Medical Preparedness for Radiation Emergency in Japan

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Introduction

Twenty-three Japanese fishermen saw a huge red light and heard a detonation sound on a fishing boat, the 5th "Fukuryu-maru" (Lucky Dragon). Early in the morning of March 1 in 1954, they were exposed to a thermo-nuclear test explosion at Bikini Atoll on the Pacific Ocean and suffered from acute radiation injuries. Five years later from the explosion, the National Institute of Radiological Sciences (NIRS) was established in Chiba, Japan for 1) researches on the mechanisms of radiation injury, and its diagnosis and treatment, 2) the medical application of radiation and radioactive isotopes, and 3) training of personnel in the fields of radiation protection, diagnosis, treatment of radiation injury, and medical application of radiation and isotopes. Since then, NIRS has been performing follow-up studies of the exposed fishermen at Bikini Atoll. Accidents of radiation exposure or contamination with radionuclides usually occur in nuclear facilities. In Japan, the utilities running such facilities are responsible for the prevention of accidents and the mitigation of radiological consequences to the outside of the plants, and government is responsible for exposures of public surrounding the plants; medical measures for radiation emergency have been mainly prepared for protection of the public. Today, however, nuclear power plants, devices, or locations whereby an individual could be exposed to radioactive materials are not rare. On the other hand, the idea that radiation-accidents rarely occur in nuclear facilities led us to have the common concept that systematic and nationwide medical preparedness for radiation emergency is not necessary. Indeed, our institute experienced for almost 40 years only one accident of acute radiation injury involving 6 young men exposed to an iridium source for industrial nondestructive examination. However, the disaster at the Chernobyl nuclear power facility in 1986 and the Great Hanshin-Awaji Earthquake, Japan in 1995 have made us to reconsider the plan for medical preparedness for radiation emergency. This paper outlines the new nationwide system for medical preparedness in radiation accident of Japan.

Regal systems

In 1961 the Disaster Countermeasures Basic Act was established. This act aims a comprehensive and systemic administration for disaster prevention by defining the obligations of national and local governments and by making the general basic plan. This act also prescribed Central Disaster Prevention Council (CDPC) in the prime minister's office and CDPC issued Basic Plan for Disaster Prevention. After the nuclear accident of Three Mile Island (TMI) in 1979, CDPC reinforced the emergency preparedness

for nuclear power station emergency and issued a report "Urgent disaster countermeasures to be taken for the nuclear facilities by the governmental agencies" in July, 1979. This report specifies national and local headquarters for emergency response and an organization of specialists maintained by national government and dispatched to the local emergency response headquarters. In June 1980, Nuclear Safety Commission (NSC) issued a guideline entitled "Off-site Emergency Planning and Preparedness for Nuclear Power Plants." This guideline implemented disaster counter-measures and criteria for public protection, and defined the medical system for radiation emergency; an emergency medical center for decontamination is organized under local response headquarters and a local government can be independent disaster countermeasures, consulting with medical specialists sent from the central government. NIRS is prepared to dispatch a medical team for radiation emergency consisting of physicians, nurses, health physicists and radiation safety specialists In 1997, 2 years later of the great Hanshin-Awaji Earthquake, CDPC revised Basic Plan for Disaster Prevention and detailed medical issues in the section of nuclear disaster

Medical care system in radiation emergency of NIRS

The medical care system for radiation emergency defined by the guideline has three categories of facility, primary medical facility, specialized facility for radiation medicine and a definite care hospital specialized for radiation injuries. Primary medical cares should be taken at medical facility of power plants or an emergency medical center which local emergency response headquarters set up as needed Primary medical facility conducts contamination surveys and initial decontamination. When necessary, a patient will be transported for treatments of injury or for further decontamination of radionuclides to a specialized facility of radiation medicine, which is established by local governments where nuclear power plants are located. The decontamination facility, which is usually within a hospital or a health center, is maintained by the local government. However, when contamination still remains or internal contamination is found possible, the patient will be transported to NIRS that designated as a hospital for radiation injuries by Nuclear Safety Commission. The local government designates one or more major general hospitals as the specialized facility where nuclear power plants are located.

NIRS has been prepared to receive the acutely injured and severely contaminated. From 1997, NIRS maintains a new large decontamination and medical care facility and 4 beds having inverse isolating systems which are usually used for training courses At the time of Chernobyl accident, the former facilities were used to decontaminate people who had traveled in Ukraine. NIRS also has a hospital for radiation oncology with 96 beds In case that number of patients are transported to NIRS, this hospital will be used for these patients. In 1997, NIRS has established the medical care network system for specialized therapies including skin graft, bone marrow transplantation, major surgery, or others (NIRS and Network Hospitals Cooperative Arrangement) This system includes sending patients to specialized hospitals within the network or inviting experts from these hospitals to NIRS when these therapies are

required.

