Original Research

Awareness of Intraoperative Team from Occupational Hazards Related to Surgical Smoke in Allame Bohlool Gonabadi hospital in 2019

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Abstract

Electrocauterization smoke consists of 95% water and 5% toxic and mutagenic. It is an operating room hazards because it causes health problems for intraoperative teams including cancer, respiratory disorders, hypoxia, cardiovascular disorders, anemia, leukemia, and transition of hepatitis, HIV and HPV. Intraoperative team should be aware of the potential hazards of electrosurgery and take it seriously. The purpose of the present study was to determine intraoperative team' awareness of electrocauterization smoke hazards in Allame Bohlool Gonabadi hospital. Present descriptive cross-sectional study evaluated awareness of intraoperative team in Allame Bohlool Gonabadi hospital in 2019 by census method. After data collecting by a questionnaire, obtained data were analyzed by SPSS software, Kruskal-Wallis and Mann-Whitney tests. Finally, mean score of participant awareness of surgical smoke hazards was calculated and evaluated relationship between awareness level with gender, level of education and work experience. The significant level was $P \leq 0.05$. This research demonstrated that there was no notable difference between awareness and gender, level of education and work experience ($p=0.203$, $p=0.591$, $p=0.286$; respectively). Also, mean score of awareness of electrocauterization smoke hazards was 6.8± 0.14; such that 87% of them had poor awareness. The lowest rate of awareness was linked to women (45%), individuals with bachelor's degree (82.85%), and work experience of 0-10 years (73.57%). Given that the awareness of intraoperative team in Allame Bohlool Gonabadi hospital is poor; holding workshops or pamphlets seems necessary.

Keywords: Awareness; Electrosurgical Smoke's Hazards; Intraoperative Team; Knowledge

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Introduction

Technology is progressing but sometimes along with its benefits, we see their unwanted

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hazards that awareness of these hazards can help us in better utilization of this technology. In field of surgery, electrocautery is the most common heat-producing device that uses the high-frequency electrical current to cut or coagulate the targeted tissue. This heat causes boiling of the cellular contents so releases the plume into the air that is called "surgical smoke" (1). The Occupational Safety & Health Administration (OSHA) in the United States (US) estimates that 500,000 workers in the US such as surgeons and operating room technologists, perioperative nurses, anesthesiologists, and medical and under-graduating students are exposed during several hours per day for many years (2). Surgical smoke consists of 95% water and 5% toxic and mutagenic components such as acetaldehyde, formaldehyde, Toluene, Ethylene, Phenol, Xylene, Benzene, Naphthalene and Phenanthrene (1, 3-5). It was found that 91.1% of the nurses and 86.1% of the physicians use common surgical masks (6). Unfortunately, standard surgical masks do not adequately filter surgical smoke particles because these particles are extremely small (7-9). So, it is listed as a workplace hazard in the operating room because it causes health problems for intraoperative teams such as cancer (10), respiratory disorders (11, 12), hypoxia and dizziness, sneezing and coughing, nausea and vomiting, dermatitis, cardiovascular disorders, anemia, leukemia, weakness, eye and throat irritation, tearing (13, 14), double vision, anxiety and headache. It is necessary to mention that this smoke is a vehicle for the transition of malignant cells such as hepatitis, HIV (15) and HPV (human papilloma virus) (16, 17). Based on studies, it is estimated that cauterizing one gram of tissue is equivalent to using six unfiltered cigarettes (18). One of the solutions offered to evacuate the surgical smoke is suctioning; but surgeons believe that suctioning the surgical smoke makes a lot of noise and reduces the speed of action; therefore, only the use of masks and room ventilation is sufficient to protect the staff from the surgical smoke (19). It should be noted that awareness of the complications of electrosurgical smoke causes the intraoperative team to do preventive proceedings and individual protection including local exhaust systems, effective ventilation systems, in addition to the use of the N95 mask, and safety goggles (5); so that create a smoke-free environment and ensure their health to some extent. Since the exposure with surgical smoke is many, this study was done to investigate the awareness of intraoperative team from electrosurgical smoke's hazards and complications in Allame Bohlool Gonabadi Hospital.

