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A comparative study of effects of formalin exposure on visual acuity in First year M.B.B.S. students

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Abstract

Formalin is an aqueous solution of Formaldehyde is a chemical commonly found in residential and occupational environment. It had been used as preservative in various procedures like embalming, preservation of viscera in histology, and organs and storage of cadavers in the anatomy. The formaldehyde that is adsorbed on respiratory particles may elicit a greater, conjunctival, nasal mucosal, and respiratory mucosal, allergic and inflammatory effects. The purpose of this study was to determine effects of formaldehyde on visual acuity of exposed students in anatomy laboratory. The visual acuity of formalin exposed group were recorded and compared with non-exposed group shown to have significant difference of visual acuity.

Keywords: Formaldehyde, Preservative, Visual acuity, Snellen's, Jaeger's chart

Introduction

Formaldehyde is a colourless, flammable, quite water soluble gas commonly available for its use as 37% by weight by volume 40% gas in water. In the body formaldehyde is quickly converted in to formic acid. It is also used widely in adhesive, cosmetic, paints, plastic, textile industries and for preservation of organs and viscera in various school, biological, zoological, forensic, and pathological laboratories for years. In anatomy faculty, students, technicians, and staff is regularly exposed to this chemical by inhalation. After inhalation through respiratory tract it reaches in body metabolizes to formic acid. Robert B. Perna *et al.* (2001) [9] has demonstrated that chronic formaldehyde exposure can cause multiple health related problems, cerebral dysfunction and persistent neuropsychological sequelae. Symptomatically the exposure has been associated with respiratory problems, excessive fatigue, headache, mood changes, and impaired attention, concentration, and memory functioning. Some research suggested that exposure results in long term immunological changes, cell neurofilament protein changes and demyelination. Alexandersson, R., *et al.* (1982) [1]; Dally, K. A., *et al.* (1981) [4]; Garrett, M. H., *et al.* (1999) [6]. Elicited that Formaldehyde exposure has been associated with irritation, tearing of eyes, burning of mucous membrane of air passages, dizziness, headache and tightness in chest. Taskinen *et al.* (1999) [10], in a large study with 1,094 participants, found that female woodworkers exposed to formaldehyde had significantly risk of abortions, delayed conception, and endometriosis. Farah K. *et al.* (2009) [5] in their study have found that in the expose group 88 percent subjects suffer from eye irritation, 74 percent suffers from nose irritation, while 29 percent suffers from throat irritation and 21 percent from airways. Andersson I. *et al.* (1983) [2] in a controlled exposure study in humans Increase formaldehyde concentration causes dose related symptoms like dryness in the nose, throat and conjunctiva. So the need to assess visual acuity became mandatory for the formalin exposed group of students.

Aims and objective

Aims of present study is to observe effect on visual acuity caused by formalin on exposed group of MBBS first year students in dissection hall and to compare the results with the non-exposed group.

Material and Methods

50 students of first MBBS randomly selected who exposed to formalin for six months in dissection hall for 2 hours daily for 6 days in a week at department of Anatomy Dr. S. N. Medical College Jodhpur and 50 students of B.P.T. and B.M.L.T freshly joined non-exposed group were selected. Examination for visual acuity, distant (Snellen's chart) and near vision (Jaeger's chart) for each candidate were recorded and tabulated to form graph and statistical results.

Results

In present study out of 100 students in which 50 cases were control (Non-exposed) and 50 were exposed to formalin for six months, we found refractive error for Distant vision in 42% in formalin exposed group in comparison to non-

exposed group which was having 26%. We observed refractive error for near vision in 9% in formalin exposed group in comparison to non-exposed group which was having 3%. In similar study done by Yadav Abhijeet, *et al.* (2014) [13] at medical college Sagar (M.P.) of effects of formalin on 150 first year M.B.B.S. students by giving them questionnaire 30% had unpleasant smell of formalin, 24.67% students have reported irritation and watering of eyes, others reported symptoms includes running or congested nose (20.67%), Sore throat (17.33%), headache (14.67%), skin problems (12%), lack of concentration (16.67%). They found disturbances of sight in 3% student only.

Innovation1

Distant Vision (DV) Record (Snellen's Chart)

Group	Vision	6/6	6/9	6/12	6/18	6/24	6/36	6/60
Non Exposed (50)	RE	38	7	3	0	1	1	0
	LE	36	9	2	2	0	1	0
	Total	74	16	5	2	1	2	0
Formalin Exposed (50)	RE	29	12	5	1	1	2	0
	LE	29	14	4	0	1	2	0
	Total	58	26	9	1	2	4	0

Chi Square Testing (DV)

Group	6/6	6/9 and below	Row Total
Non Exposed	74(66.00) (0.97)	26(34.00) (1.88)	100
Formalin Exposed	58(66.00) (0.97)	42(34.00) (1.88)	100
Column Totals	132	68	Grand Total - 200

The Chi Square statistic is $\chi^2 = 5.7041$ The P-Value is 0.016925 The Result is significant at $P < .05$