Medical teams for radiation disaster relief

NIRS is responsible for medical care in radiation emergency and has the Committee for Nuclear Disaster Planning. Its subcommittee for radiation emergency medicine maintains three teams of medical and paramedical personnel:

Team 1 Medical Team for Radiation Disaster Relief
Team 2 Medical Team for Radiation Emergency Handling Suite
Team 3 Medical Team for Isolating Care Unit

Team 1 will be sent to Local Emergency Response Headquarters for medical advice and cooperation. Nurses, medical technicians, or health physicists are also included in Teams 1 and 2. Team 2 is to perform decontamination at Radiation Emergency Handling Suite and Team 3 is to treat the acutely exposed severe cases Team 1 gives a priority to patients who should be transported to NIRS in cooperation with medical teams at an accident site (triage).

NIRS as the center for radiation injuries

NIRS, as the definite care hospital for radiation injuries, has following activities:

(a) The International Computer Database for Radiation Exposure Case Histories of the WHO REMPAN
NIRS has medical data at acute phase of Bikini-fishermen or persons exposed to an iridium source in 1971. NIRS contributes to the medical data to this system.

(b) Establishment of "The Research Society of Medical Preparedness for Radiation Accidents" in Japan

Today, facilities or locations whereby an individual could be exposed to radioactive materials are not rare. The number of nuclear power plants is also increasing in Japan and other countries of Asia Accelerators are also frequent source of accidents for external exposure. However, few cases of accidental exposure to radiation or contamination have been reported in Japan even if they occurred. In August 1997, "The Research Society of Medical Preparedness for Radiation Accidents" has been established by medical doctors, health physicists, nurses, or others in Chiba. The Society plays as a nonprofit organization for education and scientific purposes. The purposes of this incorporation shall be to engaged in scientific

and educational activities including diagnosis and treatment of radiation injuries, systems of medical preparedness for radiation emergency, and encouraging investigators of these fields

In Japan, the medical care system for the exposed individuals in the radiation disaster has been maintained by Science and Technology Agency (STA) and local governments. On the other hand, the emergency medical system has been run by the Ministry of Health and Welfare In order to raise problems in matters of nationwide medical systems for radiation emergency, an open forum on medical preparedness for radiation emergency was held in August 29 1997 in NIRS 150 people participated in this forum from hospitals, universities, nuclear power plants and their related organizations, central and local governments, and The Japanese Association of Acute Medicine (JAAM), and problems concerning transportation, education, response of local emergency medical centers were identified.

(c) Clinical follow-up studies of exposed patients

NIRS is involved in follow-up studies conducting periodical medical check-ups of patients with thorotrast contrast media and fishermen exposed at Bikini Atoll.

(d) Research activities related to exposure to radiation in NIRS

Research in NIRS has made strides in the use of radiation to benefit human health Research emphasis is on human effects of radiation and cancer or other disease related occupational exposures to radiation Specific programs are focused on the following areas.

- hematological and immunological aspects of acute exposure to radiation;
- experimental late effects of radiation;
- human radiobiology and radiation medicine,
- research on reactive oxygen species during exposure to radiation;
- cytogenetic investigations designated to assess exposure,
- molecular biological aspects of radiation in disease processes;
- epidemiological evaluation of occupational exposures;
- dose assessment by whole body counting.

(e) Reference center of emergency medical practices for severe acutely exposed patients

Acutely exposed cases are rare. However, it can happen that such patients might be transported to a hospital emergency room. NIRS should have the capability to provide advice regarding assessment and treatment to physicians, researchers, plants or companies.

(f) Treatment for internal contamination

NIRS can provide advice regarding treatment in cases of internal contamination with radioactive materials. NIRS coordinates the national use of DTPA and Prussian blue for decorporation therapy of actinides and cesium, respectively by;

- managing the protocols for DTPA and Prussian blue;
- developments of new chelation therapy;
- managing the DTPA and the Prussian Blue Registry.

(g) Education and training center

NIRS serves not only as a treatment facility but also as a education and training center where Japan, foreign medical (especially Asian), nursing, comedical, and health physics personnel receive training in medical management for radiation emergency Currently two courses on radiation emergency rescue and care are conducted each year for those who may be potentially involved in radiation emergency. One course is for personnel may be called upon to provide emergency medical service to the exposed. Another course for physicians presents an information on the diagnosis and treatment of acute irradiation exposure or contamination.

Summary

Medical Preparedness for Radiation Emergency in Japan is primary for off-site public protection Many things remains to be discussed about on-site emergency medical problems. On the other hand, each nuclear facility should have a countermeasure plan of radiation emergency including medical measures for the emergency Disaster countermeasure act and a guideline from NSC entitled "Off-site emergency planning and preparedness for nuclear power plants" establish the system for countermeasures in radiation emergencies.

The guideline also establishes medical plans in radiation emergencies, including care system for the severely contaminated or injured. NIRS is designated by the guideline as the definite care hospital for radiation injuries and is prepared to dispatch medical specialists and to receive the injured NIRS conducts clinical follow-up studies of the injured, researches of diagnosis and treatments for radiation injuries, and education and training for medical personnel. NIRS has the plans to serve as the reference center for emergency radiation medicine in Japan and also in Asia, if necessary

NIRS would like to serve as a member of WHO Collaborating Center for Radiation Emergency Medical Preparedness and Assistance (REMPAN). Now, NIRS is making preparation for providing 24-hours direct or consultative assistance with medical problems associated with radiation accidents in local national. and hopefully international incidents

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