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Note

Survey on Training of the Nuclear Emergency Medical Assistance Team and Their Educational Needs

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Hirosaki University provides regular training to the Nuclear Emergency Medical Assistance Team (NEMAT), which is owned by a nuclear emergency core hospital since 2017. In this paper, we provide details of the NEMAT training that was held by Hirosaki University in March 2018, and discuss the satisfaction level and educational needs of the trainees who participated in the 2018 NEMAT training. After the training, which provides a combination of table-top lecture and practical training, we conducted a survey on the NEMAT training held by Hirosaki University. Out of 40 trainees, 33 (82.5%) stated that they were either "extremely satisfied" or "slightly satisfied" with the training program. Upon investigating the educational needs of the trainees, we found that many of them wanted insights on regulated science, such as "dispatch criteria of NEMAT" and "preparation of radiation emergency medical manual at own hospital." Based on these results, we suggested that the curriculum of the future training program should be developed after taking into account trainees' comments.

Key words: radiation accidents, nuclear disaster, radiation emergency medicine, educational activity, nuclear emergency medicine assistance team

1. Introduction

Japan has witnessed radiation accidents/nuclear disasters like the JCO accident in 1999 and the Fukushima Daiichi Nuclear Power Plant (FDNPP) accident in 2011[1]. The FDNPP accident in 2011 unveiled problems in smooth medicine due to lack of knowledge of stakeholders, such as the disaster core hospitals and the Disaster Medical Assistance Team, on radiation emergency medicine[2]. In other words, it was proved that the education of stakeholders on the acceptance of exposed/contaminated patient and support to hospital was an urgent requirement.

The nuclear disaster medical care/radiation medical care system in Japan has been developed based on the Nuclear Emergency Preparedness Measures Law and the Nuclear Emergency Preparedness Guidelines. In particular, as a result of the revision of the Nuclear Emergency Response Guidelines for 2015, the nuclear disaster medical care system has been significantly reconfigured and has evolved into its current form[2-4]. Since 2015, "nuclear emergency core hospitals," which have nuclear emergency medical assistance teams

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Table 1. NEMAT training program

Format	Lecture time (min)	Contents	Instructor's occupation
lecture 1[a]	15	Nuclear emergency preparedness system in Japan	medical doctor
lecture 2	60	Basic knowledge of radiation, human influence, protection	medical doctor
practical training 1[b]	**20**	**Use of radiation measuring instruments**	radiological technologist
lecture 3	10	Contamination inspection at medical institution	medical doctor
practical training 2	**20**	**Simple decontamination**	medical doctor, nurse, radiological technologist
lecture 4	20	Initial response at hospital	medical doctor
practical training 3	**45**	**Protective covering of hospital and medical equipment**	medical doctor, nurse, radiological technologist, logistic
lecture 5	20	The role of NEMAT	medical doctor
practical training 4	**145**	**Simulation Practice: Medical response and hospital support at the time of nuclear disaster**	medical doctor, nurse, radiological technologist, logistic

[a] Lecture using textbook prepared by NRA.
[b] Practice using textbooks or scenarios created by Hirosaki University.

Table 2. Number of trainees and lecturers and their respective specialties

	Profession	Number	
Trainees	medical doctor	10	
	nurse	15	
	radiological technologist	5	
	logistic	10	
			total 40
Instructors	medical doctor	5	
	nurse	3	
	radiological technologist	3	
	logistic	2	
			total 13

(NEMAT) aimed at hospital support and provision of medical services for exposed/contaminated victims in the acute phase of nuclear disaster have been developed[5]. In addition, the "Advanced Radiation Emergency Medical Support Centers" and the "Nuclear Emergency Medical Support Centers" that support dose assessment and medical treatment of serious exposed/contaminated patients are beginning to be designated nationwide. Hirosaki University has received these two designations from the Nuclear Regulatory Authority (NRA). In both national centers, it the greatest duty is to educate the medical staff and build a network with similar medical institutions. Hirosaki University currently conducts various training on radiation emergency medicine in various regions and medical institutions[6-11].

Hirosaki University started organizing their training program for NEMAT in 2017. In this paper, we provide details on the NEMAT training that was held by Hirosaki University in March 2018, and discuss the problems that must be addressed for future NEMAT development.

2. Details of NEMAT training

2.1. Outline of training

On March 2018, NEMAT training was held at Japanese Red Cross Ishinomaki Hospital in Miyagi Prefecture. Details about the training program are shown in Table 1. On January 1, 2018, Japanese Red Cross Ishinomaki Hospital was registered as a nuclear emergency core hospital from the prefecture; it is a large hospital located within 30 km of a commercial nuclear power plant. Trainees comprised medical staff from the Japanese Red Cross Ishinomaki Hospital and nearby nuclear emergency core hospitals (Tohoku University Hospital and Sendai Medical Center). The instructors were in charge of Hirosaki University staff and was a member specializing in disaster/emergency medical care. Please see Tables 1 and 2 for more information.

