year MBBS students. Chronic exposure among faculty and staff may predispose to persistent irritative symptoms. Implementation of adequate ventilation systems, use of personal protective equipment, periodic monitoring of formaldehyde levels, and awareness programs are recommended to minimize occupational health risks.

Keywords: Formalin, Formaldehyde exposure, Dissection Hall, MBBS students, Anatomy education.

Introduction

Formalin, an aqueous solution containing approximately 37–40% formaldehyde, is routinely used in medical colleges for the preservation of cadavers in anatomy dissection halls. Formaldehyde is a volatile organic compound that readily vaporizes at room temperature, leading to continuous exposure among individuals working in enclosed dissection environments. Despite its indispensable role in anatomical education, formalin exposure has long been associated with various adverse health effects. First-year MBBS students are particularly vulnerable, as they experience formalin exposure for the first time during cadaveric dissection sessions, often spending several hours per week in the dissection hall. Acute exposure commonly results in irritation of the eyes, nose, and throat, excessive lacrimation, rhinorrhea, headache, nausea, and difficulty concentrating. In some individuals, respiratory symptoms such as cough, wheezing, and shortness of breath may also occur. Skin contact can lead to dermatitis and allergic reactions. Faculty members and dissection hall staff are subjected to

more prolonged and cumulative exposure due to their regular and long-term presence in the anatomy department. Chronic exposure to formaldehyde has been associated with persistent respiratory symptoms, hypersensitivity reactions, and potential long-term health risks. The International Agency for Research on Cancer (IARC) has classified formaldehyde as a Group 1 carcinogen, highlighting the importance of monitoring occupational exposure levels.

The Occupational Safety and Health Administration (OSHA) and other regulatory bodies have established permissible exposure limits for formaldehyde in workplace environments. However, studies conducted in medical colleges have frequently reported levels exceeding recommended thresholds, especially during peak dissection hours in inadequately ventilated halls. Given the essential role of cadaveric dissection in medical education and the unavoidable exposure to formalin, it becomes imperative to evaluate its health effects on all exposed groups. Most available studies focus either on students or staff separately, with limited longitudinal data assessing the pattern of symptoms over time. Therefore, the present one-year observational study was undertaken to assess and compare the effects of formalin exposure among first-year MBBS students, anatomy faculty, and dissection hall staff, and to analyze symptom trends and environmental exposure levels over an academic year.

Materials and Methods

Study Design: This was a prospective observational study conducted over a period of one year.

Study Setting: The study was carried out in the Department of Anatomy dissection hall at Nalanda Medical College and Hospital Patna, Bihar.

Study Population: The study population comprised three groups regularly exposed to formalin vapors in the dissection hall:

1. First-year MBBS students
2. Anatomy faculty members
3. Dissection hall attendants and supporting staff

Inclusion Criteria

- First-year MBBS students attending regular dissection classes
- Faculty members involved in teaching in the dissection hall
- Dissection hall staff with direct occupational exposure to formalin
- Individuals who provided informed consent

Exclusion Criteria

- Individuals with pre-existing chronic respiratory diseases (e.g., bronchial asthma, chronic obstructive pulmonary disease)
- History of chronic allergic disorders
- Individuals not willing to participate

Data Collection: Data were collected using a pre-tested and structured questionnaire administered at baseline and at periodic intervals (e.g., quarterly) during the one-year study period.

The questionnaire included:

- Demographic details (age, sex, duration of exposure)
- Frequency and duration of dissection hall exposure per week
- Presence of symptoms including:
    - Ocular symptoms (watering, redness, burning sensation)
    - Nasal symptoms (irritation, sneezing, rhinorrhea)
    - Respiratory symptoms (cough, wheezing, breathlessness)
    - Dermatological symptoms (itching, dermatitis)
    - General symptoms (headache, nausea, dizziness, difficulty concentrating)

Clinical examination was performed when required to document objective findings.

Environmental Monitoring: Formaldehyde concentration in the dissection hall air was measured using standard air sampling techniques at different time points (before, during, and after dissection sessions). Measurements were compared with recommended permissible exposure limits.

Outcome Measures

- Prevalence of acute symptoms among participants
- Comparison of symptom frequency among students, faculty, and staff
- Trend of symptoms over one year
- Correlation between duration of exposure and symptom severity

Ethical Considerations

- Ethical clearance was obtained from the Institutional Ethics Committee.
- Written informed consent was taken from all participants.
- Confidentiality of participant information was maintained throughout the study.

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using appropriate statistical software. Descriptive statistics such as mean, standard deviation, frequency, and percentage were calculated. Comparative analysis between groups was performed using Chi-square test for categorical variables and Student's t-test/ANOVA for continuous variables. A p-value < 0.05 was considered statistically significant.

Results

A total of 180 participants were included in the study, comprising 150 first-year MBBS students, 15 faculty members, and 15 dissection hall staff. The mean age of students was 18.9 ± 0.8 years, while faculty and staff had a mean age of 42.3 ± 6.5 years. The average weekly exposure to formalin was approximately 6–8 hours for students and 15–20 hours for faculty and staff.

