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European Project BRAPHYQS

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Background. *Quality assurance in radiotherapy and brachytherapy is extremely important because errors that may occur during treatment process can be fatal for the patient. European Society for Therapeutic Radiology and Oncology has therefore founded BRAPHYQS, a special group that is responsible for the revision of quality assurance procedures of treatment performed in brachytherapy centers and for outlining common standards of work in European countries.*

Conclusions. *The project BRAPHYQS has the following aims: (1) to publish European recommendations for implementing QA/QC in European brachytherapy centers; (2) to set up a central dosimetry audit in European brachytherapy centers (this task will be delegated to ESTRO-EQUAL laboratory at the Institute Gustave Roussy in Paris); (3) to set up a central audit for the geometrical reconstruction of source positions with a special test phantom that will be available to each brachytherapy center. Hence, a series of »Baltas phantoms« will be elaborated and distributed to the brachytherapy centers in Europe; (4) to prepare a draft of booklet of QA/QC recommendations for testing the brachytherapy equipment and therapy planning systems.*

Key words: quality assurance, health care; radiotherapy; brachytherapy; Europe

Introduction

Quality Assurance (QA) in radiotherapy ensures accurate dose prescription and application of radiation doses for each individual localization of tumor growth in cancer patients. The higher is the accuracy of radiotherapy, the greater are the chances of cure. QA in radiotherapy requires regular control of irradiation equipment as well as continuous upgrading of skills of the personnel in charge of QA. Dosimetric and electromechanic properties of the irradiadition devices and all related equipment should be regularly checked. QA in radiotherapy and brachytherapy is of utmost importance because any failure in the treatment procedure may be fatal for the patient.

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Brachytherapy physics quality assurance system (BRAPHYQS)

In January 2001, the European Society for Therapeutic Radiology and Oncology (ES-

TRO) submitted an extensive and valuable project, entitled ESQUIRE (Education Science and Quality Assurance in Radiotherapy in Europe), to European Commission for financing (ESTRO 2001). The project was accepted. This is a great step forward in the endeavors for quality assurance in radiotherapy in Europe. Mr. Hans Svensson (Sweden) was appointed Chief of the Project. Professional and cost-wise, radiotherapy is considered to be the prevalent treatment modality of cancer patients, despite extremely high investments in the purchase of equipment. ESQUIRE project will take charge of quality control (QC) of the therapy as well as of upgrading the knowledge and skills of the personnel in the training programs prepared by different committees under the patronage of ESTRO. These are:

- monitoring of radiation dose application
- registration and data managing of radiation side-effects
- transfer of technology experiences and skills to other radiotherapy centers in Europe
- control over complete radiotherapy procedure and research
- quality assurance in Intensity Modulated Radiotherapy (IMRT)
- quality improvement in brahytherapy (BRAPHYQS)

The BRAPHYQS group will undertake the revision of QA procedures in brachytherapy centers in Europe and suggest common standards to be respected in European countries. The revisions will involve the accuracy of dosimetry and geometric reconstruction of radioactive sources implanted by different brachytherapy methods. The team is also in charge to publish a booklet containing a set of descriptions of QA/QC procedures in brachytherapy. In radiotherapy, the general tendency is to apply the doses to target tissue using the procedures that can avoid the exposure of the healthy surrounding tissue.[1,2] Brachytherapy is a treatment modality that allows irradiation of smaller volumes with lower doses to the surrounding tissue than those usually emitted in radiotherapy with external beam.[3] At the same time, there is also a greater probability of committing errors in dosimetry, which urgently requires setting up uniform European QA standards in brachytherapy. Brachytherapy will continue to be the principal treatment modality of cancer patients, particularly as an additional boost in combination with external beams during teletherapy. Brachytherapy has a significant role in clinical studies, e.g. in the famous EORTC 22881/10882 study which compared two treatment modalities of breast cancer, one with the boost and the other without it. The study confirmed that local control in younger patients was improved if these patients received a boost with brachytherapy to the tumor.[4] In the brachytherapy of the prostate, manual insertion of low-energy sources, such as J-125 and Pd-103, is still practiced,[5] though at present radioactive sources are usually inserted by afterload devices, which certainly improved the protection of the medical staff against ionizing radiation. Today, we generally use the isotopes Cs-137 and Ir-192. The progress in brachytherapy undoubtedly requires a constant checking of mechanized and computerized treatment procedures. These procedures have been extensively described in various articles and brochures published by different national and international organizations. Though numerous, they lack uniform and common QA standards of work that could be directly followed by other brachytherapy centers. In addition to language barriers that arise from national protocols, there are also problems that are due to the differences in the definitions of QA/QC procedures regarding the frequencies and tolerances specified in these procedures. The principal task of BRAPHYQS is to analyze the currently valid protocols and to set up methodology together