Methods

Present descriptive cross-sectional research examined the intraoperative team awareness, including surgeons, operating room technicians and students who are dealing directly with the electrocauterization smoke in Allame Bohlool Gonabadi hospital in 2019. In this study, sampling did by census method and willingness to participate in this study was done. After obtaining informed consent verbally, the questionnaires were completed by the intraoperative team within 15-20 minutes in the operating room. This questionnaire consisted of two parts, demographic characteristics and questions about knowledge of the electrocauterization smoke complications. Demographic characteristics consisted of gender, level of education and work experience. Second part contains 21 three-choice questions (true, false, I do not know) that showed knowledge of intraoperative team about the electrocauterization smoke complications. The scoring was based on, one for correct answer, zero for wrong answer and I do not know. Finally, scores were totalized to

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obtain the subjects' score. Thus, the maximum knowledge score was 21. Obtained scores were classified as poor (less than 50% of total score), moderate (51 to 75% of total score) and good (more than 75% of total score) (20, 21). Data were analyzed using SPSS 20 and Kruskal-Wallis and Mann-Whitney tests. The level of significance was at $P \leq 0.05$.

Results

In this study, the number of participants was 140 peoples. As shown in Table 1, the highest number was belonging women (52.1%, 73 people), with history work 10-0 years (82.85%, 116 people) and bachelor's degree (89.28%, 125 people). The number, percentage, mean and standard deviation of each question are shown separately in Table 2. In this study, in order to evaluate the normality of data distribution, Kolmogorov- Smirnov test was used, which was the result of the test (P = 0.038) and showed that the data distribution was not normal and non-parametric tests should be used. It should be noted that in this study, Mann-Whitney test results showed that there was no significant difference between the knowledge and gender (P = 0.203). Also, results of Kruskal-Wallis test showed that there was no significant relationship between knowledge and level of education (p = 0.591) and between knowledge and work experience (p = 0.286). Based on the results, the mean ± sd of participants' knowledge about electrosurgical smoke's hazards was 6.8± 0.14; so that 87% of the participants had a low level of awareness. In this regard, the lowest level of awareness allocated to women (45%, 63 people), people with 0-10 years of experience (73.57%, 103 people) and participants with a bachelor's degree (82.85%, 116 people) Table 3.

Discussion

Based on the results, the awareness of intraoperative team from electrosurgical smoke's hazards in 87% of participants was poor. Also, women's awareness was less than men's; but there was no significant relationship between awareness from electrosurgical smoke's hazards with work experience and education.

Limchantra et al. 2019 reported that surgical smoke is dangerous for Operating Room Personnel (22). The results of previous studies have shown that the use of cautery smoke evacuation is not common and universal, and one of the factors that affect its evacuation is awareness of its dangers. In this regard, Ball et.al. in 2010 reported that awareness of the effects of cautery smoke is directly related to its evacuation, and training programs can create a smoke-free environment (23, 24). Numerous studies have emphasized that the surgical team exposed to cautery smoke should be aware of its side effects (25-28). Not only the surgical team should consider short-term complications such as burning of the mucous membranes and vision; but also they needs to consider its long-term risks (25, 29). Ortolano et al. 2009 explained chronic exposure of operating room personnel to surgical smoke is a worrying factor (27). Despite the complications of electrocauterization smoke and high exposure of intraoperative team to it, there was a few studies to determine the level of knowledge of intraoperative team about these. Results of present study are similar to our previous findings in Birjand and Mashhad (20, 21) that were showed poor knowledge of intraoperative team about complications of this smoke. Operating room personnel and surgeons must be aware of the surgical smoke hazards. Massarweh et al. 2006 stated that because of the hazards of conventional electrosurgical instruments, intraoperative team must be trained in the correct use of these devices (25). Health care personnel are responsible for

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training of cautery using and must try to decrease the risks of these materials (18). In line with the findings of the present study, Clark in his study had indicated that the level of knowledge about the surgical diathermy hazards is low (30). Also, Lehman et al. 2008 assessed the level of knowledge about medical electrical equipment with a questionnaire that was emailed to 1000 urologists and found the level of knowledge of urologists to be low (31). Sudhindra et al. 2000 reported that surgeon's awareness of the hazards of cautery smoke was poor in a UK hospital (32). Unver et al. in 2016 reported that only 55% of operating room staff in two hospitals in Turkey are aware of the negative effects of cautery smoke (33). Contrast to the results of the present study, Marzouk et al 1999 reported that 96% of intraoperative team were aware of the operating room hazards (34). these dissimilarities may be due to the generality of this study about awareness from the hazards in the operating room. Spearman et al. 2007 demonstrated that only three of 98 surgeons used smoke extractors, while 72% of intraoperative team believed there are inadequate precautions to protect from the potential hazards of electrosurgical smoke (35). The consistent use of individual protection devices is dependent on knowledge and training about the hazards of surgical smoke (36).

