The GEC ESTRO Handbook of Brachytherapy

585 Figures and 78 Tables

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Preface

A great step towards modern brachytherapy was made in France in the mid sixties, under the impulse of Bernard Pierquin followed rapidly by Daniel Chassagne. New application systems and dosimetry rules could be developed for the new radioactive sources available, thanks to the first computers used in physics departments. These methods spread out rapidly throughout Europe, with some adaptations to the local requirements. However, there was no agreement between brachytherapy teams on the best way to state the dose delivered to the tumour. As a consequence, the same treatment could be described in different radiotherapy departments by doses varying by more than 30%.

An attempt to solve the problem led ICRU to publish a first report (n° 38) in 1985 on dose and volume specification for reporting intracavitary therapy in gynaecology. It was followed by a second one (n°58) in 1997 dedicated to interstitial therapy.

These 2 reports elaborated after more than 10 years of discussions were compromises between the old systems of brachytherapy established a long time before for radium, and the new systems better adapted to the modern sources and assuming the use of computers for dose distribution calculations. Some of the statements were not always clearly understood and led to many questions. However these two reports had the great merit to propose definitions of doses and volumes which could serve as a basis for further discussions.

Following these discussions there was a strong demand for a brachytherapy course to be organised in the series of the already famous ESTRO courses. In 1990 the first brachytherapy course has been organised with Alain Gerbaulet as the course director. Many of the European leaders in brachytherapy participated as teachers in these courses which were an opportunity to exchange ideas and report experience.

Entering into the new millennium, the situation has evolved dramatically: the impressive progress in 3D imaging, the sophisticated techniques developed for the modern afterloaders associated with the high speed and capacity of computers, has opened new possibilities to improve the now “old” techniques of the so-called “modern brachytherapy”.

For the pioneers of this modern brachytherapy the revolution is impressive and one looks at the last developments with admiration and a touch of jealousy.

Obviously, the time is coming for new reports taking into account the radical changes in the technical features, the progress in biological knowledge as well as the clinical experience gained during the last decades. It was then decided to begin with the publication of the courses, but it was rapidly obvious that an important editing work was necessary.

The editors of the present book, following the suggestion of the Brachytherapy Course Director, have had the great merit to gather in this very comprehensive book of more than 600 pages, the last brachytherapy clinical methods from the most innovative European teams.

They did not neglect the basic principles of physics, radiobiology and imaging excellently presented in the first part.

Respectful of the work of the pioneers, the editors have nevertheless considered in a critical and positive way the first publications so as to propose the necessary modifications and improvements to be brought to the first ICRU recommendations.

This book covers the obvious need for a comprehensive handbook presenting the state of the art of brachytherapy at the beginning of the millennium.

August 2002,

Andrée Dutreix

Introduction

The editors` goal was to write a book documenting a comprehensive and integrated approach to brachytherapy. The content is based on the combined knowledge of major schools of brachytherapy built up over more than a decade of European teaching experience.

The first earnest versions of the ESTRO Teaching Course on "Modern Brachytherapy Techniques" were largely based on the experience of the French school (Daniel Chassagne, Bernard Pierquin, Andrée Dutreix, Alain Gerbaulet). In parallel, different international groups had started publishing a significant amount of data on dose rate, radiobiology, and imaging and new indications for brachytherapy were emerging such as the use of permanent implants for prostate cancer and endovascular brachytherapy. These were gradually integrated along with the experience of other European and American groups thus presenting a broader picture of brachytherapy.

The successful 5-day course was organised every year in a different European city: Paris (1990), Oslo (1991), Prague (1992), Athens (1993), Tübingen (1994), Izmir (1995), Gdansk (1996), Bratislava (1997), Berlin (1998), Oslo (1999), Venezia (2000), Paris and Bratislava (2001), Lisboa (2002). The total number of participants from Europe and overseas thus far adds up to 1434 with a mean number per course of more than 100.

As is the case for other ESTRO courses, the ingredients for the success of this course have been: a dedicated and enthusiastic (rotating) teaching team, (4 to 5 radiation oncologists and 1 physicist), the input of guest lecturers, creative local organisers and the professional support of efficient ESTRO staff (Germaine Heeren during the early years, Christine Verfaillie more recently). Together with the international mix of the participants and the thrill of discovering a different culture in each of the host countries, these ingredients create the warm and friendly chemistry unique to ESTRO courses.

Participants have learnt to understand different schools of thinking, practicing brachytherapy with different techniques, dose rates and fractionation schedules. The teachers went through a similar process. In different ways but jointly participants and teachers have experienced a significant learning curve. In the course of time a more integrated approach to teaching resulted from the protracted and intensive discussions within the course faculty and from the feed back given by the participants. This approach is the basis of this book.

It became clear that teaching the different topics mainly by reporting on the experience of a major school had to be replaced by a joint curriculum and methodology appropriate for a basic course on brachytherapy in a postgraduate setting. This new strategy needed to be reflected in a new concept for the course book which could no longer be mainly based on the experience of one of the famous schools. Nor should it become a mere compilation of chapters with classical contributions by leaders in the field.