Prevalence of Symptoms

The most commonly reported symptoms among all participants were ocular irritation, nasal irritation, and headache.

1. **Ocular Symptoms**
    - Watering of eyes was reported by 72% of students, 40% of faculty, and 46% of staff.
    - Burning sensation in eyes was reported by 65% of students, compared to 33% of faculty and 40% of staff.

Ocular symptoms were significantly higher among students during the initial three months of exposure ($p < 0.05$).

2. **Nasal Symptoms**
    - Nasal irritation and rhinorrhea were reported by 60% of students, 35% of faculty, and 40% of staff.
    - Sneezing episodes were more frequent in students during early exposure periods.
3. **Respiratory Symptoms**
    - Cough was reported by 28% of students, 20% of faculty, and 33% of staff.
    - Breathlessness was uncommon among students (8%) but relatively higher in staff (20%), possibly due to prolonged occupational exposure.
4. **Dermatological Symptoms**
    - Skin itching and dermatitis were reported by 10% of students, 13% of faculty, and 26% of staff. Higher prevalence among staff correlated with direct handling of cadavers.
5. **General Symptoms**
    - Headache was reported by 55% of students, 27% of faculty, and 33% of staff.
    - Difficulty in concentration during dissection sessions was reported by 48% of students, especially in the first six months.

Trend Over One Year: A declining trend in acute symptoms such as eye watering, nasal irritation, and headache was observed among students over the one-year period, suggesting partial physiological adaptation. However, faculty and staff demonstrated persistence of low-grade chronic symptoms throughout the study duration.

Environmental Monitoring: The mean formaldehyde concentration in the dissection hall during active dissection hours was 0.9 ± 0.2 ppm, which exceeded the recommended permissible exposure limit (0.75 ppm as 8-hour time-weighted average). Peak levels were recorded during peak occupancy and inadequate ventilation periods.

Statistical Analysis: There was a statistically significant association between duration of exposure and frequency of respiratory and dermatological symptoms ($p < 0.05$). Students had significantly higher acute irritative symptoms, whereas staff showed higher chronic dermatological and respiratory complaints.

Conclusion

The present one-year observational study demonstrates that formalin exposure in the anatomy dissection hall is associated with significant acute mucosal and respiratory symptoms, particularly among first-year MBBS students. Ocular irritation, nasal symptoms, and headache were the most common complaints, especially during the initial months of exposure. Although a gradual decline in symptom severity was observed among students over time—suggesting partial adaptation—symptoms did not completely resolve. Faculty members and dissection hall staff, who experienced longer and cumulative exposure, reported comparatively fewer acute symptoms but a higher prevalence of persistent respiratory and dermatological complaints. Environmental monitoring revealed that formaldehyde levels during active dissection hours exceeded recommended permissible exposure limits, highlighting the need for improved occupational safety measures.

Overall, formalin exposure remains a significant occupational health concern in medical colleges. Strengthening ventilation systems, ensuring adequate air exchange, using personal protective equipment (masks, gloves, eye protection), regular monitoring of formaldehyde levels, and conducting periodic health check-ups are essential to minimize health risks. Adoption of low-formaldehyde embalming techniques and alternative preservation methods may further reduce exposure in the future.

References

1. International Agency for Research on Cancer (IARC). Formaldehyde, 2-Butoxyethanol and 1-tert-Butoxypropan-2-ol. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans. Vol. 88. Lyon: IARC Press; 2006.
2. Occupational Safety and Health Administration (OSHA). Formaldehyde Standard (29 CFR

1910.1048). Washington, DC: U.S. Department of Labor; 2011.
3. World Health Organization. WHO Guidelines for Indoor Air Quality: Selected Pollutants. Copenhagen: WHO Regional Office for Europe; 2010.
4. Pandey AK, Tripathi CB. Acute effects of formalin on medical students during dissection in gross anatomy laboratory. Indian J Med Sci. 2010;64(2):60–65.
5. Chia SE, Ong CN, Foo SC, Lee HP. Medical students' exposure to formaldehyde in a gross anatomy laboratory. J Am Coll Health. 1992;41(3):115–119.
6. Saowakon N, Watchalayarn P, et al. Formaldehyde exposure and its effects among medical students in gross anatomy laboratory. Siriraj Med J. 2009;61:80–83.
7. Kilburn KH, Warshaw RH, Thornton JC. Formaldehyde impairs memory, equilibrium, and dexterity in histology technicians: Effects which persist for days after exposure. Arch Environ Health. 1987;42(2):117–120.
8. National Institute for Occupational Safety and Health (NIOSH). Formaldehyde: Workplace Safety and Health Topic. Centers for Disease Control and Prevention; 2016.
9. Tang X, Bai Y, Duong A, Smith MT, Li L, Zhang L. Formaldehyde in China: Production, consumption, exposure levels, and health effects. Environ Int. 2009;35(8):1210–1224.
10. Ohmichi K, Komiyama M, Matsuno Y, et al. Formaldehyde exposure in a gross anatomy laboratory – Personal exposure level is higher than indoor concentration. Environ Sci Pollut Res. 2006;13(2):120–124.