Ethics in radiation protection in healthcare

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INTRODUTION

Radiation protection is very close to me thanks to the fact that I graduated as a Radiological assistant and I still work in this field. Daily I face ethical dilemmas, which are connected to the radiation protection, mostly of patients, but of workers in radiodiagnostics as well as in radiotherapy.

In healthcare, the radiodiagnostic sector is the first and largest sector using ionising radiation. The greatest development occured after World War II, but unfortunately no one had any idea about the side effects. The first recommendations on protection from the negative side effects of ionizing radiation were issued by the International Commision on Radiological Protection in the first half of the 1950s. At first were all protective measures limited to doctors and other medical personell. Since then, the recommendations in the system of radiation protection of persons were evolving together with new discoveries of undesirable effects of radiation on the body and practical experiences, up to clearly defined goals and principles of radiation protection as they are known today. In this process, ethics has always played an unmistakeable and irreplaceable role.

This essay is about ethics in radiation protection in healthcare. The introduction contains basic information on radiation protection of patients, specifying the 4 casic principles of radiation protection. Next chapter introduces roles of ethics in the radiation protection system of people, and specific ethical values are presented as well. Ethical values in radiation protection are also presented in the context of the radiological assistant practise.

1 RADIATION PROTECTION

In 1921, the British X and Radium Protection Committee took the radiation protection rules as its own, leading to limiting the exposure. In 1934, ICRP (International Commission on Radiological Protection) adopted the first limits. In 1991, ICRP Recommendation No. 60 was issued, which established new system of radiation protection, that is still in place today. International Atomic Energy Agency (IAEA) and the European Union elaborated this recommendation as Basic Safety Standards – BSS (IAEA 1996). Directive of the Council of Europe 96/29 became the basis of EU legislation and was also adopted by our country (Decree 184/1997 Sb. and its amendment Decree 307/2002 Sb. as amended).

The current concept of radiation protection is based on knowledge of the biological effects of ionizing radiation, on general approaches of society to protect the health of the population against factors of technological development and the environment, on the needs of current and expected practice, i.e. it takes into account all situations in human exposure that occur or may occur, and proposes a principled solution for them.

The main goal is to „*completely eliminate the occurence of deterministic effects to an acceptable level"*. There are four basic principles in order to achieve this goal: the principle of justification, the principle of optimization, the principle of dose limitation and the principle of source safety. (National Radiation Protection Intitute, IAEA-Radiation protection)

1.1 The pronciple of justification

According to this principle, there must be a certain benefit for the patient from an examination or therapy where ionizing radiation is a part, which must be less than the possible risk of damage due to ionizing radiation. In practice, therefore, other diagnostics that do not include ionizing radiation (sonographic examination, magnetic resonance imaging) should be considered before the examination. Any examination involving ionising radiation must therefore be accurately indicated. (ICRP Publication 122)

1.2 The principle of optimalization

The aim of optimisation is to ensure the lowest individual dose size and the probability of exposure, as reasonably achievable. The principle of optimization is referred to as ALARA: "as low as reasonably achievable". The ideal of this principle is to obtain a high-quality X-ray image using the lowest possible doses. (ICRP Publication 122)

1.3 The principle of limitation

The limitation is a quantitative indicator for limiting the total exposure of an individual from exposure planning activities.

The limits are set:

- For the population (general limits)
- For radiation workers
- For pupils and students preparing for occupations with ionizing radiation sources (ICRP Publication 122)

1.4 The princip of resource security

In the principle of machinery safety, it is a requirement that the source of ionizing radiation is not stolen and that access by unauthorized persons is prevented. It's also important to track the source and report its loss. The operator must have a valid permit and properly record everything. Everything is supervised by the State Office for Nuclear Safety, which performs tests of the stability of the source. (ICRP Publication 122)

2 ETHICS IN RADIATION PROTECTION

The term „ethics“ comes from the Greek word „ethos“, which means a character trait, a habit or a way of thinking. Nowadays counts ethics as a philosophical discipline, examining moral values of people.

According to the ICPR (Publication 138) are the ethical values, scientific knowledge and experiences the three main pillars of radiation protection. Scientific knowledge and experiences are then derived from practice. The ICRP Publication 138 of 2018 is called Ethical Founfations of the System of Radiological Protection. This publication describes the ethical foundations of radiation protection. (ICRP Publication 138, ICRP)

2.1 Basic ethical values for the radiation protecion system

There are four ethical values according to ICRP of 2018 which apply in Europe, America, Asia and Africa. These are therefore the following ethical values:

1. Beneficence a non-maleficence
2. Prudence
3. Justice
4. Diginity (ICRP Publication 138)

2.1.1 Beneficence a non-maleficence

Charity is doing good, or it can also be support. Harmlessness then means the behavior of a person who tries not to cause harm. According to the ICRU, these values are just one ethical value. In practice, this principle is associated with the goal of radiation protection. The benefit takes into account the benefits for individuals, communities and the environment. The role and challenge is to measure the benefits, risks and harms. In radiation protection, it is necessary to take into account individual and social aspects and consider the direct benefits of the use of ionizing radiation in health care – i.e. improving the patient's condition. But the benefits must also be weighed against the possible undesirables. Thus, individual, social, psychological and other aspects should be taken into account during this. It is also worth remembering the definition of health of the WHO. (ICRP Publication 138)

I can compare the principle of charity within the profession of radiological assistant to the principle of justification in radiodiagnostics, which was mentioned at the beginning of this work. The patient must agree with the examination and the doctor should therefore explain

the reason for this examination, talk about various alternatives to non-ionizing radiation (sonography, magnetic resonance imaging), etc. In practice, doctors consider alternative non-ionizing radiation tests and discuss this with the patient, explain the reasons for the examination emitted by ionizing radiation.

