

# REPORTS OF PRACTICAL ONCOLOGY AND RADIOTHERAPY

---

The official journal of: Czech Society of Radiation Oncology, Biology and Physics, Catalan Occitan Oncology Group, Guild of Bulgarian Radiotherapists, Hungarian Society for Radiation Oncology, Latin American Association for Radiation Oncology, Polish Society of Radiation Oncology, Polish Study Group of Head and Neck Cancer, Portuguese Society of Radiotherapy Oncology, Romanian Society of Radiotherapy and Medical Oncology, Slovenian Society for Radiation Oncology, Spanish Society of Radiation Oncology and the Greater Poland Cancer Centre.

---



Amsterdam – Boston – London – New York – Oxford – Paris – Philadelphia – San Diego – St. Louis

**2**  
Volume 22  
2017

## ELSEVIER STAFF

### Journals Department

Elsevier Sp. z o.o.  
Migdałowa 4/59  
02-796 Warsaw, Poland  
Tel. +48 22 546 38 20  
Fax. +48 22 546 38 21

#### DIRECTOR OF JOURNALS PUBLISHING

Ewa Kittel-Prejs

#### PUBLISHING MANAGER

Agnieszka Pawłowska  
a.pawlowska@elsevier.com

#### ADVERTISING PHARMA SOLUTIONS

Monika Giergielewicz  
m.giergielewicz@elsevier.com  
+48 519 796 821

#### ASSOCIATE PUBLISHER

Justyna Kasprzycka  
j.kasprzycka@elsevier.com  
+31 20 485 3846

#### MARKETING & PROMOTION MANAGER

Anna Szkolut  
a.szkolut@elsevier.com  
+48 546 38 40, +48 515 090 174

For a full and complete Guide for Authors, please go to: <http://www.elsevier.com/locate/rpor>.

#### Guide for Authors:

- All articles are subject to **double blind peer review**
- Disclosure of any actual or potential **conflict of interest** (any financial, personal or other relationships with other people or organizations), **ethics** and **funding** should be provided in separate file attached to the article (**Acknowledgement**)
- Upon acceptance of an article, authors will be asked to transfer **copyright** to the owner of the journal
- Submission of an article implies that the work described **has not been published previously**, that it is **not under consideration for publication elsewhere**, that its publication is **approved by all authors** and tacitly or explicitly by the responsible authorities where the work was carried out, and that, if accepted, it will not be published elsewhere in the same form, in English or in any other language, including electronically without the written consent of the copyright-holder
- A statement that **all authors have approved the final article** should be true and included in the disclosure (authors are obliged to provide details about **authors' contribution**)

Authors are requested to submit their manuscripts at <https://ees.elsevier.com/rpor>. There are online tutorials for authors and reviewers available at <http://support.elsevier.com/app/epsupport>

#### Submission checklist

Ensure that the following items are present:

One author has been designated as the corresponding author with contact details:

- E-mail address
- Full postal address
- Phone numbers

All necessary files have been uploaded, and contain:

- Keywords
- Abstracts and text for Research papers should be structured, not exceed 250 words and should consist of five paragraphs labeled: **Aim, Background (text: Background, Aim), Materials and Methods, Results, Conclusion**
- All figure captions
- All tables (including title, description, footnotes)

#### Further considerations

- Manuscript has been 'spell-checked' and 'grammar-checked'
- References are in the correct format for this journal
- All references mentioned in the Reference list are cited in the text, and vice versa
- Permission has been obtained for use of copyrighted material from other sources (including the Web)

For any further information on please visit our customer support site at <http://support.elsevier.com>

Please consult the Guide for authors for further details of any item.

⊗ The paper used in this publication meets the requirements of ANSI/NISO Z39.48-1992 (Permanence of Paper).

# Special Issue: 21 Liver SBRT

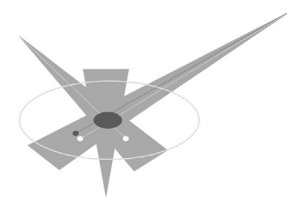
Guest Editors: M. Macià,  
C. Llacer-Moscardo

---



Amsterdam – Boston – London – New York – Oxford – Paris – Philadelphia – San Diego – St. Louis

