



## Ophthalmological, ENT complications in dissection lab – sharing experiences of medical students from Nepal

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### Background:

Dissection is a crucial part of Anatomy, which helps future training in the clinical subjects like surgery. Formalin is used as a preservative substance for cadavers. The main objective of the research was to find out the ophthalmological and ENT associated clinical manifestations allied with formalin preserved cadaveric dissection among basic science medical students.

### Methods:

A questionnaire-based study was carried out in the Basic Science Campus of Manipal College of Medical Sciences, Pokhara, Nepal. The questionnaire included Ophthalmological, ENT and other clinical manifestations associated with dissection.

### Results:

Response rate of the study was quite high (406 students, 97.83%) among which females 181, 44.58% and males were 225, 55.41%. ENT and ophthalmological manifestations like Lacrimation 62.1%, Ocular irritation 58.6% and Running or congested nose 42.1% were the commonest problems reported during dissection of the cadavers. Males had [OR 1.403 (0.941, 2.091)] times Running or congested nose than females during dissection. Male student also experienced disturbance sight, [OR 1.48 (0.930, 2.356)] times more compared to females.

### Conclusion:

Different clinical manifestations were relatively less comparing with other medical colleges. This is practically impossible to remove preservative substances from the dissection lab entirely, but adopting suitable measures can change the scenario. Ventilation Improvement, installation of exhaust ventilation dissection tables is more effective in this context. Giving short breaks in dissection sessions, protective measures like, activated carbon mask and rubber glove for sensitive students will be helpful.

### Keywords:

Anatomy, cadaver, clinical manifestation, dissection, formalin, medical student, Nepal.

## Background

Anatomy is one of the most basic, vital subjects of integrated basic medical sciences, which is taught in the first two years, beginning of the medical career [1]. A sound understanding of human anatomy knowledge is required for surgical specialization which ultimately helpful for further development of medical professionalism [2]. Cadaveric Dissection is the important most practical aspect of anatomy which significantly influences the skills and attitudes of future medical professionals [3]. Cadavers are used to conceptualize more about the practical aspect of anatomy [4, 5]. The first exposure may be a emotional shock, but repeated exposure makes students comfortable for this teaching/learning process [6]. Formalin is used to preserve cadavers [7] which are the leading cause of certain clinical manifestations such as airway irritation and obstructive disorders such as asthma, ocular irritations, carcinomas, female reproductive disorders, dermatitis, skin sensitization [8-11]. Formaldehyde concentration higher than 0.5mg/m<sup>2</sup> responsible for dry nose, throat and conjunctiva. Worldwide studies have shown the dissection associated health hazards of medical students and professionals, which is mainly due to formaldehyde exposure [12-18].

The main purpose of this present study was to find out the Ophthalmological, ENT and other complications in dissection lab amongst medical students studying in Nepal with 40% formalin-treated cadavers. This is the first study unlocking the scenario of dissection lab in Nepal.

## Material and Methods:

### Study Period

The current research work was done in 15<sup>th</sup> March 2012 to 15<sup>th</sup> July 2013.

### Study design and the participants

This was a questionnaire based study carried out at the Manipal College of Medical Sciences, Pokhara in Nepal. Questionnaires were distributed among students mainly, based on the causative factors allied with Ophthalmological, ENT and other complications in dissection. Students are instructed to fill it freely and anonymously.

### Response Rate

The response rate was quite higher, out of 415 students, 406 filled the questionnaires correctly giving an overall response rate of 97.83%.

### Questionnaire design and Validity

Questionnaire was designed to obtain clinical manifestations of ophthalmological, ENT and others coupled with dissection. There was option to choose "yes" or "no".

The questionnaire started with specific instructions followed by demographic data. Any identifiable personal details like name, address, or roll number they had not entered. Study identification numbers were used in this context. Pilot study was done among 10 volunteer medical students, 3 senior residents and 4 faculty members among them two were subject experts (Dr. Rajandra Upadhyaya – Professor, Department of Anatomy and Mr. Pugazhandhi – lecturer department of Anatomy); who commented on the relevance and unambiguity of the questionnaire. With their suggestions and opinions, necessary modifications were done and questionnaire was validated with Alpha Cronbach 0.69.