2.1.2 Prudence

The term „prudence“ means the ability of a person to make a decision without full knowledge of the scope and consequences of the action performed, and has a significant history in ethics. Within radiation protection, it is related to the effects of radiation on the body. In determining actual estimates of deterministic effect thresholds, it is wise to consider certain uncertainties. For stochastic effects, a non-threshold linear model is important for radiation protection at low doses. (ICPR, 2007). Regarding hereditary issues, there is no clear evidence in humans today, but it does exist by experimental animals.

Prudence first appeared in the 50s (it has been constantly changing ever since) and should not be taken as conservatism or non-risk-taking. It does not describe the outcome of the decisions. (ICRP Publication 138)

As an example, I will mention the situation from practice during prostate irradiation in a patient who has been introduced into the target volume of so-called golden grains for higher irradiation accuracy and it is possible to use two different techniques (CBCT or megavoltage X-ray images) for verification. When verifying the position of the patient, it is important that the golden grains in the prostate are contoured in the CT planning images. The principle of optimization was violated when the colleague verified the patient's position according to the pelvic bones, not according to the grains in the prostate. However, it is not clear how big a mistake in the patient's position was ultimately involved. However, it is clear that there was no maximum irradiation of the patient's prostate, but rather the dose reached the rectum and bladder. In my opinion, it is a violation of the principle of radiation protection because if my colleague discovered the error immediately, the patient could receive a smaller dose from the verification of its location. Due to the fact that the error was not detected immediately, verification irradiation had to be performed by me twice, and thus against the ALARA principle.

2.1.3 Justice

In general, justice is expressed as a fair distribution of advantages and disadvantages among a group of people. Fairness in healthcare depicts the need for healthcare professionals to behave professionally regardless of the patient's situation (e.g. age, social issues, etc.)

The justice has two tasks, the first of which is to prevent uneven distribution of exposure when it could happen that one patient would have a larger dose than another patient. To prevent this from happening, benefit restrictions have been created. Dose restrictions apply to planned exposures. In addition, a system of benchmarks has been developed, which in turn applies to exposure situations and accidents.

The aim of the next and final task is that no exposure to ionising radiation exceeds values that would be risky and undesirable. This is achieved by using dose limits that are available to exposed workers and the public during planned exposure situations. (ICRP Publication 138)

As an example from practice, I would say that when imaging patients on X-rays, the radiological assistant is obliged to cover mainly the gonads of all patients. In my practice, however, I have encountered the approach of radiological assistants, where this protection was provided only to some people. Apparently, the age of the patients played a role. In this case, the principle of justice was violated and radiology assistants unfairly decided who to give the apron and who not, despite the fact that everyone is entitled to it and it is one of the basic parts of patient protection during scanning.

2.1.4 Diginity

Dignity means, that everyone deserves respect. In protection against ionizing radiation, it is ensured by the fact that the patient signs a consent to have been informed about everything. Any patient treated or diagnosed with ionizing radiation accepts or rejects the risks. In practice, the so-called informed consent of the patient is used, which is mostly confirmed by the signature of the patient or legal guardian (e.g. for children). (ICRP Publication 138)

As an example, I can mention here computed tomography examination, where the patient receives informed consent on the register of receipt of requisitions, as soon as he fills it in, he is again asked by the radiological laboratory technician for information that is needed to know before the examination in order to prevent possible complications. One of the most common questions before computed tomography examination is whether the patient is

allergic to iodine contrast agent, a very crucial question, because obfuscating information could lead to life-threatening conditions.

2.2 Procedural ethical values

For the practical implementation of the above ICRP recommendations, three requirements (procedural ethical values) are important and need to be emphasized. These three values are interrelated and clearly indicate the general standards. These values are also common to all exposure situations in healthcare. It is therefore mainly accountability, transparency and inclusiveness. According to them, it is therefore important to behave responsibly by persons involved in the radiation protection process (responsibility), to properly inform and provide information to all parties (transparency), and also to preserve the autonomy and dignity of people exposed to ionizing radiation (inclusiveness, participation of all stakeholders). (ICRP Publication 138)

CONCLUSION

Unfortunately, ethics in radiation protection in health care were not addressed at all, until recently. It was not until 2018, thanks to ICRU, that ethics in this issue began to be officially addressed, and a new publication is currently being prepared. In my opinion, this topic is very important in the area of patient and worker protection, and in practice I often encounter ethical dilemmas on this topic.

This essay deals with ethics focused on radiation protection in healthcare. At the beginning of the essay, the reason why I chose this topic for writing the essay is given and is briefly introduced mainly radiodiagnostics, which is the most widespread field where ionizing radiation and radiation protection are used in healthcare. In the chapter on radiation protection itself, the development of radiation protection in medicine is described and various agencies etc. such as IAEA and ICRP that deal with radiation protection are described. The following are 4 basic principles governing radiation protection. In the chapter Ethics in Radiation Protection, the basic values in Radiation Protection Ethics are mentioned and described. Both the principles in radiation protection and the basic ethical values in radiation protection are very interrelated, complement each other and appear daily in medical practice. Without these principles, radiation protection in practical health applications would have a lower ability to protect both patients and workers as well.

LIST OF USED LITERATURE

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