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Review

Global radiation oncology waybill

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ABSTRACT

Background/aim: Radiation oncology covers many different fields of knowledge and skills. Indeed, this medical specialty links physics, biology, research, and formation as well as surgical and clinical procedures and even rehabilitation and aesthetics. The current socio-economic situation and professional competences affect the development and future or this specialty. The aim of this article was to analyze and highlight the underlying pillars and foundations of radiation oncology, indicating the steps implicated in the future developments or competences of each.

Methods: This study has collected data from the literature and includes highlights from discussions carried out during the XVII Congress of the Spanish Society of Radiation Oncology (SEOR) held in Vigo in June, 2013. Most of the aspects and domains of radiation oncology were analyzed, achieving recommendations for the many skills and knowledge related to physics, biology, research, and formation as well as surgical and clinical procedures and even supportive care and management.

Results: Considering the data from the literature and the discussions of the XVII SEOR Meeting, the "waybill" for the forthcoming years has been described in this article including all the aspects related to the needs of radiation oncology.

Conclusions: Professional competences affect the development and future of this specialty. All the types of radio-modulation are competences of radiation oncologists. On the other hand, the pillars of Radiation Oncology are based on experience and research in every area of Radiation Oncology.

1. Background

The term 'waybill' is literally a document used by a haulier providing detailed instructions related to the sending of a merchandize shipment. Nowadays, this term is also used in order to uneventfully establish the steps required to perform a great social, human or universal task. In this article we would like to describe our 'waybill' for radiation oncology considering our goals step by step and taking into account the current global economic crisis around the world. As in a 'waybill', some instructions are

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needed to accomplish these tasks and these are described below.

1.1. *The mission of radiation oncology*

Radiation oncology is a speciality involving medical, technical, surgical and clinical praxis, research, teaching, and management functions.

The clinical aspects involve the treatment of different tumours by multidisciplinary teams in which radiation oncologists offer many types of treatments also associated with the use of radiomodulators. This implies the need for continuous scientific updating and knowledge on how to manage all the resources available.

2. Developments in radiotherapy equipment

Recent publication by Rajamanickam Baskar 2012 confirms radiotherapy curative power.[1] Other important aspects related to radiotherapy include organ preservation, palliation of pain and, of course, an increase in survival.[2] More than 50% of cancer patients receive radiotherapy, and there has been a rise in the use of this therapeutic approach in benign diseases.[1,2]

If the 20th century played an important role in the development of radiation oncology,[3] the progress in technology to date in the 21st century has been impressive with regard to precision, verification and quality assurance, allowing adaptive treatments, dose escalation and a reduction in early and late complications. The advances in morphological and functional images have contributed to the improvements in each modern radiotherapy technique. Indeed, we can expect the use of hybrid positron emission tomography/magnetic resonance (PET/MR) equipment for treatment planning in the forthcoming future.[4]

Despite having initially been developed at the end of the last century, the use of intensity-modulated radiotherapy (IMRT), image-guided radiotherapy (IGRT), adaptive radiotherapy and stereotactic body radiotherapy (SBRT) has not been extensive until now. In 2012 Milano reported a 2- and 5-year survival of 74 and 47%, respectively in oligometastatic breast cancer patients treated by SBRT.[5] Recent advances, including continuous registry of movement control, elastic fusion, 4D treatment delivery, and different dose plan summation systems, have also been commercialized by different companies.[4,6]

A report from the Department of Health Cancer Policy Team in the UK in 2012 concluded that initiation of radiotherapy within 31 days after achieving the diagnosis saved 2500 lives per year.[7] Recent data from Burnet et al. indicate that improvement in survival could reach 25%.[8] The Australian Cancer Council estimated that over a period of 10 years (1996–2006), almost 51,000 cancer patients eligible for radiotherapy did not receive it, representing nearly 40,000 years of life lost to cancer patients overall.[9]

2.1. *Verification and quality control*

Since the development of IGRT, better tumour and OAR definition and treatment delivery control are assets which may be incorporated into daily practice. IGRT is a verification and quality control measure. Despite the implementation of regulatory laws to control the clinical steps from the diagnosis to treatment delivery in different European countries, including Spain,[10] technological advances develop more quickly. Quality control using treatment protocols has shown an impact on patient survival, however, there is a need for protocols adapted to the new technological developments.[11,12] Patients are more controlled when included in protocols, clinical trials and guaranteed quality programmes.

3. Radiomodulation: physical, chemical and biological

Radiomodulation in radiotherapy is the concurrent addition of treatments: pharmacological, chemotherapeutic, biological, or physical to be able to change the effects of radiation to enhance the healing effect or protection of patients.

3.1. *Physical radiomodulation*

IMRT allows precise dose treatments protecting healthy tissues, with an escalation in dose having an impact on the gain in the therapeutic ratio with a reduction in acute and late toxicity in almost all tumour sites.[13–20] One of the most frequently studied and reported tumour sites that show important benefits with IMRT is nasopharynx carcinoma; the reduction obtained in xerostomia results in an increase in quality of life and local control with the most frequent type of relapse being distant metastasis.[21,22] Hypofractionation has provided promising results in breast and prostate cancer, and its use is being extended to treatments involving a reduction in the overall treatment period with a subsequent impact on the waiting lists of Radiation Oncology Departments.[23,24] The use of IGRT for treatment delivery is becoming increasingly necessary. The association of IMRT, IGRT and 4D has demonstrated a reduction in toxicity and an increase in overall survival in lung cancer.[25,26] Software allowing deformable fusion of geometry for volume definition in treatment planning and for image-guided treatment delivery provides better knowledge of the dose administered to the tumours and organs at risk.[27]

Protons have also shown excellent results in uveal melanoma. The results of prospective and retrospective series comparing proton versus uveal plaques showed better results with the former at 5 years (92–99% vs. 81–96%, respectively).[27] In chordomas and chondrosarcomas, a higher radiotherapy dose is allowed with a dose reduction in healthy tissue.[28] Benefits have also been reported in children in need of craniospinal irradiation considering the reduction of the dose in the exit field. Considering the cost of these machines and the number of patients benefiting from them, one proton accelerator per 10 million inhabitants seems reasonable.

Brachytherapy developed after the discovery of radium has greatly improved. Following the development of several software, high-dose rate (HDR) sources and source projectors,