

Report

Report on the Third Exercise and Education of Radiation Emergency Medicine in Jeju

Masaru Yamaguchi¹, Kazuki Nomura¹, Yasuyo Fukushi², Kasumi Mikami²,
Yoko Saito¹ and Toshiya Nakamura^{3*}

¹*Division of Radiological Technology Sciences, Hiroasaki University Graduate School of Health Sciences,
66-1 Hon-cho, Hiroasaki, Aomori 036-8564, Japan*

²*Nursing Sciences, Hiroasaki University Graduate School of Health Sciences, 66-1 Hon-cho, Hiroasaki, Aomori 036-8564, Japan*

³*Bioscience and Laboratory Medicine, Hiroasaki University Graduate School of Health Sciences,
66-1 Hon-cho, Hiroasaki, Aomori 036-8564, Japan*

Received 20 August 2016; revised 12 September 2016; accepted 26 September 2016

This article is a report of our activity in the third “Radiation Emergency Medicine (REM) Education and Training Course” held in Jeju, South Korea, from May 24-27, 2016. This training program was a large-scale on-site training in which a major institution from South Korea participated. Hiroasaki University collaborated with the Korea Institute of Radiological and Medicine Sciences (KIRAMS) and Cheju Halla General Hospital. The training was conducted with the aim of extracting problems mainly in the coordination/cooperation against nuclear terrorism between South Korea and Japan. Our missions focused primarily on triage, a surface contamination survey, decontamination, and the treatment of victims injured by dirty bombs in a terrorist attack. During the training, we realized the difficulty in the execution of medical activities and communication in the face of terror-related confusion. We value the experience we gained by participating in activities involved in international cooperation during an emergency. We expect that future exercises will see the participation of many organizations involved in radiation medicine.

Key words: nuclear terrorism, triage, decontamination, radiation emergency medicine

1. Introduction

The third “Radiation Emergency Medicine (REM) Education and Training Course” was held in Jeju, South Korea, from May 24-27, 2016. This training was a large-scale on-site training in which major institutions

of South Korea participated. Under the direction of Dr. Minsu Cho at the National Radiation Emergency Medical Center in the Korea Institute of Radiological & Medical Sciences (KIRAMS), the training was conducted with a central focus on the establishment of a system capable of responding to nuclear terrorism and enacting medical measures, including the initial motion response, triage, and decontamination (Table 1). There were five participants from Japan: two teaching-staff members, two graduate students, and one visiting researcher at Hiroasaki University School of Health Sciences. Hiroasaki University collaborated with the KIRAMS, and the training was

*Toshiya Nakamura: Division of Bioscience and Laboratory Medicine, Hiroasaki University Graduate School of Health Sciences, 66-1 Hon-cho, Hiroasaki 036-8564, Japan
E-mail: toshiyana@hiroasaki-u.ac.jp

Table 1. REM training schedule

<i>Day 1: Tuesday, May 24</i>	
14:00 – 17:00	Visit and Check Out the Training Site
<i>Day 2: Wednesday, May 25 (Lecture)</i>	
13:30 – 14:00	Registration Period: REM, Refresher Course
14:00 – 14:10	Greetings & Opening Remarks
14:10 – 14:50	Triage and Action level of Massive Casualties in a Radiological Accident (Lecturer: Dr. Minsu Cho)
14:50 – 15:30	Communication and documentation (Lecturer: Hyunjing Kim)
	1. Educational Program on Radiation Emergency Medicine in Hirosaki University (Lecturer: Dr. Yoko Saito)
15:30 – 16:00	2. Mitigative Effects of Romiplostim, a Recombinant c-mpl Agonist, on the Survival of Mice Exposed to Lethal Ionizing Radiation (Lecturer: Dr. Masaru Yamaguchi)
16:00 – 16:20	Test
16:20 – 16:40	Break Time
16:40 – 18:00	Tabletop Drill Exercise (Triage + Communication & Record)
18:00 – 18:20	Q & A / Closing Remarks
<i>Day 3: Thursday, May 26 (Training)</i>	
09:30 – 10:00	Departure to Pyoseon Stadium
10:00 – 12:00	Pre-Exercise Directional Check and Equipment Setup
12:00 – 13:30	Lunch
13:30 – 14:00	Pre-Training Briefing
14:00 – 17:00	On-site Training/Exercise
17:00 – 18:00	Training/Exercise De-briefing
18:00 – 20:00	Dinner
<i>Day 4: Friday, May 27</i>	
09:30 – 11:00	Status Discussion: Radiation Emergency Medical, Japan and REM International Educational Training

conducted with the aim of extracting problems mainly in the coordination/cooperation against nuclear terrorism between South Korea and Japan.