### Data collection

Questionnaires were distributed amongst the medical students of basic sciences and they were asked to answer each question frankly, honestly. Project investigators cleared the doubts of students, so that they can fill it correctly.

### Inclusion criteria

All the students of Basic Sciences were included in the study from Manipal College of Medical Sciences, Pokhara, Nepal (MCOMS). MCOMS is the oldest and one of the most reputed, prestigious private medical of Nepal which was established in 1994.

### Exclusion criteria

Students who were not willing to participate voluntarily or who filled the questionnaire incorrectly were set up as exclusion criteria for the avoidance of study bias.

### Sample size calculation

From the pilot study of 10 students, 90% showed clinical manifestations during dissection so  $P=90\%$   $Q=10\%$ ,  $E=4\%$  of  $P = 3.6$  and sample size required was 267 [19].

### Outcome variables

Clinical signs and symptoms associated with eye, ENT, and dermatological manifestations were considered as outcome variables.

### Explanatory variables

The demographic factors defined at individual level including age, gender and nationality; were set as explanatory variables.

### Ethical committee approval

This research study was conducted in accordance with the latest version of the Declaration of Helsinki. Ethical committee approval was taken from college authority and consent was also received from participants prior to study.

### Data management and statistical analysis

Descriptive statistics and testing of hypothesis were used for the analysis. Statistical Package for the Social Sciences (SPSS) for Windows Version 16.0 (SPSS Inc; Chicago, IL, USA) was used in the study. Chi-square test was used to obtain the associations between the different variables and strength of the relationship with logistic regression. Odds ratios (OR) and their 95% confidence intervals (95% CI) was calculated and a p value < 0.05 was considered statistically significant.

### Results

Half of the Nepalese and Srilankan students complained about running or congested nose whereas among Indians complication was comparatively less. Burning sensation in the throat was relatively less among Indians. Coughing, tightening in the chest more in Nepalese followed by Indians.

None of the Srilankans complained about this. Ocular irritation was more in Nepalese, followed by Indians and Srilankans. Lacrimation was more common in Nepalese followed by Srilankans and Indians. Disturbance of sight was less complained by Srilankans. Except running or congested nose and disturbance of sight there was very little gender disparity among all of the above factors [Table 1].

**Table – 2: Dermatological manifestations**

Nationality	Allergic dermatitis		Burning sensation of the skin		Drying, cracking of the skin		Blistering, and scaling of the skin	
	No	Yes	No	Yes	No	Yes	No	Yes
Nepali	210 (94.6)	12 (5.4)	199 (89.6)	23 (10.4)	142 (64.0)	80 (36.0)	200 (90.1)	22 (9.9)
Indian	124 (94.7)	7 (5.3)	119 (90.8)	12 (9.2)	108 (82.4)	23 (17.6)	120 (91.6)	11 (8.4)
Sriankan	50 (94.3)	3 (5.7)	47 (88.7)	6 (11.3)	47 (88.7)	6 (11.3)	53 (100)	0 (0.0)
<b>P value</b>	0.996 <sup>x</sup>		0.891 <sup>x</sup>		0.000 <sup>†</sup>		0.059 <sup>†</sup>	
Female	169 (93.4)	12 (6.6)	149 (82.3)	32 (17.7)	122 (67.4)	59 (32.6)	164 (90.6)	17 (9.4)
Male	215 (95.6)	10 (4.4)	216 (96.0)	9 (4)	175 (77.8)	50 (22.2)	209 (92.9)	16 (7.1)
<b>P value</b>	0.334 <sup>x</sup>		0.000 <sup>†</sup>		0.019 <sup>†</sup>		0.404 <sup>x</sup>	

<sup>†</sup>p<0.05, statistically significant

<sup>x</sup>p>0.05, statistically not significant.

