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Report

Report on Radiation Emergency Medicine Education and Training Course

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This report was described about Radiation Emergency Medicine (REM) Education and Training Course that was conducted in Jeju, South Korea for two days on September 9 and 10, 2015. This training was a large-scale on-site training in which major institutions of South Korea participated. Hirosaki University collaborated with Korea Institute of Radiological & Medical Sciences (KIRAMS), and the training was conducted with the aim of extracting problems mainly in the coordination/cooperation systems against nuclear terrorism between South Korea and Japan. Our missions took place mainly in a triage and a surface contamination survey for victims, who were injured by dirty bombs. During the training, we realized the difficulty in the execution of medical activities and communication in terror-related confusion. It was possible to experience for the actuality of activities involved in the international cooperation during an emergency. We expect participation by many organizations involved in radiation medicine in the future.

Key words: nuclear terrorism, triage, contamination survey, radiation emergency medicine

1. Introduction

"Radiation Emergency Medicine (REM) Education and Training Course" was conducted in Jeju, South Korea for two days on September 9 and 10, 2015. 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 Korea Institute of Radiological & Medical Sciences (KIRAMS), the training was conducted with a central focus on the establishment of a system, which responds to nuclear terrorism and medical measures including initial motion systems, triage, and decontamination (Table 1). There were ten participants from Japan as follows: four teaching-staff members at Hirosaki University School of Health Sciences, one graduate student at Hirosaki University, one doctor and one nurse at an advanced emergency medical service center, one emergency medical technician in the district of Hirosaki, one teaching-staff member at Kagoshima University, and one nurse at Kagoshima University Medical and Dental Hospital (Fig. 1). Hirosaki University collaborated with the KIRAMS, and the training was conducted with the aim of extracting problems mainly in the coordination/cooperation systems against nuclear terrorism between South Korea and Japan.

Hirosaki University has been educating medicine-related individuals, responsible for providing through the "Education Program for Development of Professionals in Radiation Emergency Medicine" since 2008[1] and in 2010, established the Institute of Radiation Emergency Medicine[2] and Emergency and Disaster Medical Center

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Table 1. REM Training Schedule

Day 1: Wednesday, September 9	
Time	Subject
-11:00	Arrival in Jeju
12:00-13:30	Lunch
13:30-13:50	Welcome Remarks
13:50-14:00	Introduction of participants
14:00-14:15	Training Schedule Review
14:15-15:00	Radiation Detection Equipment Hands-on Training
15:00-15:15	Break
15:15-16:00	Mass Casualty Triage Simulation Hands-on Training
16:00-17:45	Scenario Discussion & Mission Assignment
17:45-18:00	Discussion/Questions
18:00-20:00	Banquet
Day 2: Thursday, September 10	
09:30-10:00	Transportation to Pier 6
10:00-10:15	Training/Exercise Briefing
10:15-12:00	Pre-Exercise with Equipment & Supplies
12:00-13:30	Lunch
13:30-14:00	Final Check of the training
14:00-16:00	On-site Training/Exercise
16:00-16:45	Training/Exercise De-briefing
16:45-17:00	Concluding Remarks
18:00-20:00	Dinner

Table 2. Participating Organizations

Participating Organizations
1. Locals
- Jeju Defence Command
- Jeju Reginal Headquarters Korea Coast Guard in the Ministry of Public Safety and Security
- Jeju Dongbu Police Station
- Jeju Special Self-Governing Provincial Police Agency
- Jeju Fire Station
- Jeju UREST
- Cheju Halla General Hospital
2. Federal organization and Others
- National 119 Rescue Headquarters in the Ministry of Public Safety and Security
- The Armed Force CBR Defence Command
- Korea Institute of Radiological & Medical Sciences
- Hirosaki University in Japan

Fig. 1. Participating members of Hirosaki University and Kagoshima University.

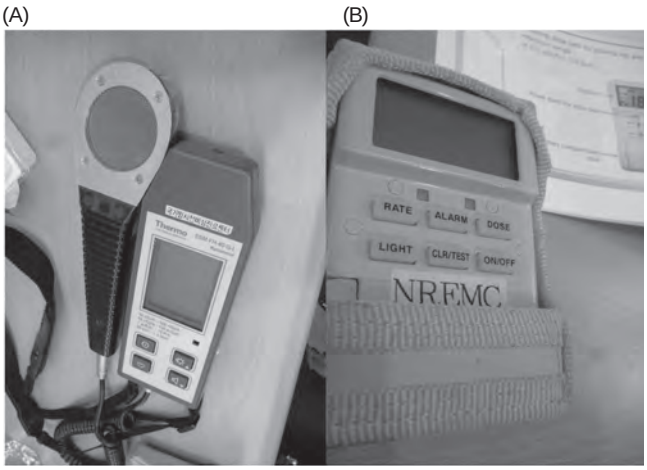

Fig. 2. Survey meter (A) and Personal Dosimeter (B) made in South Korea.