In 2010, Hirosaki University initiated an educational program, the Educational Program for Professionals in REM, to train people with sufficient knowledge and skills to provide support to medical care professionals during a radiation emergency, such as transporting radiation emergency patients, nursing, employing countermeasures against pollution and decontamination, performing radiation dosimetry, and conducting special clinical examinations. In addition, the Institute of Radiation Emergency Medicine and the Emergency and Disaster Medical Center with radiation emergency medicine facilities were established at Hirosaki University and its hospital. Hirosaki University has been designated two international support centers on radiation medicine by the Nuclear Regulation Authority in 2015 and is responsible for the affairs related to nuclear disaster medical care before and during emergencies. We have also put effort into overseas cooperation and discussing and exchanging memoranda of understanding, and the

Institute of Radiation Emergency Medicine signed a cooperation agreement with KIRAMS declaring their mutual cooperation in human resource development and research to conduct joint training on how to respond to nuclear terrorism in 2013. The first joint training was conducted in Jeju, South Korea, on November 12-16, 2013, under the title of Medical Study and Training on Jeju Island for Responding to Nuclear Terrorism. The joint training held this time was the third such program.

We participated in the training with a focus on the international cooperation associated with REM, and, during the training, we realized the difficulty in the execution of medical activities and communication in the face of terror-related confusion. We value the experience we gained by participating in activities involved in international cooperation during an emergency. Furthermore, we were able to gain valuable knowledge regarding how we should behave when providing REM during international cooperation activities. We herein describe the details of the training and present our thoughts.

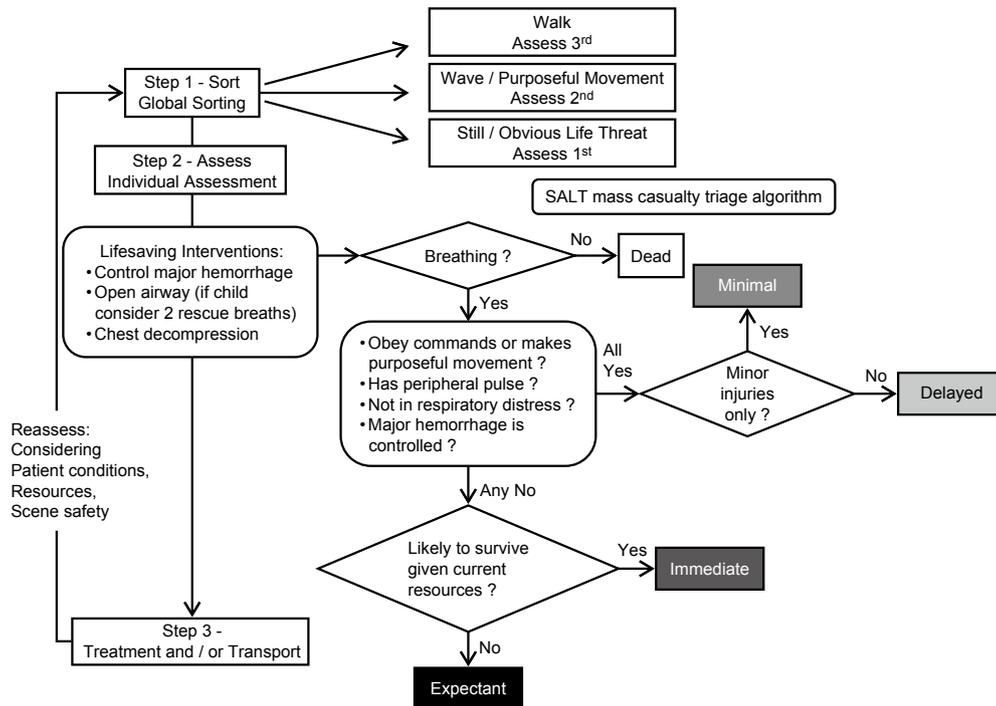


Fig. 1. Simplified diagram of SALT triage

2. Triage and action level of mass casualties in a radiation accident hand-on training

Mass casualties triage in radiation accident hand-on training was conducted on the second day. The objective of this training was to be able to triage patients who might have radiation contamination. Dr. Minsu Cho discussed four subjects: (I) overview of triage system; (II) SALT triage, which is an abbreviation of “Sort”, “Assess”, “Lifesaving interventions”, and “Treatment/transport”; (III) combined injury triage; and (IV) later triage and action level. The victims are classified into the following triage categories: those who require immediate treatment (“Immediate [I]”), those who require treatment but whose treatment priority is low (“Delayed [D]”), those who require only minimal treatment (“Minimal [M]”), those whose chances of survival are small even if treatment is carried out (“Expectant [E]”), and those who are dead (“Dead”). A simplified diagram of the categories is shown in Figure 1.

