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New perspectives in radiation oncology: Young radiation oncologist point of view and challenges

Jose Luis Lopez Guerra[a,*], *Nicolas Isa*[a,b], *Michelle M. Kim*[c], *Celine Bourgier*[d], *Hugo Marsiglia*[a,d]

[a] *Department of Radiation Oncology, Instituto Madrileño de Oncologia/Grupo IMO, Madrid, Spain*
[b] *Department of Radiation Oncology, Instituto Nacional del Cancer de Santiago de Chile, Santiago, Chile*
[c] *Department of Radiation Oncology, The University of Texas MD Anderson Cancer Center, Houston, TX, United States*
[d] *Department of Radiation Oncology, Institut de cancérologie Gustave Roussy, Villejuif, Paris, France*

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ABSTRACT

Aim: To assess the role of the young radiation oncologist in the context of important recent advancements in the field of radiation oncology, and to explore new perspectives and competencies of the young radiation oncologist.

Background: Radiation oncology is a field that has rapidly advanced over the last century. It holds a rich tradition of clinical care and evidence-based practice, and more recently has advanced with revolutionary innovations in technology and computer science, as well as pharmacology and molecular biology.

Materials and methods: Several young radiation oncologists from different countries evaluated the current status and future directions of radiation oncology.

Results: For young radiation oncologists, it is important to reflect on the current practice and future directions of the specialty as it relates to the role of the radiation oncologist in the comprehensive management of cancer patients. Radiation oncologists are responsible for the radiation treatment provided to patients and its subsequent impact on patients' quality of life. Young radiation oncologists must proactively master new clinical, biological and technical information, as well as lead radiation oncology teams consisting of physicists, dosimetrists, nurses and technicians.

Conclusions: The role of the young radiation oncologist in the field of oncology should be proactive in developing new competencies. Above all, it is important to remember that we are dealing with the family members and loved ones of many individuals during the most difficult part of their lives.

* *Corresponding author at*: Department of Radiation Oncology, Instituto Madrileño de Oncologia/Grupo IMO, 7 Plaza Republica Argentina, 28002, Madrid, Spain. Tel.: +34 91 515 20 00; fax: +34 91 4134940.
E-mail address: chanodetriana@yahoo.es (J.L. Lopez Guerra).

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1. Background

Radiation therapy has been in use for the treatment of cancer and other diseases for approximately 100 years. As early as 1897, it was concluded that X-rays could be used for therapeutic as well as diagnostic purposes, and in 1912, Marie Curie published the Theory of Radioactivity. The investigation of X-ray radiation for patient therapy moved into clinical practice in the early 1920s.[1] Since the first uses of radiation to treat cancer, important changes and advancements have occurred,[2–5] including: (1) the generation of higher energy radiation beams from linear accelerators; (2) the use of computed tomography (CT), positron emission tomography (PET), magnetic resonance (MR), and other image data sets to create three-dimensional planning models to accurately guide treatment; (3) the development of new radiation techniques, such as intensity modulated radiation therapy (IMRT), image guided radiation therapy (IGRT), robotic radiosurgery and proton therapy; (4) the implementation of new molecular targeted therapies; (5) an increase in the multidisciplinary treatment of cancer; and (6) a greater emphasis on high-quality research and evidence-based care.[6–8]

2. Aim

The focus of the current article is to investigate the role of the young radiation oncologist in the context of these important advancements, and to explore new perspectives and competencies of the young radiation oncologist.

3. Materials and methods

Several young radiation oncologists from different countries evaluated the recent advancements and the current status of the field of radiation oncology, providing new perspectives about the role of the young radiation oncologist. A young radiation oncologist was defined as having ten or fewer years of clinical practice in Radiation Oncology. To provide a broad range of perspectives, the contributions from four young radiation oncologists from four different countries (United States, Chile, France, and Spain) were included in this article. Three of them are members of a national young radiation oncology group (i.e. Spanish young radiation oncology group [SYROG]).[9–11] The four participants agreed to focus on two topics that currently affect the daily work activities: the implantation of novel technology in the radiation oncology departments and the new competencies developed within a multidisciplinary group. All of them contributed to this report with their own thoughts and experiences.

