

Preparedness of general practitioners to provide medical care in the events of radiological terrorism or radiation accidents

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Abstract

Aim: Optimization of medical care in cases of radiation terrorism or radiation accidents through study and analysis of the preparedness of general practitioners (GPs) in Sofia, Bulgaria, to participate in such activities in line with the recommendations of leading international organizations in the field of nuclear safety.

Methods: We performed a single cross-sectional study in order to collect data and analyse the preparedness of general practitioners. The study was performed in September 2011. The relative share of the study group of 400 GPs was 45% (out of a total of 890) with a standard error of 2.5% and 95%CI=40.1%-49.9%.

Results: Knowledge and skills of general practitioners are fragmented and superficial, where any practical experience in the medical care for victims is missing. The majority of participants in the study reported that they needed additional training in the medical management of victims of radiation terrorism or radiation accident (85.5%, 95%CI=81.66%-88.8%).

Conclusions: Preparedness stands on a low level in Bulgaria. It is necessary to establish instructions and algorithms for action in the cases of radiological terrorism and injuries from ionising radiation to support physicians in providing medical care.

Keywords: general practitioners, medical care, radiation accident, radiological terrorism.

Introduction

Nuclear terrorism is the intentional use of nuclear weapon or the intentional causing of accident in a nuclear facility. Radiation terrorism is the intentional use of radioactive substances (sources or materials) against people. The International Commission on Radiological Protection (ICRP) uses the term radiological terrorism as a common term instead(1). If nuclear ammunitions are excluded, all the remaining possibilities to use sources of ionizing radiation (SIR) could not lead to a situation with a large number of severely injured people, since in smaller doses of ionizing radiation risks are mainly related to stochastic effects. On the other hand, due to the existing radiophobia amongst the population, the usage of SIR would trigger an enormous psychological effect, which is in fact one of the main goals of terrorism – to spread panic among the general population, as well as mistrust in the ability of authorities to guarantee the security and normal functioning of the state (2). The multiplication of effects – fear of terrorism and fear of radiation, make the possibility of realization of a radiological terrorism scenario very real (3).

The possible scenarios for radiological terrorism include: nuclear weapon attacks; blasts of nuclear installations or a repository of nuclear wastes; dissemination of radioactive materials (dirty bombs); radioactive contamination of nutritional products, drinking water, etc.; a source of ionizing radiation with high activity used for exposure of a relatively small group of people to high doses. The most probable scenario is the dissemination of radioactive material (dirty bombs) (4-7). To date, no cases of radiation and nuclear terrorism have been registered. Only a few unrealized threats have been reported (6,7). According to some authors, only two cases in the last 50 years can be considered as nuclear terrorism acts (5,8).

In its essence and consequences, the radiological terrorist act is an accident, albeit one deliberately provoked. This means that when providing medical care to the population, we must make use of the experience gained in preceding accidents. Population health effects and medical care provision activities can be foreseen. The Radiation Emergency Assistance Centre of the US (REAC) defines the case in Goiania as an “accident, which is identical to a terrorist act”. Other accidents may also be

viewed in similar light (8-10).

A comprehensive analysis of information from radiation accidents shows that very often medical care is provided to the injured by general practitioners (GPs) (11, 12). The main reason why radiation injuries remain unrecognized is the insufficient knowledge of consequences from exposures to SIR and their clinical manifestations. This leads to inappropriate and sometimes outright improper treatment of victims in the first hours after the accident. This aggravates the patients' condition and limits the opportunities for effective treatment (11,13-17).

The relevance and significance of radiological terrorism justifies many studies on the preparedness of hospitals and emergency wards (18). The role and place of GPs have been underestimated. So far, no studies on the preparedness of family physicians to participate in the medical care provision in the event of radiological terrorism have been performed. All of this background provoked us to conduct the present study.

Objective

Optimization of medical care in radiation terrorism through study and analysis of the preparedness of GPs in Sofia, Bulgaria, to participate in such activities in line with the recommendations of leading international organizations in the field of nuclear safety.

Methods

We performed a single cross-sectional study in order to collect data and analyse the preparedness of GPs. The study was performed in September 2011.

We used direct individual survey “face-to-face” using a questionnaire developed by us on the basis of documented analysis of preceding radiation accidents, existing emergency plans, the results from performed exercises for coping with radiation accidents, and the recommendations of leading national and international organizations (IAEA, ICRP, BEIR, NCRP, NRPB, REAC, and UNSCEAR) for medical provision in cases of radiation accidents. The selection process of persons included in the study aimed to provide a representative sample of GPs in Sofia. We drew a simple random sample using a generator of random numbers and based

on the register of GPs in Sofia. This register is publicly available through the website of the Regional Health Insurance Fund. The relative share of the study group of 400 GPs was 45% (out of a total of 890) with a standard error of 2.5% and 95% CI=40.1%-49.9%.