with the recommendations for work in European medical physics as well as elsewhere. New protocols would be a supplement to the existing QA/QC database. European brachytherapy centers should therefore get together and jointly work on the compilation and unification of the procedures in brachytherapy radiophysics and to collect them in a booklet that will be formally published by ESTRO. This kind of international cooperation is planned to go on for two years and is expected to be concluded by the end of 2002. Slovenia also takes part in this joint European project which is certainly most advantageous for better flow of information into the country.

In 1999, the Institute of Physics and Engineering in Medicine in United Kingdom published recommendations for QA in radiotherapy that also involve protection against irradiation and calibration of brachytherapy sources. In the Netherlands, such recommendations concerning low dose-rate (LDR) were published already in 1989, whereas the recommendations for handling the high dose-rate facilities (HDR) were appeared as late as 1994. A particular emphasis was placed to the dosimetry of HDR sources. The last report of the year 2000 contains minimal requirements for QA/QC in brachytherapy as regards the frequencies and tolerances to be respected in testing brachytherapy equipment.[6] In Germany, the dosimetry in brachytherapy was fixed in 1993 in accordance with the German standard DIN 6809-2, whereas in France, the appropriate standards are CFMRI dated from 1983 and NFC 74-210 from 1992. In Spain, TG 43 formulism,[7] published in 1995 in American Association of Physicists in Medicine (AAPM), served as a base. From then onwards, formulism is applied to many planning systems and is more and more likely to develop into the standard for dose calculation. AAPM also published 'Code of Practice for brachytherapy physics' and 'High dose rate brachytherapy treatment delivery'. [8,9] This report covers all aspects of HDR, including dose prescription, safety, planning and dose calculation, and protection against ionizing irradiation. Intravascular brachytherapy in America is covered by 'Intravascular Brachytherapy Physics'.[10]

International Atomic Eneregy Agency (IAEA) has dealt with brachytherapy in several publications. In 1996, IAEA founded the Department for Calibration of LDR Cs-137 Sources, and in 1999, the Agency published TECDOC-1079 »Calibration of brachytherapy sources«.[11] Guidelines to Secondary Standard Dosimetry Laboratories and medical physicists on standardized methods for calibration of brachytherapy sources'. In 2000, the IAEA report No. 17 'Lessons Learned from Accidental Exposures in Radiotherapy' appeared.[12] The report comprises descriptions of 92 unfortunate cases of patients having received miscalculated doses. Of these, 32 were treated with brachytherapy with sealed sources. The failures were mainly due to inaccurate assessment of source activity, inaccurate dose calculation and entering of incorrect parameters into the planning system. The failures were also due to inadequately inserted sources or unprofessionally removed sources by the patients themselves. The most serious failure that resulted in the death of a patient was caused by the malfunction of afterload device.

The above cases are truly requiring an outline of a well-conceived program for QA in brachytherapy.

Conclusions

The BRAPHYQS Projects has the following aims:

1. To publish European recommendations for implementing QA/QC in European brachytherapy centers;
2. To set up a central dosimetry audit in European brachytherapy centers (this task

will be delegated to ESTRO-EQUAL laboratory at the Institute Gustave Roussy in Paris);

3. To set up a central audit for the geometrical reconstruction of source positions with a special test phantom that will be available to each brachytherapy center. Hence, a series of »Baltas phantoms« will be elaborated and distributed to the brachytherapy centers in Europe;
4. To prepare a draft of booklet QA/QC recommendations for testing the brachytherapy equipment and therapy planning systems.

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