4. Results

4.1. *Technology and radiation therapy*

Interestingly, the media present this subject as a major recent 'breakthrough' in treatment, largely by demonstrating aspects of technology itself.[12] Yet we know that since the discovery of ionizing radiation, the clinical practice of radiation oncology has benefited tremendously from a long string of discoveries and innovations in physics and technology. One of the major problems that is not often highlighted is that high-tech therapy is often associated with a high cost and, therefore, is not always widely available.[13] The young radiation oncologist should have an understanding of the rational use of new technologies based on scientific evidence of its cost-effective contribution to cancer management. In broader terms, the cancer profession and technology industry should take responsibility by not accepting substandard evidence of marginal benefit without regard for cost. More work is needed to demonstrate true value from new technologies and the cost-effectiveness of emerging new treatments.[14]

In addition, major changes in radiation treatment planning have occurred with advances in functional imaging, especially PET and nuclear MR spectroscopy which are of great value in the planning of radiation therapy, allowing us to define with greater precision the target volume. With more sophisticated imaging and understanding of normal tissue and anatomy, the young radiation oncologist will need more detailed understanding of which constraints are essential and which are desired.[15–17]

Regarding treatment delivery, image guidance in radiation treatment is not a novel concept, and remains of major importance today. For many years, radiation field placement was verified using portal films and, more recently, electronic portal images. However, these modes of imaging are limited to visualizing high-contrast matter in 2-dimensional views. This concept has now evolved into IGRT and volumetric soft-tissue imaging at the time of treatment.[17] The cone beam CT, which consists of a kV X-ray tube mounted on a linear accelerator, has the potential to reduce setup errors and, hence, planning tumor volumes. This, in turn, permits potential delivery of hypofractionated regimens to small tumors with greater accuracy. Investigation of adaptive therapy and online planning is also possible as a result of these technological advances.[17,18]

Perhaps the most attractive feature of these advancements in technology is the ability to now approach any complex tumor geometry, regardless of shape, with an enhanced ability to optimize the dose distribution. Much of the excitement surrounding new advances in radiation technology stems from this concept of dose-escalation. Theoretically, increasing radiation dose should lead to improvements in local control. Studies have shown that CT-based planning and IGRT are associated with reduced dose rate to surrounding normal tissues and a subsequent reduction in serious grade 3 or greater acute morbidity.[12] The real question is what proportion of patients will truly benefit from techniques beyond "conventional" treatment. The cost-effectiveness of these sophisticated radiation therapy methods depends on our ability to identify which patients are at higher risk of locoregional relapse and more likely to benefit from dose-escalation. Not only would this improve the cost-effectiveness ratio, but also improve the individual patient's therapeutic gain.[13]

Ideally, the specialist's training period of the young radiation oncologist should include learning about these new techniques in radiation planning and treatment. Residents should have the opportunity to visit other institutions, if their cancer center does not offer this type of technology, in order

to learn how it works, as well as to see its potential benefits and indications.[19]

4.2. *Role of the young radiation oncologist: developing new competencies*

Between 2010 and 2020, the total number of patients receiving radiation therapy during their initial treatment course is expected to increase by 22% in the United States (US). In contrast, assuming that the current graduation rate of 140 residents per year remains constant, the number of full-time equivalent radiation oncologists is expected to increase by only 2%. Therefore, demand for radiation therapy is expected to grow 10 times faster than supply between 2010 and 2020 in the US.[20] For the young radiation oncologist, it is imperative to explore strategies to enhance capacity to deliver quality radiation therapy and meet the increase in patient load. In addition, the young radiation oncologist must master all the new clinical, biological, and technical information necessary to comprehensively care for the cancer patient. The young radiation oncologist must be competent in all relevant clinical aspects of cancer treatment, have a good understanding of the indications for cytotoxic and molecular therapies, and be thoroughly familiar with the technical aspects of radiotherapy.[21]

As young radiation oncologists, we are responsible for the radiation treatment delivered to our patients and its subsequent impact on their quality of life. Therefore, in our empathic dealings with our patients, we must be aware of the various psychosocial factors that influence their outcome. This comprehensive approach to cancer care should underlie our leadership of the radiation oncology team. The delivery of radiation therapy requires a coordinated, many-membered team consisting of radiation oncologists, radiation therapists (including dosimetrists and other planning experts), medical physicists and administrative, engineering, computer, and information technology specialists.[17] We have also a critical role in leading this team.

