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Original Article

Investigation and Analysis on Occupational Exposure Causes and Mental Status of Infectious Diseases in Pre-Hospital Emergency Medical Personnel

Mingyi Qin [1], Yu Li [2], Zongze He [2], *Xiaojuan Hou [3]

1. *Department of Nursing, The Fourth Hospital of Hebei Medical University, Shijiazhuang, 050000, Hebei, China*
2. *Department of Emergency, The Fourth Hospital of Hebei Medical University, Shijiazhuang, 050000, Hebei, China*
3. *Department of Endocrinology, The Fourth Hospital of Hebei Medical University, Shijiazhuang, 050000, Hebei, China*

***Corresponding Author:** Email: houtgzy@163.com

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Abstract

Background: We aimed to probe into the occupational exposure causes and mental status of infectious diseases in pre-hospital emergency medical personnel.

Methods: Forty medical personnel with occupational exposure to infectious diseases who participated in pre-hospital emergency work in 120 emergency center of The Fourth Hospital of Hebei Medical University, Shijiazhuang, Hebei, China were selected as respondents from February 2018 to February 2021. The occupational exposure modes, exposure degrees, exposure sites, exposure sources and exposure causes of infectious diseases were summarized, and the mental status of emergency medical personnel after occupational exposure to infectious diseases was analyzed.

Results: In the occupational exposure modes of infectious diseases, needle stick injuries were overtly higher than mucosal pollution, hematic and humoral pollution and incised wound by glass (P<0.05). In exposure degrees, slight bleeding was notably higher than excessive bleeding, bleeding and no bleeding (P<0.05). The hand was distinctly higher than the eye in exposure sites (P<0.05). In exposure sources, hepatitis B virus was visibly higher than hepatitis C virus, HIV, syphilis, intravenous drug, hemorrhagic fever and unknown cause (P<0.05). The scores of somatic symptoms, anxiety, depression, fear, interpersonal sensitivity, hostility, compulsion and paranoia in medical personnel were clearly higher than the norm in Chinese adults after occupational exposure to infectious diseases (P<0.05), with no statistical significance in the comparison of psychotic scores.

Conclusion: The occupational exposure risk of infectious diseases among pre-hospital emergency medical personnel is high. It is necessary to strengthen pre-job training and education and improve standardized management for protection.

Keywords: Pre-hospital emergency; Medical personnel; Infectious diseases; Occupational exposure

Introduction

Occupational exposure refers to the situation that the health of medical personnel is directly or indirectly damaged by physical, chemical, biological and other harmful factors in the process of pro-

fessional activity (1-3). Pre-hospital emergency, as a medical activity for salvage at scene and guardianship on the way of critically ill patients, has the characteristics of diversity, randomness, urgency and mobility (4-6). Medical personnel are faced with poor emergency environment, complex and diverse diseases and complex risk factors of occupational exposure, so they have become the high-risk population of occupational exposure in the medical care group.

The occupational exposure risk faced by medical personnel further increases if patients have infectious diseases like hepatitis B virus and hepatitis C virus, and the possibility of occupational exposure to infectious diseases increases. The occupational exposure to infectious diseases will lead to psychological stimulation of medical personnel and a series of adverse mental status, affecting their daily work and life (7).

The conclusion of characteristics and causes of occupational exposure to infectious diseases and analysis of mental status in medical personnel can provide evidence-based proofs for clinical reduction of occupational exposure to infectious diseases in pre-hospital emergency, and provide reference for strengthening psychological intervention.

We aimed to probe into the occupational exposure causes and mental status of infectious diseases in pre-hospital emergency medical personnel.

Materials and Methods

Study design

As a retrospective study, this study was conducted in The Fourth Hospital of Hebei Medical University, Shijiazhuang, Hebei, China from February 2018 to February 2021.

This study was in line with the principles of the Declaration of Helsinki (2013) (8), and medical personnel who were aware of the purpose, significance, content and confidentiality signed the informed consent.

