Increased Focus on Safety and Security of a High-Activity Sealed Radioactive Iridium-192 Source in Brachytherapy

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Sealed radioactive sources are commonly used in different medical applications such as brachytherapy, external beam radiotherapy and sterilisation units that use iridium-192, caesium-137, radium-226, californium-252 and cobalt-60 sources. These sources are defined as high-activity, sealed sources (HASS) under the source category 3 and safety level C classifications of the International Atomic Energy Agency (IAEA), since they show the enhanced activity of more than 80GBq but less than 800GBq (1). International recommendations produced by the IAEA on the security of radioactive sources were recently transposed to Swiss national legislation (1,2). In 2017, the Swiss Radiological Protection Act was revised and released with a new article 99 that covered the safety and security of HASS for licence holders. These licence holders included radiation oncology facilities (3). The Swiss Federal Office of Public Health (FOPH) launched an action plan to strengthen radiological safety and security (radiss) in Switzerland. The plan focused on the prevention and detection of any unwarranted radiological releases and intervention to ensure no concerns occurred regarding HASS in general for a period of five years that began in 2020 (4).

Our department of radiation oncology has an active brachytherapy programme that provides high dose rate (HDR) treatment. Therefore, radiss directly affects us as a licence holder. We assessed the situation and prepared a confidential, site-specific security plan in close cooperation with the in-house security department and the local law enforcement agencies of Zurich. For obvious reasons, we will not share in this newsletter the confidential content of our security plan nor detailed information regarding our safety and security infrastructure, but we would like to make you, the members of the European SocieTy for Radiotherapy and Oncology (ESTRO), aware of the sort of measures we have taken and draw your attention to possible scenarios. Simple measures can be applied with little effort to increase safety and security to such an extent that anyone with malicious intentions is discouraged from attempting any criminal action. The main components of our security plan, which is designed to align with international recommended standards and with the new national guidelines on safety and security of HASS, are: 1) the definition of the roles of the radiation protection officer and safety manager; 2) the reconstruction of the room to enable safe storage of the source; 3) the restriction of access to the iridium-192 source; 4) the training of all staff members; and 5) the teaching of external partners.

As we started to apply the measures that were required by the FOPH, the two roles of radiation protection officer and safety manager were assigned to experienced professionals within the team who were familiar with working with radioactive sources. Both were highly involved in the assessment of the situation, the implementation of the safety and security infrastructure and the setting up of a continuing education programme. They are also responsible, as supervisors, for ensuring that all parties follow the site-specific security plan.

The technical infrastructure was adapted to meet international recommended standards through the reconstruction of the treatment room where brachytherapy is performed. Direct access to the iridium-192 source was limited to only a handful of personnel with the highest security level. The rest of the HDR staff were given only limited clearance to the vault, according to their responsibilities. This was feasible because the hospital already applied a dedicated system of controlled access to the site, which we also applied to the new HDR treatment room.

A major focus of the security plan was to increase the understanding of the staff regarding possible threats and to concentrate on the establishment of an improved safety and security culture for HASS. During opening hours, medical staff who work in the close surroundings of the brachytherapy treatment vault contribute by their presence to a high level of safety of the HASS and could prevent unauthorised persons from gaining access to the room.

The biggest challenge was to change the mindsets of external task groups and of different occupational groups that contributed to HDR treatments, to provide the best level of safety for our iridium-192 source. Some professionals, such as radiation oncologists,

radiation therapists (radiation therapy technologists) and medical physicists, who worked in radiotherapy, were already trained in the handling of and close work with radioactive sources. Other groups, such as nurses, in-house security staff and local law enforcement forces, had never thought about how ionising radiation could have an impact on their private as well their professional lives. It was our major aspiration to educate all participating parties and emphasise their role in the safety and security infrastructure and establish a regular and continuous education programme.

The different occupational groups have now been educated on the main goal of brachytherapy, the nature of HASS and possible threats from the use of radioactive sources. Education on safety and security was pragmatic regarding work with HASS to avoid spreading fear among the staff. Only fragments of the hospital security plan were shared with each target group according to their security level, so that they could operate with the maximum level of security possible and the least disruption to their daily workflow. The order of magnitude of radiation-induced health effects that could be caused by an iridium-192 source at maximum clinical activity was pointed out for different scenarios of threat, fire or first-aider response. Simple measurements of radiation exposure through the use of active dose-rate monitors were demonstrated and compared with radiation-induced health effects (5). Our staff receive regular training regarding the appropriate response to exposure, with maximum focus on their own protection. Over the last 12 months, we have found that the better the information and education that are provided to staff on how they can contribute to improving the safety and security of HASS, the more confidence they have shown in their ability to contribute. Now, radiation therapists, radiation oncologists, nurses, medical physicists, local security staff and law enforcers work more closely together, are much more aware of each other's presence and contribute together to a safer working environment than they did previously.

Since we live in a world where threats and danger beyond imagination can occur all of a sudden, it is more than justified for us to prepare for certain scenarios and to reconsider a few facts when we work with HASS in clinics. We believe that the more the ESTRO community addresses the topic of safety and security of HASS, and thereby increasing levels of understanding, the more a sustainable safety culture is maintained and, probably, the concept of deterrence of malicious acts gains momentum.

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