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Report

International Activities on Radiation Emergency Medical Personnel Training: Reports of Japan-Korea Joint Radiation Emergency Medicine Winter Training 2019

Takakiyo Tsujiguchi[1, 2], Seokki Cha[3], Jihyeon Lee[3], Minsu Cho[3], Yohei Fujishima[1†], Kotetsu Tanaka[1], Masaru Yamaguchi[1] and Chieko Itaki[1, 2*]

[1]*Hirosaki University Graduate School of Health Sciences: 66-1 Hon-cho, Hirosaki, Aomori 036-8564, Japan*
[2]*Hirosaki University Center for Radiation Support and Safety: 66-1 Hon-cho, Hirosaki, Aomori 036-8564, Japan*
[3]*Korea Institute of Radiological & Medical Sciences: 75 Nowon-ro, Nowon-gu, Seoul, Korea*
[†]*Present affiliation is Department of Radiation Biology, Tohoku University School of Medicine: 2-1 Seiryo-machi, Aoba-ku, Sendai, Miyagi, Japan*

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Hirosaki University and the Korea Institute of Radiological and Medical Sciences signed an agreement in 2013 regarding research and human resource development in radiation emergency medicine. The two institutions collaborated to hold the "2019 Radiation Emergency Medical Education and Training Winter Course" from February 11 to 22, 2019. This article describes the content of the training course and the results obtained. Doctors, nurses, and radiological technologists, among others, from radiation emergency institutions in Korea and Japan took the course, which ran a total of ten days. For the first eight days, participants learned a wide range of fundamentals in radiation emergency medicine and disaster medicine, including the use of personal protective equipment, portable radiation measurement instruments, communication tools, and various tents. During the last two days, the participants went to a campsite near a nuclear power plant and conducted the simulated operation of a nuclear disaster medical countermeasure headquarters. Through this activity, participants learned that information management is very important in disaster activities and also learn the difficulty to treat with contaminated patients in winter.

Key words: nuclear disaster, emergency medicine, educational activity, nuclear emergency medicine assistance team, triage, disaster countermeasures headquarters

1. Introduction

Hirosaki University and the Korea Institute of Radiological and Medical Sciences (KIRAMS) signed an agreement in 2013 regarding research and human resource development in radiation emergency medicine[1)]. Specifically, in terms of human resource development, both organizations have in the past dispatched staff to nuclear disaster response training conducted in Japan and Korea, and have participated in each other's training, learning the actual situation of radiation emergency medical education in both countries[2, 3)]. The two institutions collaborated to hold the international "2019

*Chieko Itaki : Hirosaki University Graduate School of Health Sciences: 66-1 Hon-cho, Hirosaki, Aomori 036-8564, Japan
E-mail: itakichi@hirosaki-u.ac.jp