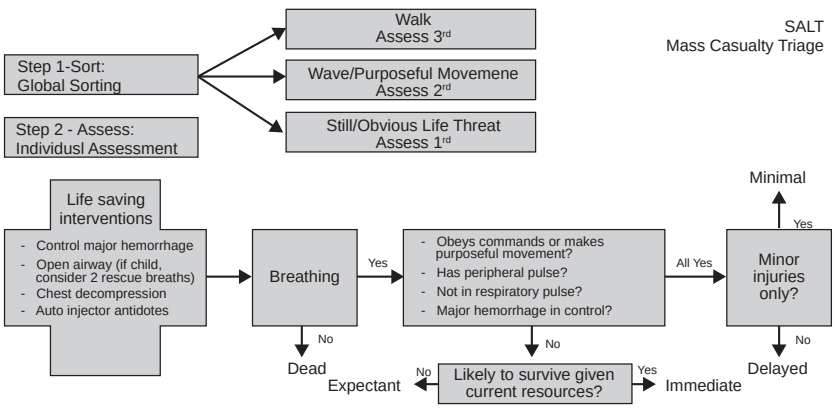

Fig. 3. Simplified Diagram of SALT Triage.

Table 3. Scenario of On-site Training/Exercise

Basic Information
The event and situations described in this scenario have been fictionalized for an instructional and illustrative purpose. The purpose and scope of this scenario is to exercise the first response for radiological emergency which is supposed to continue for 2-3 hours at the scene. The objectives are 1) cooperate among related organizations for fast and accurate response and 2) to describe and/or consider an appropriate process to manage injured and/or contaminated victims and uninjured people in an affected area involved in a radiological incident. Target groups are first responders and medical personnel in radiation emergency response.
Scenario
Radiological dispersal devices (RDDs) (dirty bombs) and radiological exposure devices (REDs). In this scenario, a terrorist group obtains an undetermined amount of ^{137}Cs and ^{57}Co unshielded, and then said cesium and cobalt are divided in two devices: RDD and RED. The terrorist embarked on a passenger ship which just docked 1:30 p.m. at pier 6 in Jeju harbor and the passengers are getting ready to get off the ship. The RDD is packed with about 2 kg of explosives, and the RED is left in passenger rooms. The ship will clear a port around 4:00 p.m. One bomb detonates and the other fails. Responders and technical experts will need to evaluate the immediate impact on injured passengers' health, assess the extent and magnitude of the release on potentially affected passengers and environments, and take actions to prevent further spread of the radiological materials.
Exercise Assumption and Artificialities
In any exercise, assumptions and artificialities may be necessary to complete in the time allotted and/or account for logistical limitations. Exercise participants should accept that assumptions and artificialities are inherent in any exercise, and should not allow these considerations to negatively impact their performance.

Fig. 4. Situation of Discussion by Each Team.

Fig. 5. Situation of Setting-up of a Tent.

with radiation emergency medicine facilities in Hirosaki University Hospital[3]. In addition, the university planned an overseas training at the KIRAMS[4], and the two organizations tied up to conduct joint training on how to respond to nuclear terrorism. 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"[5]. The joint training held this time was the second one.

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 terror-related confusion. It became a great treasure for us that we could experience the actuality of activities involved in the international cooperation during an emergency. Furthermore, we could take valuable hints for creating images of the personnel capable of providing REM from a viewpoint of international cooperation activities. We report the situation of the training and present some thoughts.

2. Radiation Detection Equipment and Mass Casualty Triage Simulation Hands-on Training.

Radiation detection equipment hands-on training was conducted on the first day. The objectives of this training were to understand the purpose and principle of radiation measurement, and to use radiation equipment skillfully. Aiming at familiarizing trainees with the basic usage of an electronic personal dosimeter (EPD) and a survey meter (Fig. 2), we were taught how to use a personal dosimeter and a survey meter, each made in South Korea; additionally, we learnt the way of monitoring by using the said meters. In an external contamination monitoring method, when a record background radiation level is measured, the following steps are carried out in an order: first, a survey meter probe is held at about 1 cm away from the body, and the probe is slowly moved at the rate of 5 cm/sec. Next, all areas (for example, face, hands, feet, etc.) are completely scanned, and finally, a maximum value within 100 cm^2 of a contaminated spot is recorded. Further, during external contamination monitoring,

Fig. 6. Situation of Briefing.

Fig. 7. Complete Image of the Ship.

following must be remembered: performing background check by measuring the background radiation at a place that is not affected by external contamination, being beware of contamination, and covering the probe with vinyl to avoid contamination with radioactive substances. This hands-on training was a good review of knowledge that we had, obtained until now during our study and training for radiation medicine at Hirosaki University.

In the mass casualty triage simulation hands-on training, we learnt triage of patients who could be radiation-contaminated. SALT is an abbreviation of sort, assess, lifesaving interventions, and treatment/transport; therefore, prompt treatment is provided during SALT triage. The victims are classified into the following triage categories: those who require immediate treatment ("Immediate [I]"), those who require treatment but whose degree of priority of treatment 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 Fig. 3. Further, if nuclear terrorism such as that illustrated in the training occurs in reality, triage according to the exposed doses is necessary, and change

Fig. 8. Evacuation of the Victims by the Emergency and Rescue Teams.