General data

Forty medical personnel with occupational exposure to infectious diseases who participated in pre-hospital emergency work in 120 emergency center, with 12 males and 28 females and average age of (34.55±3.62) years old, including 10 doctors and 30 nurses. There were 38 patients with bachelor degree or above and 2 patients with college degree. Twenty-five cases had primary title, 14 cases had medium-grade professional title and 1 case had senior professional title, and 35 cases were married and 5 cases were unmarried. Inclusion criteria: 1) The cases were registered nurses and medical practitioners. 2) The working life exceeded 1 year. 3) Their job was pre-hospital emergency. 4) They had preferable abilities of verbal communication and cognitive comprehension.

Exclusion criteria: 1) They were intern or advanced students. 2) They withdrew from this study midway. 3) They did not work in emergency department during investigation. The cases with occupational exposure to infectious diseases due to environment and the running vehicle were excluded.

Methods and observation criteria

A questionnaire was made to investigate the occupational exposure modes, exposure degrees, exposure sites, exposure sources and exposure causes of infectious diseases. The main exposure modes were mucosal pollution, hematic and humoral pollution, incised wound by glass, needle stick injuries and occupational exposure of respiratory tract related to new Crown. The exposure degrees included excessive bleeding, bleeding, slight bleeding and no bleeding. The exposure sources mainly were hepatitis B virus, hepatitis C virus, HIV, syphilis, intravenous drug, hemorrhagic fever and unknown cause. The exposure causes were described by medical personnel, then performing induction and summary by the study group. All medical personnel underwent emergency treatment measures after occupational exposure, such as squeezing out blood after needle injury, followed by cleaning, disinfection and bandaging.

At the same time, the questionnaire form of general condition and symptom check list-90 (SCL-90) scales for medical personnel (9) were used for investigation. The SCL-90 scale had 90 items and was divided into 9 main factors, including the extensive mental symptoms, from feeling, emotion, thinking, consciousness, behavior to living habits, interpersonal relationships, diet and sleep. Each item adopted a five-level scoring system, with 1 point as no symptom, 2 points as mild symptoms, 3 points as moderate symptoms, 4 points as slightly severe symptoms and 5 points as severe symptoms. On the day that the medical personnel agreed to participate in the study, all of them filled out the questionnaire under the unified guidance of professionals after the study group issued the questionnaire, and the professionals did not give any hint except the introduction of the questionnaire, then collecting the questionnaire on the spot to verify the integrity. The medical personnel should be encouraged to fill the missing items based on voluntary principle to ensure its integrity and authenticity. Finally, the mental status of emergency medical personnel after occupational exposure to infectious diseases was analyzed by comparing with the SCL-90 of norm in Chinese adults (10).

Statistical method

The software SPSS 20.0 (IBM Corp., Armonk, NY, USA) was used to analyze the experimental data, GraphPad Prism 7 (GraphPad Software, San Diego, USA) was adopted to draw pictures of data, and the enumeration data and measurement data in this study were tested by X^2 and *t* test. $P<0.05$ indicated a statistically significant difference.

Results

Analysis of occupational exposure of infectious diseases in medical personnel

In occupational exposure modes of infectious diseases, needle stick injuries were overtly higher than mucosal pollution, hematic and humoral pollution, incised wound by glass and occupational exposure of respiratory tract related to new Crown ($P<0.05$). In exposure degrees, slight bleeding was notably higher than excessive bleeding, bleeding and no bleeding ($P<0.05$). The hand was distinctly higher than the eye in exposure sites ($P<0.05$). In terms of exposure sources, hepatitis B virus was visibly higher than hepatitis C virus, HIV, syphilis, intravenous drug, hemorrhagic fever and unknown cause ($P<0.05$), as shown in Fig. 1.

Analysis of occupational exposure causes in medical personnel

The occupational exposure causes in medical personnel included insufficient self-protection awareness, defective safety management, improper emergency measure and protection and weak prevention and control capabilities.