Conclusion

In order to prevent and train of surgical smoke risks, it is suggested that health care professionals increase their awareness using the workshops and educational pamphlets and thus observe the principles of self-care against surgical smoke.

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Table 1.Demographic characteristics of the participants (n=140).

Demographic characteristics		Number	Percent (%)
Gender	Men	67	47.8
	Women	73	52.1
Work experience	0-10	116	82.8
	10-20	21	15
	20-30	3	2.1
Level of Education	Surgeon	5	3.5
	Master of science	10	7.14
	Bachelor of science	125	89.28

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Table 2. The level of awareness of intraoperative team from electrosurgical smoke's hazards based on questionnaire questions.

Questions	Yes Number (%)	No Number (%)	I don't know Number (%)	Mean	Standard deviation
Is surgical smoke a combination of several gases?	67 (55.8)	5(4.1)	68(56.6)	0.55	0.98
Are surgical smoke compounds harmful and dangerous?	105(87.5)	15(12.5)	20(16.6)	0.87	0.72
Can inhalation of surgical smoke cause respiratory complications such as emphysema, bronchitis and nasal injuries?	78(65)	18(15)	44(36.6)	0.65	0.90
Can inhalation of surgical smoke cause hypoxia and dizziness?	74(61.66)	18(15)	48(40)	0.61	0.91
Can contact with surgical smoke cause dizziness?	72(60)	39(32.5)	29(24.16)	0.6	0.79
Can exposure to surgical smoke cause HIV transmission?	39(32.5)	74(61.66)	27(22.5)	0.32	0.68
Does inhalation of surgical smoke increase the risk of lung cancer?	88(73.33)	4(3.33)	48(40)	0.73	0.94
Does contact with surgical smoke have skin side effects such as dermatitis?	30(25)	44(36.66)	66(55)	0.25	0.78
Can exposure to surgical smoke cause cardiovascular disease?	23(19.16)	35(29.16)	82(68.33)	0.19	0.75
Does exposure to surgical smoke cause diabetes?	9(7.5)	79(65.83)	52(43.33)	0.07	0.58
Can exposure to surgical smoke cause headaches?	96(80)	24(20)	20(16.66)	0.8	0.73
Can contact with surgical smoke cause nausea and vomiting?	100(83)	182(15)	22(18.33)	0.83	0.75
Can contact with surgical smoke cause gastrointestinal complications such as colitis?	14(11.66)	62(51.66)	64(53.33)	0.11	0.65
Can contact with surgical smoke cause transmission of the hepatitis virus?	27(22.5)	66(55)	47(39.16)	0.22	0.71
Can contact with surgical smoke cause anemia?	10(8.33)	55(45.83)	73(60.83)	0.08	0.62
Can exposure to surgical smoke cause leukemia?	36	49(40.83)	55(45.83)	0.3	0.79
Does exposure to surgical smoke cause weakness and fatigue?	55(45.83)	23(19.16)	62(51.66)	0.45	0.91
Can eye contact with surgical smoke cause eye irritation and tears?	99(82.5)	13(10.83)	28(23.33)	0.82	0.80
Can exposure to surgical smoke reduce vision and diplopia?	25(20.83)	40(33.33)	72(60)	0.20	0.77
Can exposure to surgical smoke cause throat a sore throat?	83(69.16)	35(29.16)	22(18.33)	0.69	0.75
Can exposure to surgical smoke cause transmission of the HPV virus?	18(15)	41(34.16)	81(67.5)	0.15	0.71

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Table 3. The level of awareness of intraoperative team from electrosurgical smoke's hazards based on gender, level of education and work experience.

Level of awareness	Gender Number (%)		Work experience Number (%)			Level of education Number (%)			Total Number (%)
	Men	Women	0-10	10-20	20-30	Surgeon	Master of science	Bachelor of science	
Poor (≤50%)	60 (42.85)	63 (45)	103 (73.57)	18(12.58)	2 (1.42)	3 (2.14)	4 (2.85)	116 (82.85)	123 (87.85)
Moderate (51-75%)	7 (5)	10 (7.14)	13 (9.28)	3 (2.14)	1(0.71)	2 (1.42)	6 (4.28)	9 (6.42)	17 (12.14)
Good (≥75%)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

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