Medical Response in Radiation Emergency in Argentina

Marina A. Vazquez and María M. Tadic Autoridad Regulatoria Nuclear, Av. del Libertador 8250, BNP1429 Buenos Aires, Argentina

Abstract According to the Nuclear Federal Law N° 24804, the Nuclear Regulatory Authority (ARN) is empowered to regulate and control the nuclear activity with regard to radiological and nuclear safety, physical protection and nuclear non-proliferation issues. ARN has a system for intervention in radiological -and nuclear emergencies with a primary intervention group, which is on duty in weekly shifts all year round. This paper aims at describing the system as implemented at present.

The Emergency Medical System has been_developed into three levels:

Level I: local emergency services. This level includes triage (conventional and radiological), first-aid care, and first management of contaminated victims

Level II: emergency departments of local general hospitals that are in charge of performing a second triage by a biomedical approach, the treatment of conventional and/or radiocombined injuries and completing decontamination as necessary. In this way the initial triage is completed by a physical examination, timing and severity of prodromal signs and symptoms, sequential blood counts and serum enzymatic levels that allow a first-stage dosimetric approach at this level. Victims requiring higher complexity assistance shall be transferred to third-level hospitals.

Level III: three central reference hospitals (Hospital Naval "Pedro Mallo", Hospital de Quemados from Gobierno Autónomo de la Ciudad de Buenos Aires and Hospital Británico de Ciudad de Buenos Aires) capable of providing healthcare for diagnosis and treatment of acute radiation syndrome, cutaneous radiation syndrome and internal contamination constitute this level.

An educational program for medical and paramedical responders is regularly carried out at the three levels, including theoretical background as well as practical training. Guidelines and protocols for medical handling of victims have been drawn up. Research and development of new strategies for first medical response, diagnosis and treatment of radiation injuries are promoted by ARN in close collaboration with physicians belonging to third-level hospitals.

KEYWORDS: radiation accidents, medical response

Introduction

Although radiation accidents are not frequent, the increasing use of radioisotopes in medicine, research, and industry, as well as the growing reliance on nuclear power, increases the likelihood of these situations [1]. Additionally, risks posed by the use of radioactive sources for malevolent purposes have been highlighted during the last few years. In this context, the risks associated with radioactive sources have been the subject of increasing attention during the last decade and there are diverse scenarios that could lead to medical radiation emergency.

Experience has demonstrated a need for planning medical response, for this reason, the enhancement of national capabilities for medical assistance of casualties in radiation or nuclear emergencies becomes relevant. In our country the medical response in these situations has been organized in compliance with national capabilities for medical assistance. This communication presents the organization of medical response in nuclear and radiological emergencies developed in Argentina.

Discussion

Medical response to radiation accidents in Argentina has been organized according to The Nuclear Federal Law N° 24804. In this law the Nuclear Regulatory Authority/ARN is empowered to regulate and control the nuclear activity with regard to radiological and nuclear safety, physical protection and nuclear non-proliferation issues.

The ARN has a system for intervention in radiological or nuclear emergencies: Radiological Emergency Intervention System/Nuclear Emergency Intervention System (SIER/SIEN). Both have primary intervention groups which are on duty in weekly shifts all year round. As part of this intervention system and as scientific and technical support the ARN/ Radiopathology laboratory is in charge of:

- coordinating medical response in radiation emergencies
- making arrangements for providing specific supplies and equipment
- performing research programs concerning diagnostic and therapeutic options
- improving professional expertise on Radiopathology
- elaborating recommendations, guidelines and protocols for diagnosis and treatment of radiation injuries
- promoting education and training programs for personnel's healthcare involved in radiation emergencies

Other laboratories belonging to the ARN are in charge of dose reconstruction by physical dosimetry and biological/cytogenetic dosimetry, evaluation of internal contamination and bioassays.

The national system for medical response in radiation emergencies has been organized at four levels:

1.-First level response-Pre hospital response

Pre-hospital response may be given on-site by the relevant facility medical service or by local emergency medical systems. In Argentina the first-aid response includes physicians as part of the team. At the first level a conventional triage is performed with first-aid assistance of the life-threatening injuries, followed by a radiological triage, implementation of initial decontamination and transportation of casualties, when needed, to the hospital emergency department.

Training activities are regularly organized with the systems for emergency medical assistance, as a result of the cooperation promoted by ARN. Many guidelines for on-site management and transportation of radiation victims have been included as protocols or procedures [2, 3]

2. - Second level-Medical response at local general hospital

Local hospitals emergency departments are in charge of doing the second conventional/radiological triage, including treatment of conventional and/or radiocombined injuries, completing external decontamination as necessary and evaluating and treating of prodromal symptoms. Reception in an appropriate area for radiation victims is performed, taking into account radiation protection principles to avoid radioactive contamination spread [4]. The initial triage is completed by a biomedical approach through physical examination, timing and severity of prodromal signs and symptoms, sequential blood counts and serum enzymatic levels (e.g.: amylase, glutamic oxalacetic transaminases/GOT, lactic dehydrogenase/LDH, alkaline phosphates). Blood samples for cytogenetic dosimetry and HLA typing and other biological samples like nasal mucus, sputum, and urine may be collected at this level

As a result of these evaluations, there are three possible decisions for victims:

- may return home,
- may require hospitalization at the local general hospital,
- should be transferred to a high complexity hospital.