Analysis of mental status in medical personnel after occupational exposure of infectious diseases

The scores of somatic symptoms, anxiety, depression, fear, interpersonal sensitivity, hostility, compulsion and paranoia in medical personnel were clearly higher than the norm in Chinese adults after occupational exposure of infectious diseases ($P<0.05$), with no statistic significance in the comparison of psychotic scores ($P>0.05$), as detailed in Table 1.

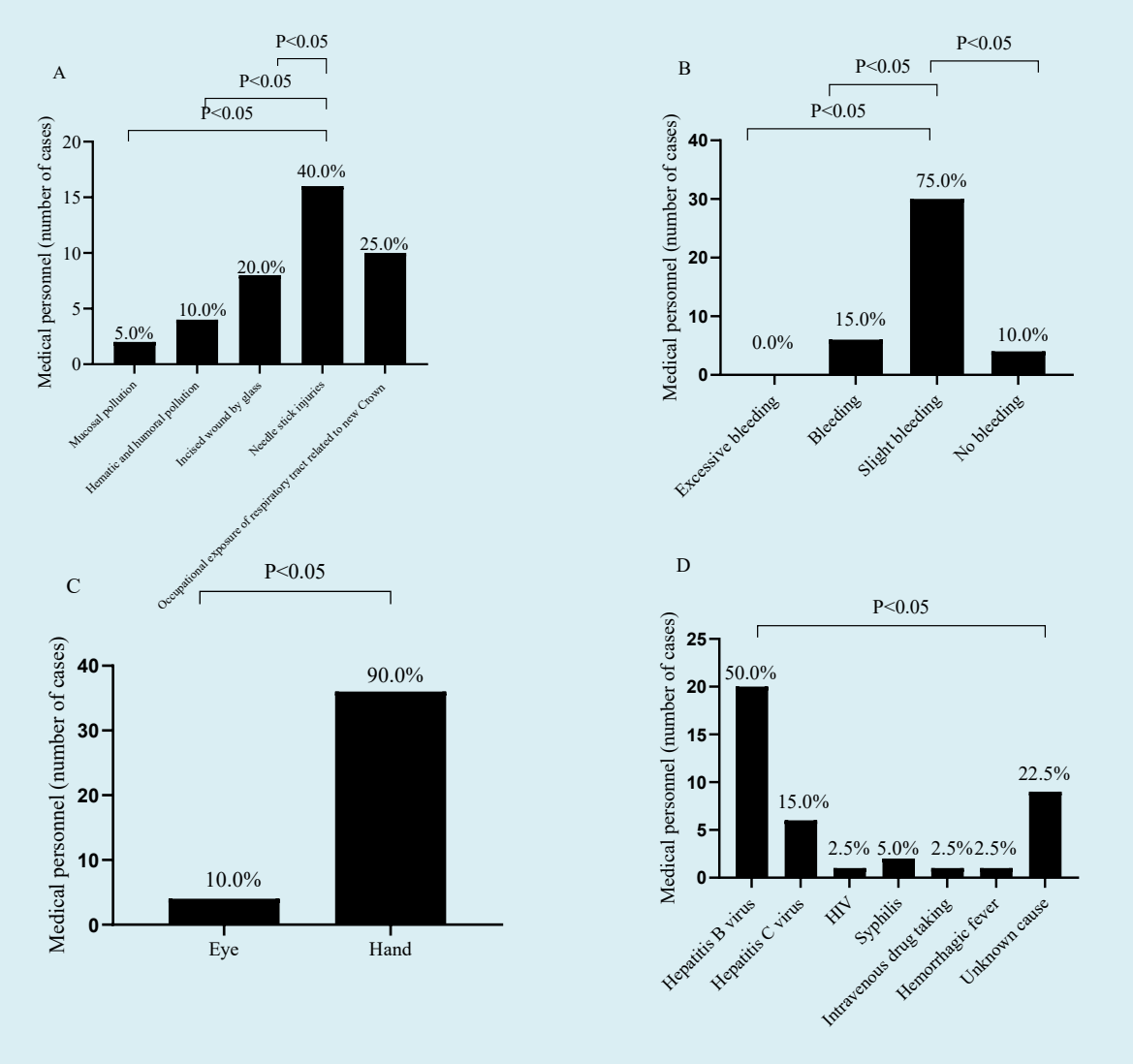

Fig. 1: Analysis of occupational exposure of infectious diseases in medical personnel [n(%)]
Notes. Figure 1A, 1B, 1C and 1D showed the occupational exposure modes, exposure degrees, exposure sites and exposure sources, respectively