The idea was not born in a vacuum. There was the shining example of Gordon Steel who created a successful teaching book which he edited together with his team and which has just appeared in its 3rd edition. This book achieved world wide acclaim and became a reference point. It was a source of inspiration for Alain Gerbaulet and Dan Ash when, in 1997, they first considered reporting their teaching experience in brachytherapy in a hard cover book format. In 1999, when the tenth anniversary of the course was approaching, the brachytherapy teaching team decided to convert what was initially only a bold dream into a solid project. In some way, the book was also meant as a celebration of 10 years of team work and an appropriate way of honouring a charismatic course

director,who was then about to retire, for his outstanding achievements in teaching brachytherapy all over the world, and in particular in Europe.

A working group, the editors, was created with Alain Gerbaulet as course director, Richard Pötter, Erik Van Limbergen, Jean-Jacques Mazeron, and Harm Meertens (Physicist), who formed the backbone of the book´s production process.

Overall the production process of the book took five full years - five years of intensive collaboration of the authors and especially of the editors to give shape to the various chapters in a collaborative approach. To achieve this goal, the editors met many times (from several days up to a full week) in Vienna, Leuven, Paris, Lisboa (Fig: “weekend” at IGR). A tremendous amount of effort went into discussing, writing, re-reading and correcting each of the 35 chapters and finally editing the book with its 585 figures and 78 tables: a job carried out by a self-motivated team. Special thanks, however, are due to Richard Poetter and his collaborators in Vienna who invested a lot of time, skill and energy to bring the whole mission to a successful conclusion.

The editorial team in action (“weekend” at IGR): Erik Van Limbergen, Jean-Jacques Mazeron, Richard Pötter and Alain Gerbaulet in the IGR brachytherapy conference room working on laptops and paper copies (Harm Meertens, the “fifth musketeer” taking the photograph).

In the first part of the book the “Basis of Brachytherapy” is presented with “General Aspects”, “Radiophysics”, and “Radiobiology”. Furthermore, other important aspects such as “Modern imaging” and “Reporting” are broadly covered.
The second part on “Clinical Practice in Brachytherapy” gives a comprehensive overview of the entire field of brachytherapy and follows a systematic structure for each clinical topic: (1) Introduction, (2) Anatomical Topography, (3) Pathology, (4) Work Up, (5) Indications, Contra-indications, (6) Target Volume, (7) Technique, (8) Dose Calculation and Treatment Planning (Dosimetry), (9) Dose, Dose rate, Fractionation, (10) Monitoring, (11) Results. Results with regard to survival, local control, and side effects are summarised in 78 tables. For a better understanding and to complete and illustrate the two parts of the book comprehensively, altogether 585 figures and drawings have been included.

The different dose rates (LDR, MDR, HDR, PDR) and related issues do not dominate the overall structure, but they are described in places where dose rate plays a major role. Links are made to the various ICRU reports on dose and volume specification as appropriate. A similar approach is followed in the fields where such reports are lacking such as in intraluminal and endovascular brachytherapy.

To keep production costs low while safeguarding both the intellectual property rights of the authors and ESTRO ownership of the book, it was decided to publish the book privately with the support of the Vienna University department of radiotherapy and the ESTRO Office. Sponsorship was sought from industrial partners (see acknowledgements) to reduce the shelf price of the book to a level which will make it hopefully accessible to everyone who is interested in the exciting field of brachytherapy.

Some shortcomings may show up due to the partly non-professional production process, for which the editors apologise. These will certainly be solved in a forthcoming edition.

A very special word of thanks is owed to Ann Barrett, for the English language editing. Her remarks, comments, and corrections were essential to give this book its finishing touches.

Sincere thanks go also to the colleagues and friends who contributed to this book as authors, after having served as teachers in the brachytherapy course for several years: Dan Ash, Edith Briot, Christine Haie-Meder, Eric Lartigau, Pierre Scalliet, Jack Venselaar and André Wambersie.

Our acknowledgments also go to all the other teachers who participated in the ESTRO Brachytherapy course from 1990 to 2002 (in alphabetical order): A. Bridier, R. Burette, D. Chassagne, J. Craven-Bartle, A. Dutreix, J.F. Evensen, D. Garcia, J.P. Gerard, M. Pernot, G. Pizzi, H. Stankusova, I. Turesson and all the 33 invited speakers and local organizers.

Last but not least should be mentioned the invaluable assistance of M. Albano, N. Baruzzi, N. Filippo, S. Fromm, and E. Roberti to Alain Gerbaulet, and S. Bednar, R. Eiböck, B. Groiss, and D. Nagel to Richard Pötter during the production process of the book.

We thank K. Meysmans and his colleagues from “Textware” in Leuven for their efficient professional work with Lay Out consulting, in particular with integrating all the figures into the final lay out.

We thank ACCO in Leuven for their excellent and fast printing of the book.

This book will serve as the basis for the ESTRO Teaching Course on “Modern Brachytherapy Techniques” in the coming years, replacing the traditional copied syllabus thus far produced annually. It is the intention of ESTRO to pursue a similar policy for each of its five basic teaching courses. The Society received substantial financial support for this effort from the “Europe Against Cancer Programme” of the European Commission, in the framework of the ESTRO-EU ESQUIRE Project (EDRO: **ED**ucation for **R**adiation **O**ncology).