2  
Volume 22  
2017



# Contents

**Special Issue: 21 Liver SBRT**  
**Guest Editors: M. Macià, C. Llacer-Moscardo**

<b>Editorial</b>	
Miquel Macià, Carmen Llacer-Moscardo .....	83
<b>Special issue papers</b>	
<b>Radiobiology of stereotactic body radiation therapy (SBRT)</b>	
Miquel Macià i Garau .....	86
<b>Dose to organ at risk and dose prescription in liver SBRT</b>	
Rives Michel, Izar Françoise, Parent Laure, Modesto Anouchka, Portier Guillaume, Kirzin Sylvain .....	96
<b>SBRT planning for liver metastases: A focus on immobilization, motion management and planning imaging techniques</b>	
Olivier Riou, Carmen Llacer Moscardo, Pascal Fenoglietto, Emmanuel Deshayes, Raphaël Tetreau, Jessica Molinier, Alexis Lenglet, Eric Assenat, Marc Ychou, Boris Guiu, Norbert Aillères, Ludovic Bedos, David Azria.....	103
<b>Robotic radiosurgery for the treatment of liver metastases</b>	
Rafael García, Iciar Santa-Olalla, Jose Luis Lopez Guerra, Silvia Sanchez, Ignacio Azinovic .....	111
<b>Radiosurgery for liver metastases. A single institution experience</b>	
Beatriz Amendola, Marco Amendola, Jesús M. Blanco, Naipy Perez, Xiaodong Wu .....	118
<b>Institutional experience in the treatment of colorectal liver metastases with stereotactic body radiation therapy</b>	
Alejandra Méndez Romero, Fatma Keskin-Cambay, Rob M. van Os, Joost J. Nuyttens, Ben J.M. Heijmen, Jan N.M. IJzermans, Cornelis Verhoef .....	126
<b>Evaluation of reproducibility of tumor repositioning during multiple breathing cycles for liver stereotactic body radiotherapy treatment</b>	
Ludovic Bedos, Olivier Riou, Norbert Aillères, Antoine Braccini, Jessica Molinier, Carmen Llacer Moscardo, David Azria, Pascal Fenoglietto .....	132
<b>Imaged-guided liver stereotactic body radiotherapy using VMAT and real-time adaptive tumor gating. Concerns about technique and preliminary clinical results</b>	
Carmen Llacer-Moscardo, Olivier Riou, David Azria, Ludovic Bedos, Norbert Ailleres, Francois Quenet, Philippe Rouanet, Marc Ychou, Pascal Fenoglietto .....	141
<b>Image guided SBRT for multiple liver metastases with ExacTrac® Adaptive Gating</b>	
Carmen Rubio, Ovidio Hernando-Requejo, Daniel Zucca Aparicio, María Allona Krauel, Mercedes López Gonzalez, Juan María Pérez, Emilio Sánchez Saugar, Pedro Fernández Letón .....	150
<b>Stereotactic body radiation therapy for liver metastasis – The linac-based Greater Poland Cancer Centre practice</b>	
Magdalena Fundowicz, Marta Adamczyk, Anna Kołodziej-Dybaś.....	158

<b>The role of SBRT in oligometastatic patients with liver metastases from breast cancer</b>	
Marta Scorsetti, Davide Franceschini, Fiorenza De Rose, Tiziana Comito, Ciro Franzese, Giovanna Masci, Rosalba Torrisi, Luca Viganò, Guido Torzilli .....	163
<b>Evaluation of response after SBRT for liver tumors</b>	
Raphael Tétreau, Carmen Llacer, Olivier Riou, Emmanuel Deshayes.....	170
<b>Management of liver cancer. The Surgeon's point of view</b>	
Pierre Rabinel, Damien Dousse, Fabrice Muscari, Bertrand Suc.....	176
<b>Other non-surgical treatments for liver cancer</b>	
Paul Revel-Mouroz, Philippe Otal, Marion Jaffro, Antoine Petermann, Olivier Meyrignac, Pierre Rabinel, Fatima-Zohra Mokrane .....	181

ISSN 1507-1367. Volume 22, 6 issues. For further details please refer to Journal website at <http://www.elsevier.com/locate/rpor/>

#### Authors inquiries

You can track your submitted article at <http://www.elsevier.com/track-submission>. You can track your accepted article at <http://www.elsevier.com/trackarticle>. You are also welcome to contact Customer Support via <http://support.elsevier.com>

#### Advertising, sponsored supplements and/or commercial reprints

For more information please contact Elsevier Sp. z o.o., Migdałowa 4/59, 02-796 Warsaw, Poland; e-mail: [reklama@elsevier.com](mailto:reklama@elsevier.com); phone: + 48 519 796 821