Distant Vision Graph

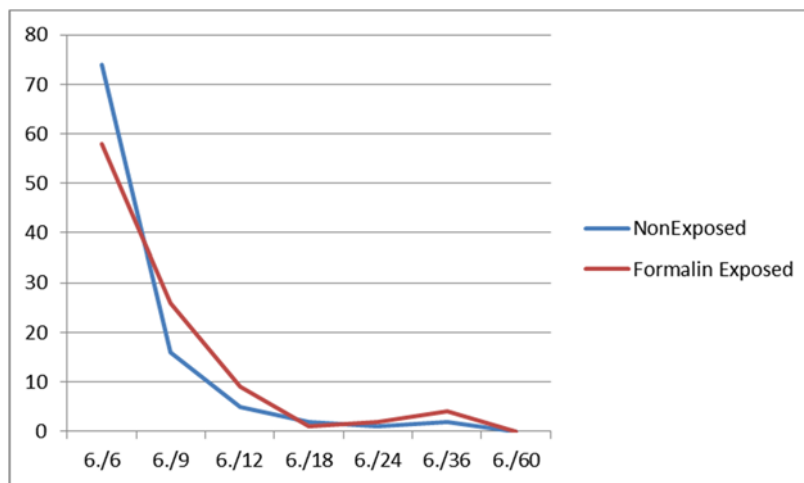


Fig 1: Showing Number of bilateral distant vision of exposed and Non-exposed groups.

Near Vision (NV) Record (Jaeger's Chart)

Group	Vision	N5	N6	N8	N10	N12	N18	N36
Non Exposed (50)	RE	32	18	0	0	0	0	0
	LE	31	16	3	0	0	0	0
	Total	63	34	3	0	0	0	0
Formalin Exposed (50)	RE	17	27	5	0	0	1	0
	LE	18	29	2	0	1	0	0
	Total	35	56	7	0	1	1	0

Chi square Testing (NV)

Group	N5	N6	N8 and Below	Row Total
Non Exposed	63(49.00), (4.00)	34(45.00)(2.69)	3(6.00)(1.50)	100
Formalin Exposed	35(49.00), (4.00)	56(45.00)(2.69)	9(6.00)(1.50)	100
Column Totals	98	90	12	Total- 200

The chi square statistic is $\chi^2 = 16.3778$. The P value is 0.000278 The Result is significant at $P < .05$

Near Vision Graph

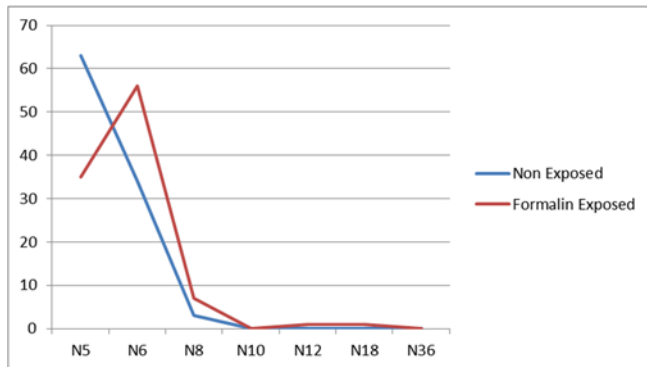


Fig 2: Showing Number of Bilateral near Vision of Exposed and Non Exposed groups.

Discussion

The exposure of formaldehyde is quite common, there are few studies of its effects. The effects of formalin exposure on visual acuity on medical students has been undertaken to see the effects which shown to be significant in chi square testing for both distant and near vision in comparison to non-exposed group. Although it is clear that formaldehyde may cause multiple physical sign and symptoms. Thrasher., J.D., *et al.* (1990) [11] reported T-lymphocyte activation in persons exposed to formaldehyde, even after exposure has ceased. They studied more than 200 cases and found subtle but chronic activation of the immune system. The exposure to low molecular weight chemicals including formaldehyde can be cause to elicit an autoimmune response and resulting immune derangement (Ashford, N. A., *et al.*) (1991) [3]. Study done by Patil G.V., *et al.* (2014) [7] on medical students concluded that Formaldehyde causes degenerative, inflammatory and hyper plastic changes in the mucosa of the target organ. The absorption it is converted to Formate by the enzymes in erythrocytes. Formate can cause cross linking of nucleic acids and amino acids that results in cell death. Finally formate is oxidized to carbon dioxide and is excreted via exhalation. Walrath J., *et al.* (1983) [12] elicited proportionate mortality due to skin, kidney and brain cancer is more among embalmers exposed to formaldehyde. Raja D.S., *et al.* (2012) [8] stated that the toxic effects of the formalin can be reduced by using hand gloves, mask while doing dissection of cadavers but there was not so much reduction in the symptom irritation and watering of the eyes by using the spectacles.

Conclusion

The effects of formalin exposure on medical students of first year M.B.B.S. students have a significant change in visual acuity in comparison to non-exposed group, so there is strong need for further evaluation of effects by means of histological changes due to chronic exposure to formalin. And further there is also strong need for keeping maintenance of health records of each medical student,

doctors, teaching and working staff on formalin exposure in every medical colleges starting from entry to regularly after six monthly periodical checkups.

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