Table 1: Analysis of mental status in medical personnel after occupational exposure of infectious diseases (x±s)

Items	***Medical personnel (n=40)***	***Norm***	***t***	***P***
Somatic symptoms	1.55±0.59	1.30±0.41	2.201	0.031
Anxiety	2.08±0.91	1.40±0.42	4.291	<0.001
Depression	1.95±0.77	1.48±0.60	3.045	0.003
Fear	1.68±0.47	1.35±0.48	3.107	0.003
Psychoticism		1.49±0.46	0.093	0.926

	1.50±0.50			
Interpersonal sensitivity		1.58±0.59	2.354	0.021
	1.95±0.80			
Hostility		1.45±0.52	4.309	<0.001
	2.10±0.80			
Compulsion		1.43±0.55	2.773	0.007
	1.80±0.64			
Paranoia		1.48±0.49	2.494	0.015
	1.83±0.74			

Discussion

Occupational exposure causes of infectious diseases in pre-hospital emergency medical personnel

In this survey, the main occupational exposure causes of infectious diseases in medical personnel included insufficient self-protection awareness, defective safety management, improper emergency measure and protection and weak prevention and control capabilities. Pre-hospital emergency has the characteristics of diversity, unpredictability and complexity. The critical work setting and the medical personnel with high work stress, heavy task, easy fatigue and weak self-care awareness increase the occupational exposure risk of infectious diseases (11-13). Due to heavy work task, save cost and weak protection awareness, some medical personnel did not apply protection tools in accordance with the standards, as an important cause of occupational exposure to AIDS (14). In addition, although medical personnel have developed a routine habit of wearing masks and gloves before home visit, most of them stay in simple protection awareness and behavior, which is far from the standard of protection requirements, and they often forget to wear protective equipment such as goggles and masks, increasing the occupational exposure risk during invasive operations (15,16).

In 40 pre-hospital emergency medical personnel with occupational exposure to infectious diseases included in this study, there were 25 cases with primary title, 14 cases with medium-grade professional title and 1 case with senior professional title, suggesting that the main subjects of occupational exposure are low professional title because of insufficient knowledge related to prevention and control of infectious diseases, small clinical experience relatively, insufficient times of training and weak prevention and control ability. Age is also related to prevention and control ability. The older medical personnel have rich experience, strong prevention awareness, standardized operation and high level of risk awareness, whose mechanism is similar to professional titles. In view of above reasons, managers should formulate the protection system for medical personnel in combination with relevant national laws and regulations, taking occupational security education as an important content of pre-job training, so that medical personnel could fully realize the danger and harmfulness of exposure to infectious disease to improve the awareness of prevention and control, then carrying out organized strict training to fully grasp various emergency plans, strengthen standard protection and occupational security education via layer-by-layer assessment, strictly regulate clinical operations and strengthen safety supervision. In the process of training, it is necessary to carry out exercises step by step to improve the abilities of emergency operation and prevention and control in medical personnel.

Characteristics of occupational exposure to infectious diseases among pre-hospital emergency medical personnel

There are about 800,000 cases of sharp injuries in the United States every year (17), and about 1 million cases of sharp injuries in Europe every year (18), finding that in the occupational exposure of infectious diseases, needle stick injuries were notably higher than mucosal pollution, hematic and humoral pollution and incised wound

by glass (P<0.05). The reason is that medical personnel should establish intravenous access, extract blood samples, and perform various drug injections during emergency rescue to cause needle stick injuries, and nurses are prone to incised injury by sharp instrument when breaking ampoules. In exposure degrees, slight bleeding was notably higher than excessive bleeding, bleeding and no bleeding (P<0.05). As the first medical worker to contact with trauma patients, pre-hospital emergency nurses often fail to wear gloves due to the critical situation, or the gloves are punctured during the emergency dressing process, so that they touch the blood. In the event of sharp injuries and needle stick injuries, only 0.004 ml of blood is enough to infect medical personnel (19-21). Therefore, medical personnel could master the safe operation method of preventing sharp injury, use safe needle head correctly and do a good job of self-protection when rescuing patients during the driving of ambulances.