Table 1. Training schedule of 2019 REM

Date	Time	Contents	Learning form
Day 1	09:10 - 10:00	Warm up	-
(February 11th, 2019)	10:00 - 12:00	Radiation emergency medical system of Korea	Lecture
	13:00 - 14:00	Act on nuclear disaster	Lecture
	14:00 - 17:00	Desktop simulation of exposed/contaminated victims acceptance	Practice
Day 2	09:10 - 10:00	Warm up	-
(February 12th, 2019)	10:00 - 12:00	How to use communication equipment	Lecture & Practice
	13:00 - 17:00	PPE[a] (level a-d)	Lecture & Practice
Day 3	09:10 - 10:00	Warm up	-
(February 13th, 2019)	10:00 - 12:00	Understanding of CPR[b] & AED[c]	Lecture
	13:00 - 17:00	Simulation of CPR & AED	Practice
Day 4	09:10 - 10:00	Warm up	-
(February 14th, 2019)	10:00 - 13:00	Simulation of emergency medicine (summary of the day 1-3)	Lecture & Practice
	14:00 - 17:00	Practice on dosimeters	Lecture & Practice
Day 5	09:10 - 10:00	Warm up	-
(February 15th, 2019)	10:00 - 11:00	Radiation emergency medical system of Japan	Lecture
	11:00 - 12:00	Confirmation of emergency (medical) equipment	Lecture
	13:00 - 17:00	Training to set up a DRASH[d] tent & Isolation chamber	Lecture & Practice
Day 6	09:10 - 10:00	Warm up	-
(February 18th, 2019)	10:00 - 12:00	Decontamination (wet/dry)	Lecture & Practice
	13:00 - 17:00	Training to set up normal tent	Lecture & Practice
Day 7	09:10 - 10:00	Warm up	-
(February 19th, 2019)	10:00 - 15:00	Pre-exercise (Set up all tent at the ground)	Practice
	15:00 - 16:00	Training to transfer patient by helicopter	Lecture & Practice
Day 8	09:10 - 10:00	Warm up	-
(February 20th, 2019)	10:00 - 13:00	Explanation of scenario of field training (scenario of the day 9-10)	Lecture
	14:00 - 17:00	Equipment preparation (for the day 9-10)	-
Day 9	10:00 - 12:00	Move to training site	-
(February 21st, 2019)	13:00 -	Winter training	Field training
Day 10	- 14:00	Winter training (within equipment withdrawn)	Field training
(February 22nd, 2019)	14:00 - 16:00	Return to KIRAMS	-
	16:00 - 16:30	Celemony	-

[a] PPE: personal protective equipment
[b] CPR: cardiopulmonary resuscitation
[c] AED: automated external defibrillator
[d] DRASH: Deployable Rapid Assembly Shelter

Radiation Emergency Medical Education and Training Winter Course (2019 REM)" from February 11-22, 2019 in Seoul.

In 2019 REM, many different workers who support medical treatment during a nuclear disaster, including doctors, nurses, radiologists, and logisticians, participated from both Japan and Korea. Although there are a number of training courses on radiation emergency medicine in each country[4-6], two institutions co-hosting international training in the deep winter is very rare. In this paper, we provide details about the 2019 REM, summarize the problems of radiation emergency medicine in deep winter, and discuss the future of the nuclear disaster medical system in Japan.

2. Details of 2019 REM

2.1. 2019 REM Program and Participants

The 2019 REM was held from February 11 to 22, 2019, at KIRAMS in Seoul, and at outdoor campsites in Gapyeong. Table 1 summarizes the schedule and contents of the ten days. In addition, Table 2 summarizes the types of work and participation dates of participants. About 30 participants, mainly medical staff, attended daily, although some of them participated only on specific days due to work reasons.

From days one to eight, we conducted a program in Seoul City to disseminate information on the basics of emergency medicine and radiation science and the logistics of disaster medicine. In the last two days, field training was conducted at the outdoor campsite in Gapyeong City to simulate the construction and operation

Table 2. Daily number of participants and types of work

	Occupational Category	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9 (Field training)	Day 10 (Field training)
Korean	Medical Doctor	3	2	2	2	2	3	2	1	3	2
	Nurse	17	15	10	6	7	11	7	6	9	9
	Emergency Medical Technician	7	6	4	4	5	6	3	3	5	5
	Radiological Technologist	6	4	4	4	4	4	4	4	4	4
	Laboratory Scientist	2	2	2	1	2	1	1	1	1	1
	Office worker	10	10	7	7	4	9	4	4	7	7
	Research Scientist	2	2	2	1	1	2	3	2	1	1
Japanese	Nurse	-	-	-	-	-	-	-	-	2	2
	Radiological Technologist	1	1	1	1	1	1	1	1	1	1
	Laboratory Scientist	-	-	-	-	-	-	-	-	1	1

of a Nuclear Emergency Response Headquarters and triage tents during winter. The main purpose of this program was field training in the deep winter, and the first eight days were considered a preparation program for the field training.