**Table 2** explains that although complaints were relatively less the number of cases of burning sensation of the skin was almost double than allergic dermatitis amongst all nationalities. Drying and cracking of the skin was more evident among Nepalese followed by Indians and Sri Lankans. Blistering, and scaling of the skin was complained by relatively less Nepalese and Indian students but none of the Sri Lankans.

**Table – 1 ENT and ophthalmological problems**

ENT complications						
Nationality	Runny or congested nose		Burning sensation in the throat		Coughing, tightening in the chest	
	No	Yes	No	Yes	No	Yes
Nepali	114(51.4)	108(48.6)	171(77.0)	51(23.0)	203(91.4)	19(8.6)
Indian	93(71.0)	38(29.0)	115(87.8)	16(12.2)	127(96.9)	4(3.1)
Sriankan	28(52.8)	25(47.2)	39(73.6)	14(26.4)	53(100)	0(0.0)
<b>P value</b>	0.001 <sup>†</sup>		0.023 <sup>†</sup>		0.016 <sup>†</sup>	
Female	113(62.4)	68(37.6)	145(80.1)	36(19.9)	168(92.8)	13(7.2)
male	122(54.2)	103(45.8)	180(80.0)	45(20.0)	215(95.6)	10(4.4)
<b>P value</b>	0.096 <sup>x</sup>		0.978 <sup>x</sup>		0.236 <sup>x</sup>	
Ophthalmological problems						
Nationality	Ocular irritation		Lacrimation		Disturbance sight	
	Yes	No	Yes	No	No	Yes
Nepali	146(65.8)	76(34.2)	154(69.4)	68(30.6)	169(76.1)	53(23.9)
Indian	68(51.9)	63(48.1)	64(48.9)	67(51.1)	92(70.2)	39(29.8)
Sriankan	24(45.3)	29(54.7)	34(64.2)	19(35.8)	46(86.8)	7(13.2)
<b>P value</b>	0.004 <sup>†</sup>		0.001 <sup>†</sup>		0.058 <sup>†</sup>	
Female	106(58.6)	75(41.4)	116(64.1)	65(35.9)	144(79.6)	37(20.4)
Male	132(58.7)	93(41.3)	136(60.4)	89(39.6)	163(72.4)	62(27.6)
<b>P value</b>	0.983 <sup>x</sup>		0.452 <sup>x</sup>		0.097 <sup>x</sup>	

<sup>†</sup>p<0.05, statistically significant

<sup>x</sup>p>0.05, statistically not significant.

**Table – 3: ENT and Ophthalmological manifestations**

ENT complications			Ophthalmological Problems		
Runny or congested nose	Burning sensation in the throat	Coughing, tightening in the chest	Ocular irritation	Lacrimation	Disturbance in sight
171(42.1)	81(20)	23(5.7)	238(58.6)	252(62.1)	99(24.4)
Dermatological manifestations					
Allergic dermatitis	Burning sensation of the skin	Drying, cracking of the skin	Blistering, and scaling of the skin		
22(5.4)	41(10.1)	109(26.8)	33(8.1)		

There were no significant difference in terms of genders regarding complains of allergic dermatitis, drying, cracking of the skin, blistering, and scaling of the skin. Females complained around four times more burning sensation of the skin than males, which was significant.

Problems regarding ENT and ophthalmological changes were running or congested nose - 42.1%, burning sensation in the throat, lacrimation -62.1% Ocular irritations - 58.6% followed by disturbance in sight. Dermatological manifestations were also seen, where drying, cracking of the skin 26.8% and

Burning sensation of the skin 10.1% were the commonest physiological and clinical manifestations [Table 3].

#### Determinants of clinical manifestations and Gender of the students by logistic regression.

Males had [OR 1.403 (0.941, 2.091)] times Running or congested nose than females during dissection. Male student also experienced disturbance sight, [OR 1.48 (0.930, 2.356)] times more compared to females. They were also experienced dryness of mouth, sweating and pass out [OR 2.158 (1.377, 3.381)], [OR 2.250 (1.490, 3.396)] and [OR 5.539 (2.420, 12.676)] times respectively compared to females. Whereas the dermatological manifestations like burning sensation of the skin was [OR 5.154 (2.390, 11.114)] times more in females than males. Drying, cracking of the skin was also more prevalent [OR 1.693 (1.088, 2.633)] among females [Table 4].