The individual data was collected in the course of three months. We used the survey network of one of leading sociological agencies in Bulgaria. The surveying team was specifically selected and trained to work with general practitioners.

All surveys were performed in the physicians' offices. Some of the selected physicians were visited several times due to absence at the time of study. Each filled questionnaire was carefully reviewed. The dropout percentage in the course of the study was 10%. During the course of study we performed control visits in the offices of 50 (12.5%) of the persons included in the sample.

We processed the collected data using the statistical package SPSS, version 19.0. The adopted level of significance in the testing of H_0 was $\alpha=0.05$ for a guaranteed probability of 95%. In order to validate results from the performed analyses we used the following statistical methods: descriptive analysis; tests for interdependence between descriptive data - χ^2 Pearson, Exact test, coefficient of contingency of Cramer (V) - for orientation estimation of the degree of manifestation of the dependence found by the χ^2 - method; tests for comparing relative shares - Z test.

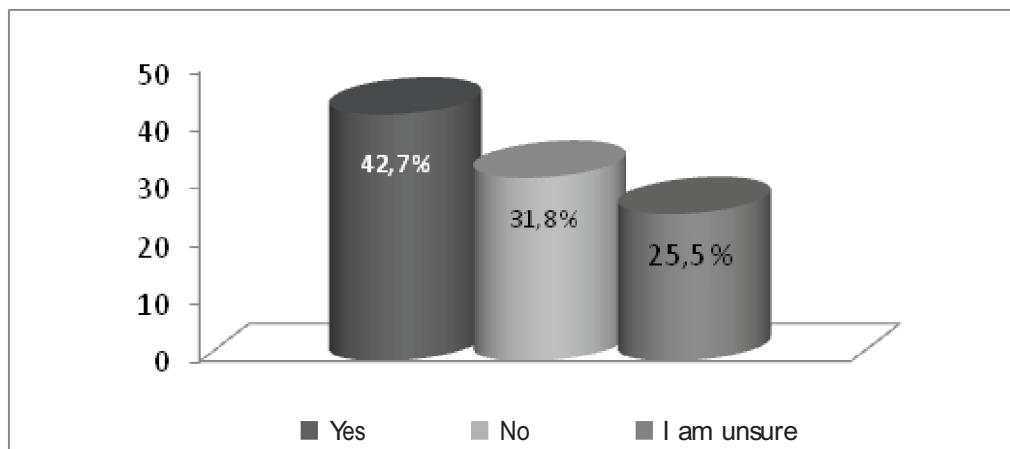
Results

Some social and demographic features of the 400 GPs participating in the study were as follows: 319 were females with a relative share of 79.7%. Males were 81 (or, 20.3%). Distribution by age demonstrated a highest share of physicians aged between 41 and 50 years (168, with a relative share of 42%), followed by those aged between 31 and 40 years (115, or 28.7%). Under the age of 30 years were only 14 (or, 3.5%). By specialty, the largest share consisted of physicians with a specialty in general medicine (40.8%), followed by internal diseases (29.3%) and paediatrics (11.5%). Conversely, 12 physicians had other specialties.

At the stage of introductory questions studying the respondents' attitudes towards the relevance and significance of the problem, 36.5% determined the relevance as "very high" and "high", 17.9% as "low" and "very low", and 22.8% – "neither high, nor low". A larger share of physicians determined the significance as "very high" and "high" (50%), as "low" and "very low" (13.3%), and 15.5% as "neither high, nor low".

A significant question concerning GPs' behaviour after an accident was: "Do you think that providing medical care to persons with external radiation exposure carries risks for the physician?". "No" answers were evident for only 31.8% of the respondents. The relative share of "yes" answers amounted up to 42.7%, which confirmed the alternative hypothesis (H_1) for a significant difference

Figure 1. "Do you think that providing medical care to persons with external radiation exposure carries risk for the physician?"



between the compared relative shares ($Z=4.40$, $P<0.0001$). Answers are presented in Figure 1.

In confirmation of the necessity of new knowledge and skills were presented the answers to the question: "Can you perform preliminary treatment of victims with radiation injury?". Only 3.8% of all respondents were convinced about this issue and answered "yes" to this question, which was significantly different than the share of "no" answers (12.6%, $Z=5.30$, $P<0.0001$). An insignificant share was evident for the "probably" answers (18.9%). An extremely important phenomenon in radiation terrorism is the external contamination followed by the incorporation of radioactive substances in the body (13,16, 19). Only 4.1% of the respondents knew how to perform primary individual deactivation.