2.2. Outline of training in Seoul City (days one to eight)

Because participants came from different institutions and had various careers, it was necessary to get to know each other. So, for eight days, participants did gymnastics and jogging together every morning. Each morning's warm-up helped greatly in communication, physical fitness and relationship building.

On day one, participants first had lectures on medical systems and laws in the event of a nuclear disaster, and in the afternoon they carried out computer exercises simulating how radiation medical institutions should be assigned exposed or contaminated victims.

On day two, participants learned how to use communication tools during a disaster and how to put on and remove personal protective equipment. Korea uses an application called K-REM[7], which can quickly collect patient and transport information at the time of a nuclear disaster. Participants learned about the essential logistics including the use of digital applications and walkie-talkies. Although protective clothing when performing radiation medical care usually uses level C or D from the viewpoint of shortening activity time, in practice also learned removal of levels A and B[8].

On day three, participants learned about Cardio-Pulmonary Resuscitation (CPR). Although this skill is basic emergency medicine, these lessons were very effective because that was not the specialty of some participants. The foundations of radiation/nuclear emergency medicine are emergency medicine and disaster medicine, and participants firmly learned the principle that CPR takes priority over contamination inspection.

On day four, participants performed a comprehensive review exercise. Specifically, the participants played the role of staff working in a hospital. After receiving a report from the fire brigade to transport contaminated patients to the hospital, they started preparing to work as a team and protect themselves, and learned the procedure for providing CPR and other measures for transported victims. In addition, participants learned how to use instruments for radiation measurement.

On day five, after studying the nuclear disaster response system in Japan, participants learned about medical equipment and materials brought by the disaster medical dispatching team, how to check generators during disasters, and how to set up deployable rapid assembly shelter (DRASH) tents which mainly used for emergency medicine.

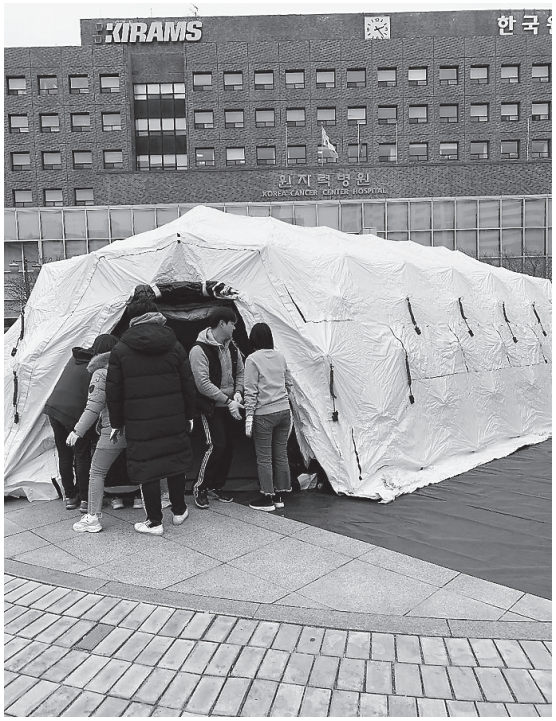
On day six, participants learned how to decontaminate radioactive materials and practiced using a manikin. They also learned how to set up various types of tents to be used in the final field training. The state of training to this point is shown in Figure 1.

On days seven and eight, pre-training and scenario explanations before field training were conducted. Field training on days nine and ten was implemented based on the scenario that accidental radioactive material release at nuclear power plants had exposed or contaminated a large number of workers. The participants were members of the disaster medical dispatching teams (Korean or Japanese), and their role was to operate the off-site headquarters, which was set up at a campsite located about 30 km from the nuclear facilities. In addition, the teams supported triage and simplified decontamination of patients transported from the disaster site, as well as wide-area transportation.