Additionally, we must be well regarded clinicians within a multidisciplinary group.[22] We must be articulate spokesmen in the selection of therapy, management of treatment-related morbidity, and careful follow-up of our patients. We must promote collaboration and exchange with other departments and augment the teaching environment in order to improve the quality of our practice for the benefit of our patients. The professional education of radiation medicine practitioners plays a major role in our ability to provide high quality care to cancer patients and to meet society's expectations. Higher education prepares students for these roles, but formal and informal professional education in health care continues throughout their working life. Medical knowledge, skills, and priorities constantly change, and keeping abreast of new developments cannot be a matter of chance. With a constantly changing practice, the links between higher education and practice must be dynamic and strong, so that professional education remains relevant to practice needs, and trainees are adequately prepared for clinical practice.

New developments in our understanding of cancer have changed the practice in radiation treatment facilities. When treatment methods change, the profession's knowledge and skills change, and practitioners must develop new competencies. The organization of the practice also adapts and responds to the new challenges.[17,23] Current radiation medicine practice is difficult to capture. It is constantly evolving in response to rapid changes in the discipline and varies according to regulatory jurisdictions and individual institutional practices.

Radiation oncology is a textbook example of applied or translational research. Evidence-based medicine has been defined as "...the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients".[24] Radiation oncology is increasingly evidence-based,[25] with a number of large randomized trials of good methodologic quality published in the past years, a number of trials open for accrual, and new trials currently being developed.

The Young Scientists' Forum organized by the Greater Poland Cancer Centre[26] is an excellent example of the promotion of scientific research. This Forum is dedicated to the development of scientific research projects of young radiation oncologists, medical physicists and radiobiologists in Poland. The major aim of the Forum is to present results of current scientific projects under development. The presented work is evaluated by the specialists in the field of radiotherapy, medical physics and radiobiology.

Other prime examples are the European young radiation oncology societies based in Spain[9] and France.[10] The main objective of these groups is to motivate young specialists and promote scholarly activity in national and international meetings. These societies also promote understanding among young specialists of the importance of receiving adequate training according to international standards (European Organization for Research and Treatment of Cancer [ESTRO] Fellow Program). In addition, these groups instigate and help young specialists to obtain international training and potentially set up new national and international protocols in the field of radiation oncology.

The Association of Residents in Radiation Oncology (ARRO) is an organization[11] based in the United States that is dedicated to promoting the ongoing education of trainees in Radiation Oncology through journal clubs, workshops, and networking opportunities. By providing consolidated resources for a variety of research funding opportunities and fellowships, it supports the scholarship of its members. It also serves to formalize residents' input into professional organizations, including the American Society for Radiation Oncology (ASTRO).

As with other groups created in past years,[27] there is no reason why young researchers should not be at the forefront of research and publication. This will be possible when young investigators apply their knowledge, skills, and resources in a manner that is focused and constructive. Including a specific program focus in clinical trial research methodology during residency would encourage young professionals to initiate high-quality, prospective research. The opportunity to provide academic leadership on an international scale is available, but it is up to us to seize the opportunity, to expand our horizons, and to proceed with energy, passion, and conviction.

5. Conclusions

In summary, education and training in radiation oncology should be based on sound educational principles and early, comprehensive experience. Learning formats should be tailored to specific needs and emphasis given to collaborative and team-based methods that are required in the multidisciplinary environment. We agree with Dr. Zietman,[28] current president ofASTRO, that if radiation oncologists become simply the guardians of a single therapeutic modality, they may find that time marches by and, while the techniques will live on, the specialty may not. As young radiation oncologists, we see new challenges in our clinical practice in this constantly and rapidly evolving field. By keeping up with the constant flow of new information that comes through scientific conferences and peer-reviewed publications, as well as the development of new technologies, we will be able to treat our patients more effectively and safely. Our role in the field of oncology should be proactive, and above all, we must remember that we are dealing with the family members and loved ones of many individuals during the most difficult part of their lives.

Conflict of interest

The authors declare no conflicts of interest regarding the work presented here.

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