Fig. 9. Situation of Setting-up of a Tent.

Fig. 10. Situation of Setting-up of a Tent.

of triage categories must be considered. A criterion used for estimating the exposure doses is "vomit". In the case where the vomit occurs after 4 or more hours have elapsed, the exposure dose is considered lower than 2 Gy. The radiation exposure of 2-6 Gy is deemed to have occurred in the case of the vomit occurring after the lapse of 1-4 hours, and the radiation exposure of 6 Gy or more is deemed to have occurred in the case of the vomit occurring within the lapse of 1 hour. If the radiation exposure of 6 Gy or more is considered to have occurred, a person will be categorized as "Expectant", even in the cases of "Immediate", "Delayed" or "Minimal". According to us, in the cases that could be accompanied by radiation contamination, triage categories must be formed according to the circumstances. There is no correct answer to triage categories. We practiced in pairs with the simulated patients, and recognized that there were differences in opinions about triage categories.

3. Scenario Discussion & Mission Assignment

After the whole study and training sessions finished, basic information and a scenario of the on-site training were explained to us (Table 3).

Next, the participants were divided into triage teams formed by mixing of members of the KIRAMS, Cheju Hala General Hospital, and Hirosaki University, and decontamination teams; their roles were determined, and they exchanged opinions and held discussions (Fig. 4). Communication among people engaged in medical services in English and through translators was meaningfull.

4. On-site Training/Exercise

On the day of on-site training, firstly tents each for the triage and the decontamination terms were set up jointly by the KIRAMS and Hirosaki University (Fig. 5), and survey meters and other apparatuses were confirmed. Next, a briefing was conducted (Fig. 6), and the situation on that day was confirmed to prepare for the actual training. The situation of on-site training/exercise on that day is presented below.

After a ship arrived at 2:00 p.m., a loud explosion was heard (Fig. 7); however, the ship was not destroyed and was not on fire at that time. A minute later, a manager announced the situation to the passengers and asked them to keep calm and stay in their rooms until further notice. Emergency operators 119 received calls from the ship that had arrived, and were informed that explosion-scattered dust, smoke, and debris had deposited in the ship. The emergency operators 119 reported the explosion to the fire department, the police department, and other related organizations. At 2:10 p.m., the fire and police departments were called to the site of the scene. Within minutes, firefighters, police officers, and other emergency rescue teams arrived at the site of the scene. Upon arrival, the firefighters investigated the stability and the potential fire blaze of the ship, and the police officers inspected the status of the second bomb that had not exploded yet and started to evacuate the passengers. At 2:20 p.m., one of the firefighters was aware of an alarm sound of a radiation detector which indicated that the radiological levels were exceeding the background levels. The firefighter notified an initial incident commander at the site. A few minutes later, the initial incident commander confirmed the radiological incident. An investigation team of firefighter reported that the glass windows had shattered; several injured victims were lying on the floor of the reception area; however, other parts of the ship were safe, and the rest of the people on the ship were unharmed. By 2:30 p.m., hazardous materials (HAZMAT) teams assessed the extent of the radioactive contamination in the ship and around the area, and identified ^{137}Cs and ^{57}Co as the source of the radiation. At 2:40 p.m., based on the information received, emergency medical response teams arrived at the site. Subsequently, evacuation of the patients by the emergency medical response team (Fig. 8) started, and treatment by the triage teams and the decontamination teams, which were formed by mixing of members of KIRAMS, the Cheju Hala General Hospital and Hirosaki University, was provided (Fig. 9). Upon the triage, the victims were classified according to the exposure doses, the severity, and the SALT indicators; further, it was determined, whether or not emergency treatment and/or decontamination was necessary. The classification of the victims was carried out while reports to the headquarters were made on an as-needed basis (Fig. 10). In the decontamination, contaminated parts shown by the survey meter were specified, and wiping-off or washing was conducted.

In the middle of the training, there was a problem in exchanging information between a medical treatment team on the site and the headquarters. The victims were being evacuated consecutively on the site, while the headquarters could not communicate smoothly with the team on the site. Cool judgment would be necessary for taking action for the victims on the actual site. Such an ability to make judgments can not be developed unless training is conducted. Valuable experience such as that obtained from this training has been very meaningful for the participants who would be engaged in providing REM in the future.

5. Conclusion

REM Education and Training was carried out in the form

of participation by many organizations in South Korea and joint participation of the KIRAMS and Hirosaki University. It was a valuable experience for us that we could participate in such a large-scaled training as this, which involved international efforts related to radiation medicine. Only Hirosaki University and Kagoshima University have participated in this education and training until now; however, we expect participation by many organizations involved in radiation medicine in the future. In addition, conducting a joint training of South Korea and Japan like this in Hirosaki city is being considered. In the end, we extend our heartfelt thanks to Dr. Cho and all the associated people who cooperated enormously for conducting the joint training by the KIRAMS and Hirosaki University.

Conflict of Interest Disclosure

The authors declare that they have no conflict of interest.

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