2.3. Outline of field training in Gapyeong City (days nine and ten)

On day nine, the participants moved from Seoul City to the venue in Gapyeong City by bus. The team constructions and participants' roles were confirmed, the

(A)



(B)

Fig. 1. Illustration of training (days one to eight) conducted in Seoul city. (A) Illustration of tabletop drill. Participants are discussing which hospital patients should be assigned to depending on the degree of exposure and contamination. (B) Illustration of training in setting up a DRASH tent for performing relief activities.

headquarters and triage tents were set up, and various types of equipment were deployed (Fig. 2). Although the weather on the day of the field training was fine, the temperature after sundown was below freezing. It took about 5 hours for all preparations to be completed, and everyone was keenly aware that logistics would take time even for people with disaster medical training and experience. The training progressed on the assumption that the exposed/contaminated patient would be transported from the disaster site by first responders at 6 PM, by which time each staff member was deployed. In

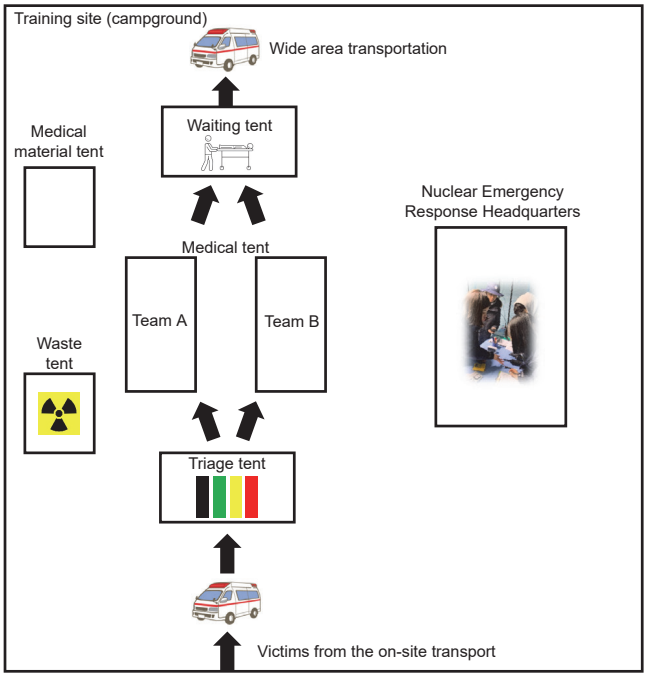


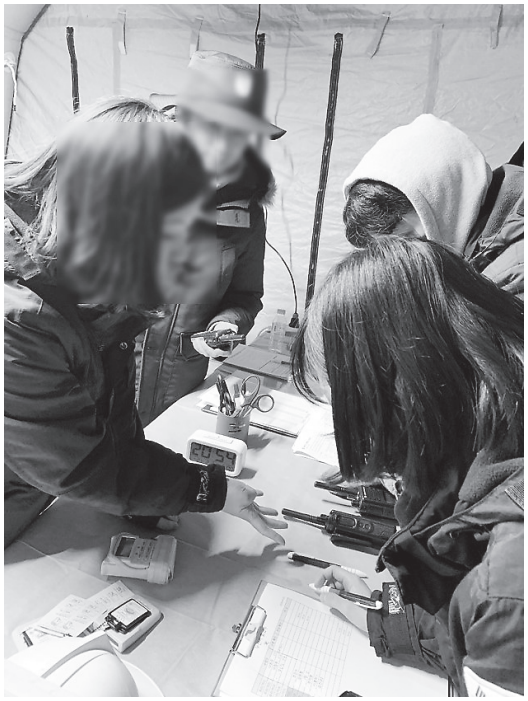
Fig. 2. Layout of field training (days nine and ten).

other words, response training to exposed/contaminated patients was conducted at night in harsh winter conditions.

The lead doctor and the logistics expert worked at the nuclear emergency response headquarters. Headquarters members used walkie-talkies and the K-REM app to share information about the injured with each tent, and commanded wide-area transportation. In triage and medical tents, emergency treatment was carried out according to the condition of the injured (for example, the presence or absence of burns, signs of acute radiation syndrome, contamination, etc.) and the information was reported to headquarters. The situation during field training is shown in Figure 3.