2.2. Training situation

When conducting training for NEMAT members, the NRA recommends using textbooks they have developed and published[12]. Since Japan developed the current nuclear emergency disaster prevention system in 2015, there were few opportunities for medical staff involved in disaster medical treatment to receive lectures on laws and regulations, and the purpose of this training was to provide appropriate and thorough information. The NRA text was particularly used in the 'Lecture' in Table 1, while 'Practical Training' was conducted using the content created by the authors (instructors). We have provided the details of practical training in the following paragraph.

In particular, practical training classes include (1) how to use radiation measuring instruments, (2) simple decontamination, (3) protective covering of hospital and medical equipment, (4) simulation practice which involves medical provision and hospital support at the time of nuclear disaster, as shown in Table 1. In practical training

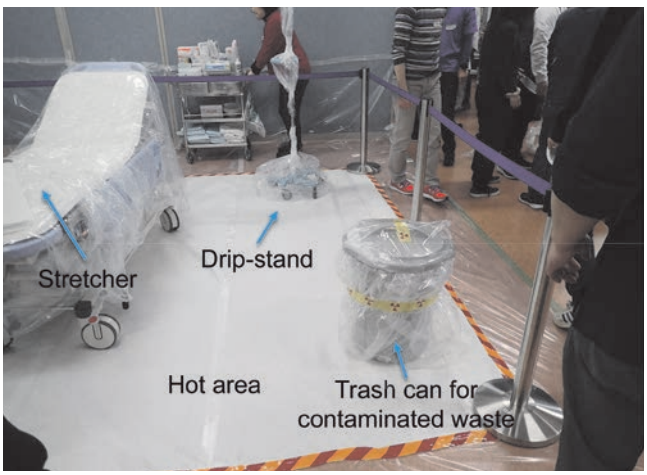

Fig. 1. A photograph of trainees using the GM survey meter. Trainees are checking how the count changes on changing the moving speed of the GM survey meter.

related to radiation measurement, we taught employees how to operate individual exposure dosimeters, GM survey meters and NaI scintillation survey meters. Participating doctors and nurses were shown how to install personal dosimeters. We explained to doctors and nurses how to install and read an individual dosimeter. In addition, we instructed radiological technologists on how to detect contamination using a GM survey meter, how to choose time constants, and how the distance between the contaminated part and the detection surface is related to the counting. In addition, by having the medical responders actually measure the sealed radioactive source, the program allowed them to experience and understand how slowly the detection surface of the survey meter should be moved and how much distance to keep between the detection surface and the contaminated surface. In the simple decontamination practice session, fluorescent paint was painted on the arm of the trainees to represent contamination and they were asked to decontaminate themselves using water and gauze. In addition, trainees performed first-hand decontamination work while being cautious of preventing further contamination expansion. In regard to protective covering the medical institution and the medical equipment, trainees engaged in practical training in covering the hospital transportation route and the floor of the treatment room as quickly as possible with vinyl sheets. For the protective covering of the emergency room (ER) we devised the training considering the size of the "hot area" to treat the patient and the area covered with vinyl such as drip-stand (Fig. 1) so that trainees could properly practice the covering.

Finally, for the simulation practice, we created content to help medical-responders in practicing "control of disaster countermeasures at headquarters and medical

(A)

(B)

(C)

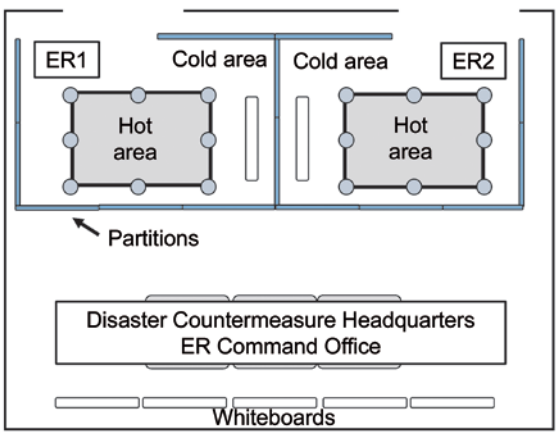

Fig. 2. The state and layout of the simulation practice. (A) Medical treatment for simulated patients. Wet decontamination is being carried out after contamination was confirmed in the right lower limb. (B) Management of disaster countermeasure headquarters. Patient information is being sent from municipal disaster countermeasures headquarters and/or nuclear company to nuclear emergency core hospitals. Trainees of the headquarters are also wearing protective clothing to practice clothing/undressing. (C) Venue layout of simulation practice. We blocked the area between the ER and the disaster countermeasure headquarters using a partition. Information is communicated using transceivers. With the help of such layout, we were able to conduct training in one room.