For triage of complex trauma victims, we must first determine the severity of the physical trauma and then perform triage by radiation exposure based on the observation of premonitory symptoms, such as nausea and vomiting. If a nuclear terrorist event such as that illustrated in the training were to occur in reality, triage according to the exposed radiation dosage would be necessary, and changing the triage categories would have to be considered. One criterion for estimating the

exposure doses is “vomiting”. If vomiting occurs after ≥ 4 h have elapsed, the exposure dose is considered to be < 2 Gy; if vomiting occurs after 1-4 h have elapsed, the exposure dose is considered to be 2-6 Gy; if vomiting occurs within 1 h of exposure, the exposure dose is considered to be ≥ 6 Gy. If the radiation exposure is ≥ 6 Gy, the victim is categorized as “Expectant”, even in the cases of “Immediate”, “Delayed” or “Minimal” exposure. A patient’s triage category may change, depending on the scale of the disaster and/or medical resources availability. As such, these triage categories are not set in stone. Indeed, we practiced triage with simulated patients and realized that there were differences in opinions regarding appropriate triage categories for our “patients”.

3. Special lectures by Hirosaki University

In this third joint training, special lectures by participants from Hirosaki University were delivered. The lecturers were Dr. Yoko Saito and Dr. Masaru Yamaguchi. First, Dr. Saito talked about the “Educational Program of Radiation Emergency Medicine in Hirosaki University” (Fig. 2A). Hirosaki University has been offering a short-term educational program to train current nurses and radiological technologists in basic knowledge and techniques of REM since 2010. This was originally offered as a three-day program; however, since 2013, we have incorporated prior learning through e-learning and have shortened the course to a two-day program. This training



Fig. 2. Special lectures of Hirosaki University. Left photo [A]: Dr. Yoko Saito; right photo [B]: Dr. Masaru Yamaguchi, Hirosaki University.

Table 2. Scenario of on-site training/exercise

Location	Pyoseon Stadium
Participants	Cheju Hallah General Hospital Hirosaki University KIRAMS
	(Total 91 people including 34 scenario actors)
Scenario	<ul style="list-style-type: none"> -First suspected terror explosion <ul style="list-style-type: none"> • Dirty bomb terror explosion • Resulting in 5 exposed/contaminated and injured patients • Initial on-site medical response from Cheju Hallah Hospital radiation emergency medicine team -Second suspected terror explosion <ul style="list-style-type: none"> • Additional dirty bomb terror explosion • Resulting in 20-30 exposed/contaminated and injured patients • Korean and Japanese Radiation Emergency Medical Assistance Team joint response • National radiation emergency medical network in full response

offers lectures to deepen participant's understanding of each specialty from the perspective of REM, as well as exercises on ways to handle irradiated and/or contaminated patients. This program intends to impart necessary REM knowledge to nurses and radiological technologists and to birth medical professionals able to cooperate, respond appropriately, and safely manage medical situations. This lecture was a good opportunity to become acquainted with the efforts of Hirosaki University in REM together with the KIRAMS.

Dr. Yamaguchi discussed the "Mitigative effects of romiplostim, a recombinant thrombopoietin receptor agonist, on the survival of mice exposed to lethal ionizing radiation", based on recent data from his laboratory (Fig. 2B). After accidental exposure to a high dose of ionizing radiation, providing proper therapeutic strategies for patients with acute radiation syndrome remains a major problem. He showed that an optimum protocol of drug therapy based on approved pharmaceutical drugs in Japan for a few consecutive days achieved high 30-day survival rates among C57BL/6JJcl mice when administered immediately following exposure to a lethal

dose of ^{137}Cs γ -rays. He explained that Japanese-approved pharmaceutical drugs are expected to be a potential medical countermeasure for the treatment of victims of accidental radiation exposure.

Such special lectures have helped facilitate the exchange of opinions and communication between Hirosaki University and the KIRAMS.

4. Scenario discussion, mission assignment, and tabletop drill exercise

After finishing this whole study, the basic information and scenario for on-site training were presented to us (Table 2). Briefly, the scenario was as follows: During a soccer match, a radiological explosion (dirty bomb) occurred. With the first explosion, five casualties were triaged and transferred by the local hospital team. The KIRAMS team and Japanese team were dispatched to help the local treatment team. At our arrival, a second explosion occurred, and many casualties occurred. Next, the participants of Hirosaki University were divided into a medical treatment team and a commander, and Japanese

team was formed by mixing members of the KIRAMS and Hirosaki University, including a doctor, three nurses, two radiological technologists, and a commander. Their roles were assigned, and then they exchanged opinions and held discussions (Fig. 3).