**Orders, claims, and journal inquiries:** please contact the Elsevier Customer Service Department nearest you:

**St. Louis:** Elsevier Customer Service Department, 3251 Riverport Lane, Maryland Heights, MO 63043, USA; phone: (800) 6542452 [toll free within the USA]; (+1) (314) 4478871 [outside the USA]; fax: (+1) (314) 4478029; e-mail: [JournalsCustomerService-usa@elsevier.com](mailto:JournalsCustomerService-usa@elsevier.com)

**Oxford:** Elsevier Customer Service Department, The Boulevard, Langford Lane, Kidlington, Oxford OX5 1GB, UK; phone: (+44) (1865) 843434; fax: (+44) (1865) 843970; e-mail: [JournalsCustomerServiceEMEA@elsevier.com](mailto:JournalsCustomerServiceEMEA@elsevier.com)

**Tokyo:** Elsevier Customer Service Department, 4F Higashi-Azabu, 1-Chome Bldg, 1-9-15 Higashi-Azabu, Minato-ku, Tokyo 106-0044, Japan; phone: (+81) (3) 5561 5037; fax: (+81) (3) 5561 5047; e-mail: [JournalsCustomerServiceJapan@elsevier.com](mailto:JournalsCustomerServiceJapan@elsevier.com)

**The Philippines:** Elsevier Customer Service Department, 2nd Floor, Building H, UP-Ayalaland Technohub, Commonwealth Avenue, Diliman, Quezon City, Philippines 1101; phone: (+65) 6349 0222; fax: (+63) 2 352 1394; e-mail: [JournalsCustomerServiceAPAC@elsevier.com](mailto:JournalsCustomerServiceAPAC@elsevier.com)

Copyright © 2017 Greater Poland Cancer Centre, Poland. Published by Elsevier Sp. z o.o. All rights reserved

This journal and the individual contributions contained in it are protected under copyright by the Greater Poland Cancer Centre, Poland, and the following terms and conditions apply to their use:

#### Photocopying

Single photocopies of single articles may be made for personal use as allowed by national copyright laws. Permission of the Publisher and payment of a fee is required for all other photocopying, including multiple or systematic copying, copying for advertising or promotional purposes, resale, and all forms of document delivery. Special rates are available for educational institutions that wish to make photocopies for non-profit educational classroom use.

For information on how to seek permission visit [www.elsevier.com/permissions](http://www.elsevier.com/permissions) or call: (+44) 1865 843830 (UK) / (+1) 215 239 3804 (USA).

#### Derivative Works

Subscribers may reproduce tables of contents or prepare lists of articles including abstracts for internal circulation within their institutions. Permission of the Publisher is required for resale or distribution outside the institution. Permission of the Publisher is required for all other derivative works, including compilations and translations (please consult [www.elsevier.com/permissions](http://www.elsevier.com/permissions)).

#### Electronic Storage or Usage

Permission of the Publisher is required to store or use electronically any material contained in this journal, including any article or part of an article (please consult [www.elsevier.com/permissions](http://www.elsevier.com/permissions)).

Except as outlined above, no part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without prior written permission of the Publisher.

#### Notice

No responsibility is assumed by the Publisher for any injury and/or damage to persons or property as a matter of products liability, negligence or otherwise, or from any use or operation of any methods, products, instructions or ideas contained in the material herein. Because of rapid advances in the medical sciences, in particular, independent verification of diagnoses and drug dosages should be made.

Although all advertising material is expected to conform to ethical (medical) standards, inclusion in this publication does not constitute a guarantee or endorsement of the quality or value of such product or of the claims made of it by its manufacturer.

#### Funding body agreements and policies

Elsevier has established agreements and developed policies to allow authors whose articles appear in journals published by Elsevier, to comply with potential manuscript archiving requirements as specified as conditions of their grant awards. To learn more about existing agreements and policies please visit <http://www.elsevier.com/fundingbodies>.

**Publication information:** *Reports of Practical Oncology and Radiotherapy* (ISSN 1507-1367). For 2017 volume 22 (6 issues) is scheduled for publication. Subscription prices are available upon request from the Publisher or from the Elsevier Customer Service Department nearest you or from this journal's website (<http://www.elsevier.com/locate/rpor>). Further information is available on this journal and other Elsevier products through Elsevier's website: (<http://www.elsevier.com>). Subscriptions are accepted on a prepaid basis only and are entered on a calendar year basis. Issues are sent by standard mail (surface within Europe, air delivery outside Europe). Priority rates are available your request. Claims for missing issues should be made within six months of the date of dispatch.