It is hoped that “The GEC ESTRO Handbook of Brachytherapy” will contribute to making brachytherapy attractive to young people as it has been in the past, allowing brachytherapy to meet the challenges of the rapidly evolving field of radiation oncology in the years to come.

With pleasure (and some pride) this first edition of “The GEC ESTRO Handbook of Brachytherapy” is presented to you.

August 2002, ***Alain Gerbaulet, Richard Pötter, Erik Van Limbergen, Jean-Jacques Mazeron, Harm Meertens***

For Alain Gerbaulet this book represents one of the last but very important events of his professional career.
As “father” of this book Alain dedicates it to his professional “father” in brachytherapy, Daniel Chassagne, not forgetting Andrée Dutreix, Bernard Pierquin as well as all his colleagues at the Institut Gustave Roussy in Paris.

A brachytherapy boost either with contact X-ray brachytherapy (Papillon) or HDR rectal endoluminal brachytherapy can increase the chance of complete clinical response. The prospective OPERA trial will provide more clinical evidence on the role of a brachytherapy boost in advanced rectal cancer after CRT to support non operative management.Â High resolution MRI of the pelvis is mandatory and should be. Rectal Cancer. THE GEC ESTRO HANDBOOK OF BRACHYTHERAPY | Part II: Clinical Practice Version 1 - 10/12/2014. repeated at regular intervals following treatment [9]. Contrast enhanced CT scanning to exclude distant metastases is important as this information could change the treatment intent. In case of uncertainty, scans should be repeated at regular intervals to assess this. @inproceedings{Gerbaulet2002TheGE, title={The GEC ESTRO handbook of brachytherapy}, author={Alain Gerbaulet}, year={2002} }. Alain Gerbaulet. Published 2002.Â Hyperfractionation of HDR brachytherapy â€“ influence on doses and biologically equivalent doses in clinical target volume and healthy tissues. Janusz Skowronek, Grzegorz Zwierzchowski, Tomasz Piotrowski. Journal of contemporary brachytherapy. 2009. View 8 excerpts. Cites background. Highly influenced. The usefulness of fleet rectal enemas on high-dose-rate intracavitary cervical cancer brachytherapy. The GYN GEC-ESTRO working group described target volume delineation and also 3D image-based planning using MRI and 3D dose-volume parameters for brachytherapy of carcinoma cervix. CT-based as compared to MR-based image-guided brachytherapy (IGBT) is much more feasible and practical because MR access is still difficult for most departments. This is a retrospective study done to assess the local control in cancer of the cervix, treated based on these guidelines and dose received by 2 cm3 of the rectum as defined by the GEC-ESTRO guidelines and its correlation with long-term toxicity.Â In: The GEC ESTRO (ed) Handbook of brachytherapy. ESTRO, Brussels, pp 301â€“364Google Scholar. 14.

A brachytherapy boost either with contact X-ray brachytherapy (Papillon) or HDR rectal endoluminal brachytherapy can increase the chance of complete clinical response. The prospective OPERA trial will provide more clinical evidence on the role of a brachytherapy boost in advanced rectal cancer after CRT to support non operative management.Â High resolution MRI of the pelvis is mandatory and should be. Rectal Cancer. THE GEC ESTRO HANDBOOK OF BRACHYTHERAPY | Part II: Clinical Practice Version 1 - 10/12/2014. repeated at regular intervals following treatment [9]. Contrast enhanced CT scanning to exclude distant metastases is important as this information could change the treatment intent. In case of uncertainty, scans should be repeated at regular intervals to assess this. The Head and Neck Working Group of the European Brachytherapy Group (Groupe EuropÃ©en de CuriethÃ©rapie-European Society for Therapeutic Radiology and Oncology (GEC-ESTRO) therefore decided to formulate the present consensus recommendations for low-dose rate, pulsed-dose rate and high-dose rate brachytherapy. The use of brachytherapy in combination with external beam radiotherapy and/or surgery is also covered as well as the use of brachytherapy in previously irradiated patients. Given the paucity of evidence in the literature, these recommendations are mainly based on clinical experience accumu GEC-ESTRO Handbook of Brachytherapy. Brussels: ESTRO. ^ Rivard, Mark J.; Reed, Joshua L.; DeWerd, Larry A. (2014-01-01). "103Pd strings: Monte Carlo assessment of a new approach to brachytherapy source design".Â (2007). "Tumour and target volumes in permanent prostate brachytherapy: a supplement to the ESTRO/EAU/EORTC recommendations on prostate brachytherapy". Radiotherapy and Oncology. 83 (1): 3â€“10. doi:10.1016/j.radonc.2007.01.014. PMID 17321620. ^ a b c d e Ash D, Flynn A, Batterman J, et al. (2000). "ESTRO/EAU/EORTC recommendations on permanent seed implantation for localized prostate cancer". Radiotherapy and Oncology. 57 (3): 315â€“321. doi:10.1016/s0167-8140(00)00306-6.

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