3. - Third level-Medical response at central high-complexity hospitals

Central high-complexity hospitals are capable of offering efficient healthcare to radiation victims with suitable infrastructure, equipment, human resources and professional expertise. In these hospitals, *ad hoc* committees of radiopathology composed of trained professionals with advice from ARN expertise make protocols for diagnosis and treatment of acute radiation syndrome, cutaneous radiation syndrome and internal radioactive contamination [5, 6]. Agreements on scientific and technical cooperation for Medical Assistance of Radiation Victims have been signed between the Nuclear Regulatory Authority and the following third-level

hospitals: Hospital Naval Pedro Mallo and Hospital de Quemados. These agreements include training of human resources and research activities on radiopathology.

Moreover, the ARN promotes the interaction between the Radiopathology and Biological Dosimetry Laboratories and other institutions with professional expertise concerning particular areas such as:

- Hematology: Bone Marrow Transplantation Units from hospitals in Buenos Aires
- Toxicology: Argentine Toxicology Network/REDARTOX

Toxicology Department of Juan Fernandez Hospital

Toxicology Cathedra of Buenos Aires University

- Pharmacology: School of Pharmacy and Biochemistry of Buenos Aires University
- Pediatric: Radiotherapy Department of the National Pediatric Hospital
- Psychological impact in emergency and disaster situations: Human Factors Group of the System for Emergency Medical Assistance/SAME
- Biological Dosimetry: ARN's biological dosimetry reference laboratory and, in process, the development of the technical competence of an associated laboratory IGEVET (La Plata National University-CONICET) for assistance when the capacity of the reference laboratory is exceeded. The ARN's biological dosimetry laboratory response is coordinated by ARN's Emergency Response System and works in cooperation with other regional and international assistance programs: Latin American network of Biological Dosimetry; RANET-IAEA; BioDoseNet-WHO

The response capability of the different areas is well established in order to allow the network healthcare services to select an appropriate cohort of individuals whose treatment may benefit from their expertise.

Education and training programs are regularly executed locally for physicians and nurses belonging to the national system of medical response in radiation emergencies, at the three levels. In collaboration with other institutions, ARN organizes courses, exercises and emergency drills on Medical Response in Radiation Accidents. Modules concerning radiation protection, radiation biology and radiopathology have been included in the syllabus of postgraduate courses for burns and toxicology by emergency specialists. Other kind of activities such as conferences, symposia and workshops are also promoted by the ARN to contribute toward the enhancement of quality of human resources in this area.

4. - Fourth level- Regional and International Cooperation

Through the Regional and International Cooperation Argentina has taken part in:

- 1. The project RLA/9/031"Medical Treatment in Cases of Radiation Accidents" was conducted by representatives of Brazil, Chile, Cuba and Argentina in the framework of the Regional Cooperation Agreement for the Promotion of the Nuclear Science and Technology in Latin America and the Caribbean/ARCAL[7]. As a result of this project, a regional consensus approach concerning diagnostic and therapeutic strategies for radiation injuries was established. The first manual on Assistance of Persons Accidentally Exposed to Radiation written in Spanish was produced. A regional training course on "Medical Response in Radiation Accidents" was held in Buenos Aires in October 2000, with the participation of 14 physicians of the four countries.
- 2. The ARCAL project RLA/.9/045 "Enhancement and Harmonization of National Capabilities in Radiation Emergencies" was conducted by representatives of Brazil, Chile, Cuba, Venezuela, Mexico, Uruguay, Peru, Ecuador and Argentina. The workshop "Training the trainers on Medical Response in Radiation Accidents" was held in Buenos Aires in October 2003 in the framework of this project, with the participation of 19 professionals from Latin America and the Caribbean.
- 3. As a Liaison Center for the Radiation Emergency Medical Preparedness and Assistance Network (REMPAN) coordinated by WHO's Radiation Program, the Radiopathology Laboratory together with Radiological/Nuclear Emergencies of the ARN take part of

the international cooperation in nuclear or radiological emergencies. Within the international legal framework, this cooperation is addressed under the Joint Radiation Emergency Management Plan of the International Organizations [8], the Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in the case of a Nuclear Accident or Radiological Emergency.

Final considerations

Medical planning is essential to cope with radiation accidents. This communication has described the organization of medical response in nuclear and radiological emergencies developed by the ARN in Argentina. As shown, medical response has been set up as a three-level system, taking into account the national needs and capabilities. Therefore instead of having medical facilities for the sole purpose of treating radiation injuries, this system has been based on adapting pre-existing healthcare infrastructure, with emphasis on education and training of personnel potentially involved in medical care of radiation casualties. In this context, the ARN also promotes regional and international cooperation in order to enhance medical preparedness and management in radiation emergencies.

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