In the case of needle stick injury, relevant measures should be taken immediately to squeeze out the wound blood, then rinsing the wound with soapy water and sodium chloride solution and disinfecting with ethanol and iodophor. For pathogens with infectivity, targeted preventive medication and follow-up observation should be taken. For some infectious diseases that might reduce the infection rate through immune injection, preventive injection should be carried out to reduce the possibility of infectious diseases. The exposure sites were mainly hands and eyes, and the hands were visibly higher than the eyes (P<0.05). It is necessary to pay attention to the preparation of isolation gown, gloves, isolated shoe sheath and other items in the ambulance, and goggles were placed in a convenient position for medical staff, thus improving the convenience of occupational protection in medical personnel. At the same time, the use of rapid hand disinfectants improved the sanitary conditions of hands in medical personnel. In terms of exposure sources, hepatitis B virus was visibly higher than hepatitis C virus, HIV, syphilis, intravenous drug, hemorrhagic fever and unknown cause (P<0.05).

After occupational exposure to infectious diseases in pre-hospital emergency medical personnel, managers need to establish an expert committee for occupational exposure assessment, which is evaluated by relevant professionals. The viral loads of exposure sources were divided into mild, severe and unknown, then formulating the corresponding measures. After the exposure treatment of infectious diseases, it is vital to report to the hospital infection department, summarize the whole process of event occurrence and provide evidence-based proofs for the subsequent formulation of the system.

Mental status of pre-hospital emergency medical personnel after occupational exposure of infectious diseases

The pre-hospital emergency medical personnel are facing a highly stressful working environment. Both doctors and nursing staff must make judgments in a short time for rescue immediately. Once an accident occurs, it will lead to medical disputes and adverse consequences, so that in the conventional working state, the pre-hospital emergency medical personnel have adverse mental conditions (22-24). After occupational exposure to infectious diseases, the scores of somatic symptoms, anxiety, depression, fear, interpersonal sensitivity, hostility, compulsion and paranoia of medical personnel were clearly higher than the norm of Chinese adults (P<0.05), indicating that the fear of medical personnel is aggravated and it is more likely to have adverse effects on life and work. Pre-hospital emergency medical personnel usually face pain and sometimes need to face patients with mutilation and mental illness (25). In addition, few patients are eager to seek help and prone to emotional extremes, and medical personnel face unprovoked scolding, which even threatens their personal safety and health, seriously affecting their mental status.

Psychosocial stress is also a risk factor for occupational exposure, showing a closed-loop relation, so that managers enable to improve the relevant work system, strive for the inclination of government policy as much as possible and provide a good working environment and logistics

support for pre-hospital emergency medical personnel. At the same time, managers should also strengthen humanistic care, follow the people-oriented concept, actively care about the mental health of medical personnel to guide, eliminate and reduce the impact of adverse factors, provide health knowledge education to strengthen psychological emergency training and help medical personnel to correctly treat work pressure. The pre-hospital emergency medical personnel need to improve the psychological caring ability actively, learn to cope with occupational stress and find out problems from multiple perspectives such as stress sources and stress responses for conclusion and consideration.

Conclusion

The occupational exposure risk of infectious diseases among pre-hospital emergency medical personnel is high, and it is necessary to strengthen pre-job training and education, improve standardized management for protection, enhance the prevention and control capabilities of medical personnel and intervene in psychological counseling in time after occupational exposure to reduce the incidence and adverse effects of occupational exposure to infectious diseases.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Not Applicable.

Conflict of Interest

The authors declare that there is no conflict of interest.

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