The field training was temporarily stopped at 11 PM, and all participants gathered for a meeting. Some representative opinions of the participants follow:

- I felt that sharing information between headquarters and each tent was very important. In other words, it is important to remember how to use communication tools such as apps (K-REM) and walkie-talkies.
- In the deep winter, wet-decontamination is impossible, and it is important to rapidly transfer injured patients to wide-area radiation emergency medical institutions. It is important to understand the capabilities of medical institutions and build a close network.
- Due to the cold, I thought that the physical exhaustion of the responders was intense. Team building including replacements is essential.



(A)

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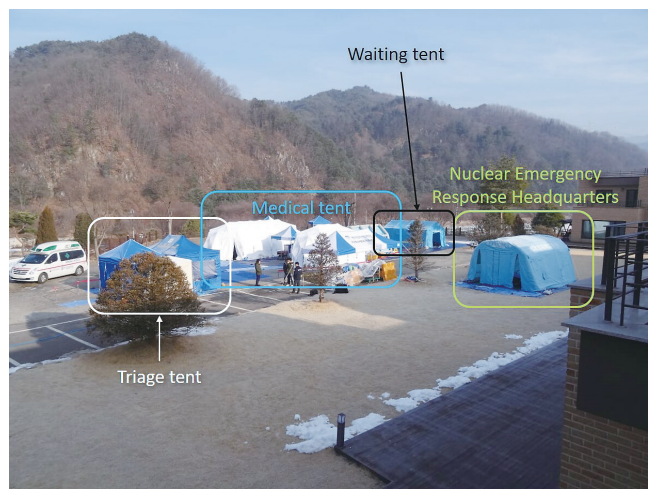

(C)

Fig. 3. Illustration of field training. (A) Illustration of the nuclear emergency response headquarters. The participants collect information on exposed or contaminated patients and their transportation plan. (B) Conducting a contamination test while intubating a patient. (C) The layout of the training venue.

3. Nuclear disaster response system learned from radiation emergency medical training in the deep winter

By conducting a ten-day long-term radiation medicine education program in the winter, the institutions from Japan and Korea learned the following. First, the first eight days of the program were very effective in teaching disaster medicine to participants in various careers. The daily warm up exercise became a good communication tool among participants, and radiologists and logistics experts who have had little exposure to emergency or disaster medicine had a good opportunity to learn the basics. Although there are many different radiation emergency medical training programs, most are short-term, and there are few opportunities to learn the basics of emergency/disaster medicine and how to use logistics tools. Although there are scheduling issues that obstruct participation in such training courses over a long period, this program was a successful pilot course. This report also outlines the field training including the design and layout of the venue, which is useful information for stakeholders involved in radiation emergency medical education. Additionally, the fact that field training was carried out in deep winter is crucial. In Korea and Japan, areas with severe cold and snow exist from December to February. The comments of the aforementioned participants concerning the difficulty of decontamination and exhaustion are very important in considering the response to nuclear disasters in cold areas.

For example, in Japan, the Japan Nuclear Regulation Authority provides guidelines on medical care and evacuation in case of a nuclear disaster[8-10], and each local government has begun to prepare a manual for their area according to these guidelines. However, there is no mention of the severe winter season in these guidelines. In the winter season, when it is difficult to treat contaminated patients at first aid stations, the organizations in charge of transportation and reception of the patients need to consider their capacities and

procedures in advance. In addition, it was shown that human resource development is an important issue that should be tackled in cooperation with the central and local governments.

Participants in the winter global radiation exposure medical personnel training in the introduced in this paper learned a great deal. The knowledge obtained through this training should be used in the development of nuclear disaster response systems in both countries.

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Conflict of Interest

The authors declare that they have no conflict of interest.

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