Table 3. Patient assumption in simulation practice

Number	Gender	Age	Contamination Level[a] (cpm)	Injury situation	Condition (vital sign)	Information of contamination and/or exposure
1	M	50	90,000 - 100,000	Deformed fracture	Body temperature (℃): 36.6 Pulse (min^{-1}): 80 Respiration (min^{-1}): 16 Blood pressure (mmHg): 135/70 JCS[b] 0	Contamination at the wound site
2	M	30	90,000 - 100,000	Laceration caused by falling Nausea	Body temperature: 36.4 Pulse: 75 Respiration: 15 Blood pressure: 134/72 JCS 0	Contamination at the wound site
3	M	40	90,000 - 100,000	Fracture Heatstroke	Body temperature: 37.1 Pulse: 80 Respiration: 25 Blood pressure: 148/84 JCS 0	Contamination at the wound site
4	M	45	90,000 - 100,000	Laceration caused by falling Strong pain in the abdomen Consciousness opacity	Body temperature: 36.5 Pulse: 120 Respiration: 25 Blood pressure: 90/56 JCS 10	Contamination at the wound site

[a] Using GM survey meter with detection area of 20 cm^2
[b] JCS: Japan Coma Scale

Table 4. Satisfaction level[a] of NEMAT training held by Hirosaki University

	Extremely satisfied	Slightly satisfied	Neither satisfied nor dissatisfied	Moderately dissatisfied	Extremely dissatisfied	No response
Medical doctor (n=10)	4	2	1	1	0	2
Nuurse (n=15)	10	4	1	0	0	0
Radiological technologist (n=5)	4	0	0	1	0	0
Logistic (n=10)	4	5	0	0	0	1
Total (n=40)	***22 (55.0%)***	***11 (27.5%)***	***2 (5.0%)***	***2 (5.0%)***	***0 (0.0%)***	***3 (7.5%)***

[a] The question content is 'Please answer the satisfaction level of the NEMAT training in 5 stages'.

provision of radiation emergency medicine." The patient assumptions controlled by the trainees, and the state of disaster countermeasure headquarters and wet decontamination are shown in Fig. 2 and Table 3, respectively. In the simulation, one team of trainees played the role of the "supervising team" of the nuclear emergency core hospital closest to the disaster site. Based on the assumption that the other trainees were dispatched from other nuclear emergency core hospitals, the intention was to stabilize the exposed/contaminated victims who were being transported. The patient assumption was created by combining their radiation information (contamination and external/internal radiation exposure) and physiological information. Each patient assumption had a different meaning; checking the wet decontamination of the wound site slowly (Patient number 1), it is necessary to suspect high-dose exposure (Patient number 2), prioritizing lifesaving, instead of decontamination, considering the circumstances (Patient number 3, 4). The exercise also realistically simulated the disaster situation by using dolls. Since it is legally difficult to obtain and use unsealed radioactive materials for practical training, we confirmed the degree of decontamination by using black light and applying fluorescent paint to the "wound."

3. Satisfaction level of trainees and educational needs

After completion of all lectures and practical training, we conducted a questionnaire survey on the NEMAT training held by Hirosaki University (Table 4). We received approval from the ethics committee of the Graduate School of Health Sciences, Hirosaki University, to conduct the survey using our questionnaire. We found that out of 40 trainees, 33 (82.5%) stated that they were either "extremely satisfied" or "slightly satisfied." Upon investigating the educational needs of the trainees, we found that many of them wanted insights on regulatory science, such as "dispatch criteria of NEMAT" and "preparation of radiation emergency medical manual at own hospital."

4. Summary

The NEMAT is mainly composed of medical doctors, nurses, radiological technologists, and clerical workers. Even the medical staff who may work with the NEMAT, which is expected to contribute in the acute period after the occurrence of a nuclear disaster, are anxious about radiation[2, 13]. Ordinarily, medical providers are tasked with understanding the needs of the patient[14]; however, in the case of nuclear disasters, NEMAT must also give support based on radiation-specific information such as the amount of exposure and the nuclide involved. In the current nuclear emergency disaster prevention system, education for NEMAT members is essential because there are few educators and medical workers who know everything about nuclear disaster response. In this article, we have provided information on the outline of the NEMAT training held by Hirosaki University, satisfaction of the students, and a few educational needs of the trainees that must be considered for future training. Since the satisfaction level of the trainees was good, overall, we believe that the contents of training and training time are not a problem. Meanwhile, it was observed that many trainees were interested in learning about the regulations and medical manual that are applicable at the time of nuclear disaster. It is difficult to provide the manual on headquarters' activities and medical provisions at the time of a nuclear disaster, but by clarifying the questions of the trainees, it may be possible to improve the understanding of the activities of NEMAT members and to reduce anxiety regarding radiation.

Hirosaki University will play an important role in nuclear disaster preparedness in the future and the university and its affiliated centers must contribute to regional and national nuclear emergency preparedness. Future work will need to focus on increasing the training surrounding nuclear emergencies in order to better prepare for these disasters.

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Conflict of Interest Disclosure

The authors declare that they have no conflict of interest.

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