Experience with previous radiological accidents shows it is absolutely imperative that GPs have clearly defined responsibilities. Our study showed that any instructions and procedures for action on behalf of GPs are missing. None of the respondents had such an instruction (100%, $95\%CI=99.08\%-100\%$), which clearly confirms the necessity of algorithms for action in the event of radiation terrorism.

The question "Do you know who to consult in the case of radiation injury?" generated the following results: persons responding "yes" were 129, which comprises 33.1% of all the respondents. The relative share of "no" answers was 66.9%.

According to the recommendations of ICRP and the US National Council on Radiation Protection and Measurements (NCRP), even in the absence of concrete data, in every radiological accident situation the presence of radioactive contamination should be presumed and precautionary measures should be taken (such as protective clothing, respirators, etc.). Even the most ordinary medical coat, surgical gloves and mask can protect the body from contamination (9,10,19). Almost none of the respondents had personal safety means. Only two of the respondents had such safety means, representing 0.5% of all respondents.

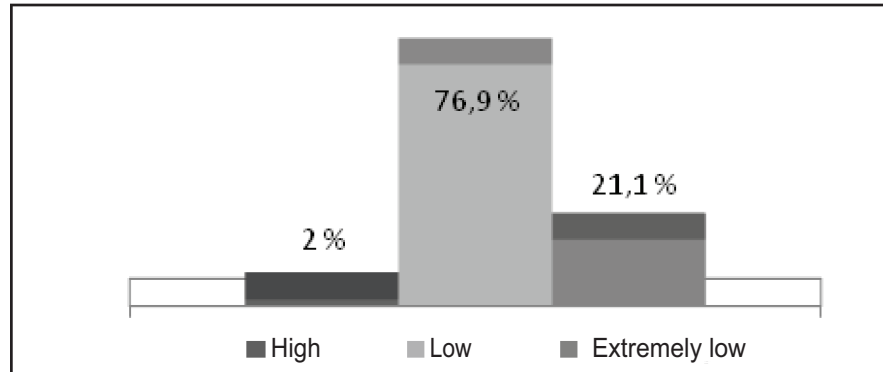
Analysing experience obtained so far, a significant number of victims with Multiple Idiopathic Physical

Symptoms (MIPS) may be expected in the event of radiation terrorism to affect the GPs (20). Normally, GPs represent the first and basic level of medical care provision. In these cases the usage of some more elementary and easily operating types of dosimeters and radiometers may prove useful, both for monitoring the injured and reducing stress among the affected. Besides, one should not enter the zone of radiation accident situation without an individual dosimeter, unless the aim is saving the lives of people. Even the simplest pocket dosimeters, radiometers and indicators may prove necessary and vitally important. Our study showed that only 9 physicians had a dosimeter-radiometer, with a relative share of 2.3%.

GPs should be able to start initial symptomatic treatment. Nausea, vomiting and anorexia typical of the prodromal phase of the acute radiation syndrome, are symptoms from the gastro-intestinal system, but control over their expression is localized in the central nervous system. These are affected by the administration of 5-HT₃ receptor antagonists, such as Dolasetron, Ondansetron, Tropisetron, and Granisetron, which block the 5-HT₃-receptors in the gastro-intestinal tract and the haemo-receptive trigger zone of the medulla (e.g. Granisetron tablet 1 mg 2 times daily or 2 mg once a day). Diarrhoea is controlled by Loperamide hydrochloride, Lonox (diphenoxylate/ atropine) (5). On the question: "Do you have medications for preliminary treatment of persons with radiation injury?", the answers "yes" constituted only 14.8% of the overall sample. The relative share of "no" answers was 85.2%.

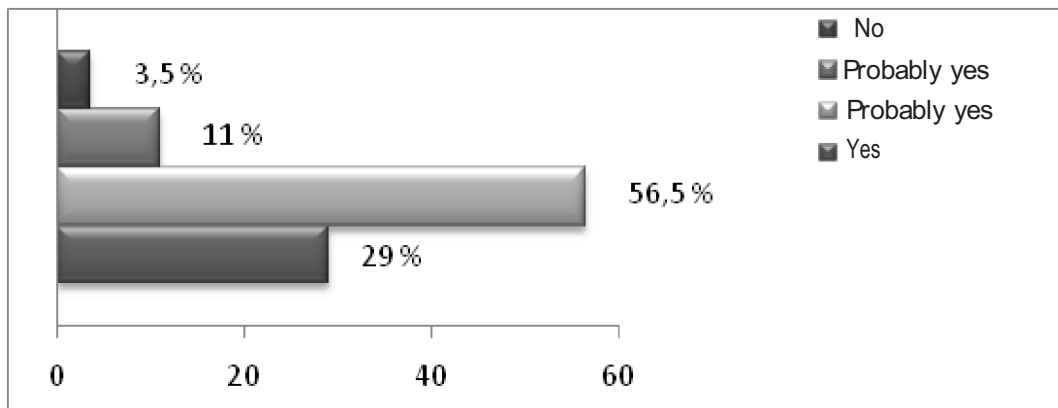
"How would you rate your preparedness for action in the event of radiation terrorism?" was a survey question aimed at self-appraisal of GPs preparedness. The number of participants responding with "low" and "very low" was 390, which represents 98% ($95\%CI=96.1\%-99.13\%$) of all responses. The relative share of "yes" answers was only 2% ($95\%CI=0.87\%-3.9\%$), which clearly rejects the null hypothesis (H_0) and proves the alternative hypothesis (H_1) for a significant difference in the compared relative shares ($Z=137.14$, $P<0.0001$) (Figure 2).