In the tabletop drill exercise, patient information cards were provided to the triage team. These information cards were written in English. The triage team performed triage and sent the patient information and triage cards to our medical treatment team. When we received those cards, we discussed the treatment plan. Unlike the information cards, the triage cards were written in Korean, which none of the Japanese participants could read; therefore, a staff member from KIRAMS on our team translated the contents into English. We maintained contact with the commander using a walkie-talkie and encountered difficulty in hearing the speaker over the device. It is necessary to devise how to tell the words or the size of voice. We are informed that only five casualties would be able to speak Japanese but were expected to treat not only these five casualties but others as well. Communication in English among people engaged in medical services was important.

5. On-site training/exercise

On the day of on-site training, first the command headquarters and then the tents for the triage and decontamination teams were set up jointly by the KIRAMS and Hirosaki University (Fig. 4). Triage and medical treatment equipment were prepared, and the availability of survey meters and other apparatuses were confirmed in appropriate tents (Fig. 5). The scenario for the on-site training/exercise on that day was as follows: During a football game in Pyoseon stadium, a dirty bomb terrorist explosion occurred. With the first explosion, five patients with exposure/contamination as well as injuries were triaged and transferred by Cheju Hallah General hospital radiation emergency medical team (Fig. 6). A second dirty bomb terrorist explosion subsequently occurred, creating many more casualties, so the Korean and Japanese Radiation Emergency Medical Assistance Team were dispatched to help the local treatment team.

The Japanese medical treatment team comprised a medical doctor, two nurses, and a radiological technologist. One Korean nurse and one Korean researcher helped translate into English or Japanese, and all records of medical information were drafted in Korean. Patients' clinical information, such as vital signs or wounds, was provided in English on the card hanging from their neck. A patient's contamination status was denoted by stickers on their clothing. There were five Japanese-speaking patients. We were mainly in charge of these patients; however, we also treated



Fig. 3. Discussion by each team



Fig. 4. Setting-up a tent



Fig. 5. Triage and medical treatment equipment in tent



Fig. 6. Initial on-site response from Cheju Hallah General Hospital radiation emergency medical team



[A]



[B]



[C]

Fig. 7. A surface contamination survey [A], triage [B], and decontamination and the treatment [C]

Korean patients. Our team was supposed to arrive on site after the local triage team had accomplished their mission, and at our arrival, a second explosion occurred, creating many more casualties. We wore Tyvek suits, shoe coverings, gloves, a mask, and goggles, and we had a personal dosimeter on the front of our suits. Some patients came to our treatment tent on foot, and some



Fig. 8. Headquarters



Fig. 9. Group photo of the participants in this training

were transferred by a triage team member. To increase the realism, many evacuees applied moulage to their faces, arms or legs, or abdomen. At patient arrival, we checked the patients' condition, including contamination, triaged them, and made a treatment plan (Fig. 7A-C). We informed the team commander of our efforts via walkie-talkie. For patients with contamination, we removed their clothing and considered decontamination to have been successfully completed. For patients with burns, dressings for the burns were applied. For patients with open abdominal wounds, a simple dressing was applied, and they were immediately transferred to a hospital. For patients with minor wounds, only dressings were applied. The intravenous route was used in many patients. When our treatment of each patient was finished, we contacted the transportation team and asked them to transport the patients. During on-site training, the commander asked or gave us information about casualties over a walkie-talkie (Fig. 8). While the walkie-talkies worked well, problems occasionally developed in exchanging information between a medical treatment team on site and the headquarters due to noise in the middle of the training. Cool judgment would therefore be necessary when

treating victims at the actual site. However, the ability to make such judgments calls can only be developed through training. The valuable experience we gained by participating in this training exercise was very helpful for those of us likely to be engaged in providing REM in the future.

6. Conclusion

REM education and training was carried out in the form of a training exercise by the KIRAMS and Hirosaki

University, with the first such program held three years ago (2013). Being able to participate in such a large-scaled training exercise as this, involving international efforts related to radiation medicine, was extremely valuable. Only Hirosaki University has participated in this education and training program thus far; however, we expect that future exercises will see the participation of many organizations involved in radiation medicine. We offer our thanks to Dr. Cho and all of the people who helped conduct this joint training by the KIRAMS and Hirosaki University (Fig. 9).