**Table – 4: Logistic Regression Table of various clinical manifestations and Gender of the students**

ENT problems - Odds Ratio (Confidence Interval)				
	Running or congested nose	Burning sensation in the throat	Coughing, tightening in the chest	
Male	1.403(0.941, 2.091) <sup>*</sup>	1.007(0.617, 1.643) <sup>*</sup>	0.601(0.257, 1.405) <sup>*</sup>	
Female	1	1	1	
Ophthalmological Problems - Odds Ratio (Confidence Interval)				
	Ocular irritation	Lacrimation	Disturbance sight	
Male	1.004(0.675, 1.494) <sup>*</sup>	0.856(0.571, 1.283) <sup>*</sup>	1.480(0.930, 2.356) <sup>*</sup>	
Female	1	1	1	
Dermatological manifestations - Odds Ratio (Confidence Interval)				
	Allergic dermatitis	Burning sensation of the skin	Drying, cracking of the skin	Blistering, and scaling of the skin
Male	0.655(0.276, 1.553) <sup>x</sup>	1	1	0.739(0.362, 1.506) <sup>*</sup>
Female	1	5.154(2.390, 11.114) <sup>†</sup>	1.693(1.088, 2.633) <sup>†</sup>	1

<sup>†</sup>p<0.05, statistically significant,

<sup>x</sup>p>0.05, statistically not significant.

#### Discussion

More awareness and attention has been drawn to the different effects of dissection among students and suggestions regarding such trauma and subsequent education and practice are more in last 10 – 15 years [20]. Adverse effects are common with the skin contact of the hazards solution – formaldehyde and the vapor can irritate the respiratory tract, eyes and cause lacrimation, burning of the nose and throat, dyspnea, and headache[21]. Susceptibility varies subject to subject. It has also observed that some individuals do not show any reaction to the exposure at the same levels [22].

#### ENT and ophthalmological Complications

A very interesting finding of our study was that about half of the Nepalese and Sri Lankan students suffered running or

congested nose whereas it was relatively less among Indians. This may be due to the fact that the formalin concentration was more in the air which affected them. Indians were less susceptible in this context. Our findings corroborates with Mizukiet al [22].

□ Nigerian research work also showed that a lesser number of students were affected with running or congested nose (mild 9%, moderate 3%) [23]. Mansour R et al, Teharan, reported 16% of the study population complained about Wheezing, which may be associated with running nose [24]. Burning sensation in the throat was due to formalin vapor mostly suffered by Nepalese and Sri Lankans. A study done by Huma Musarrat Khan shows that 15.6% student complained about this problem [25].

Oral or pharyngeal itch which may be associated with burning throat was also experienced by the students. Azari R reported that more than half of the students (56%) complained about burning throat, which may be due to a ventilation problem inside the dissection hall compared with us [24]. Though Coughing and tightening of chest were relatively rare and were mostly experienced by Nepalese students. Some studies already documented the irritating and offensive odor of formaldehyde may provoke or intensify asthmatic symptoms [26].

Other studies revealed that 19.7% complained few incidents of breathlessness while 3.5% said this was a more frequent occurrence [25]. Mansour R et al explained that shortness of breath was a clinical manifestation for 36% and coughing for 54% [24]. Formaldehyde is corrosive to the eyes and it was one of the commonest problems reported by half of the study population of each country which was similar to other studies [23, 27]. Burning eyes was also common and statistically significant in the dissection room [27].

Lacrimation which was the most common clinical manifestation amongst the students, similar to the other study done by Khan HM et al [25]. Burning sensation of the eyes was also reported by half of the students during dissection [24, 29]. The reported higher exposure rates can be explained by the greater number of fresh cadavers in the gross anatomy laboratories, similar with our findings. Disturbed vision was also associated with dissection affecting mostly Nepali and Indian students. There may be several causes like eye fatigue, eye soreness, swelling of eyelids which were already documented research works in Pakistan and Teharan. 36% of the students in Teharan complained blurred vision which may be due to the effect of formaldehyde [25]. It could be also result from disturbance of light refraction on the cornea-tear interface caused by scattering of light on account of excess tears from reflex tearing [30].