Figure 2. "How would you rate your preparedness for action in the event of radiation terrorism?"



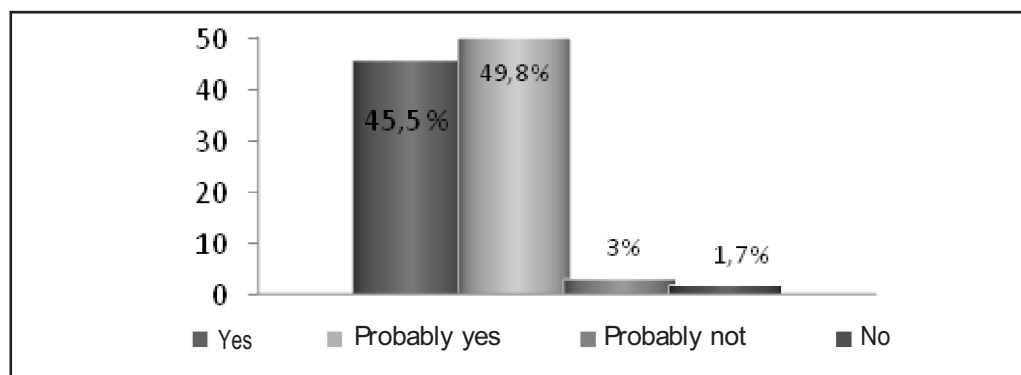
The majority of participants in the study considered that they need additional training in the medical management of victims of radiation terrorism (85.5%, 95%CI=81.66%-88.8%). Only 14.5% (95%CI=11.19%-18.34%) of them reported they don't need such training. These data are presented in Figure 3.

Figure 3. "Do you feel the need for additional training in medical management of victims of radiation terrorism?"



Almost all GPs consider it necessary to have at their disposal a simplified algorithm for action in radiation terrorism (95.3%, 95%CI=92.74%-97.15%). The relative share of individuals with an opposite opinion was only 4.7% (95%CI=2.84%-7.26%). Figure 4 presents the percentage distribution of answers on this question.

Figure 4. "Do you think it is necessary to have at your disposal an algorithm for action in the event of radiation terrorism?"



Discussion

Despite a number of indisputable advantages, approved by the European Group for Blood and Marrow Transplantation (EBMT) uniform standardized procedure for diagnostics and treatment of the injured, whose underlying basis is the programme METREPOL (Medical Treatment Protocols for Radiation Accident Victims), offered by Fliedner et al., this approach is largely unfeasible for GPs (21,22). This system does not account for exposure from external contamination, incorporation of radioactive substances and combined injuries, which are of particular significance in case of radiation terrorism. The comprehensive examinations recommended by these authors require highly qualified personnel and complex equipment. The diagnosing of radiation injury from GPs is complicated at present because specific symptoms are lacking. For these reasons GPs should have at their disposal a simplified algorithm for action in external whole corporal and/ or local exposure and in the case of external and/ or internal contamination.

Conclusions

The following conclusions were drawn from the current study:

- The medical aspects of radiation terrorism aftermath may be grouped into four directions: dealing with the acute radiation syndrome, therapy of local radiation injuries, decontamination and decorporation, and the overcoming of psychological effects.
- The experience gained in previous accidents

shows that very often medical aid to victims is provided by GPs, which points to the need for these physicians to have at their disposal clearly defined tasks and responsibilities in the cases of radiation terrorism and radiation injuries.

- Collected and analysed data allows us to state that the knowledge and skills of GPs are fragmented and superficial, where any practical experience in the medical care for victims is missing.
- Preparedness stands on a low level. It is necessary to establish instructions and algorithms for action in the cases of radiation terrorism and injuries from ionising radiation to support physicians in providing medical care.
- Almost all participants in the study reckoned they needed additional training.

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