All the ENT and ophthalmological problems may be due to diffusion of formalin vapor which excites mast cells located in the conjunctiva and nostrils leading to release of histamine and serotonin. These chemicals provoke vascular

engagement along with the above mentioned conditions [31]. Formalin vapor might mix with the cornea tear film/moist nasal surface and might provoke ocular itching, tearing, redness, nasal discharge and sneezing [30]. To minimize the above mentioned effects, abundant literatures are available explaining the use of alternative compounds such as Shellac [32], glutaraldehyde, fixing solutions with formaldehyde to water ratio 1:3 [15], ammonium carbonate [18] and salt-containing solutions which can also be used [12].

### Dermatological manifestations

Formaldehyde can be absorbed through the intact skin and is the origin of severe irritation or allergic dermatitis and formaldehyde gas exposure may lead to major allergic symptoms and the diagnosis of allergic contact dermatitis by patch testing [33, 34].

Relatively less population of all the three nationalities complained about allergic dermatitis, which may be due to less susceptibility to formaldehyde. The reason for these allergic reactions may be due to modification of tissue proteins when skin contact occurs. This causes local toxicity and initiates allergic reactions due to eczematous dermatitis, after frequent exposure [33]. Sometimes this clinical manifestation affects more population who complained of itching of the skin due to dermal exposure of HCHO [35]. This was also common among medical professionals [36-40]. In some other studies itching and paraesthesia of hands were also significant factors, but in our study burning sensation of the skin was less prevalent and not significant [28].

Comparing the magnitude of dermatological exposure, Nepali students complained more about drying or cracking of the skin, compared with the other two nationalities. Some other studies showed that this is one of the most common effects of formaldehyde—"skin-related diseases" [14].

Burning sensation of the skin was more in females and this was statistically significant.

### Common physiological and clinical manifestations

Dissimilar research studies available showing the different physical symptoms during Anatomy dissections, support our study [21, 22]. Running or congested nose, and Ocular irritation, lacrimation were some of the most important issues among the medical students, in concordance with other studies [27, 24, 25]. Dermatological manifestations were common among our medical students which is supporting many studies [14, 37 - 40].

### Conclusion

ENT and ophthalmological manifestations like lacrimation, ocular irritation and running or congested nose were the commonest problems seen in medical students during dissection of the cadavers. Comparing with other studies, complications are less in MCOMS. This is impossible to

remove hazardous preservative substances from the dissection lab entirely, but some preventive measures can diminish the clinical manifestations and change the scenario. Improvement in windows ventilation, installation of dissection tables equipped with local exhaust ventilation systems would be more effective in this context.

Negative pressure ventilation and monitoring systems can reduce formaldehyde vapor air concentration. Taking short breaks between dissection sessions could be helpful for the students. Specific instructions for sensitive students like wearing an activated carbon mask and rubber gloves during dissection will help more in this context. Alternative safer and nontoxic chemicals like glutaraldehyde can take place over formaldehyde as an embalming fluid.

### Limitations & future scope of the study

As area concentrations of formaldehyde is an important factor, which should be measured but as this study is not funded, so we were not able to measure it. In the present study, we have included only one institution, but multicentre study with formalin vapour concentration in air is recommended for the future researchers.

### Competing interests

The authors declare that they have no competing interests.

### Abbreviations

CNS – central nervous system, ENT- ear nose throat

### Authors' contribution

BR, IB and PB designed the questionnaire, interpreted the data, drafted the manuscript, and revised it. BR conceived of the study with IB, RU, PB, MM and IAK acquired & interpreted the data and revised the manuscript. BS took part in data analysis, interpreted the data, and revised the manuscript. RU critically revised the manuscript. BR and IB edited the English language of the manuscript.

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