CIRRO

The Lundbeck Foundation Center for Interventional Research in Radiation Oncology

Final Scientific Report
January 2015

Contents

Executive summary

Radiotherapy is one of the leading means of cancer treatment and plays an increasingly important role in the loco-regional management of many cancer types. The aim of the Danish Center for Interventional Research in Radiation Oncology (CIRRO) is to establish individualized radiotherapy, which will lead to improved tumour control with fewer side effects for a large proportion of cancer patients. This project encompasses biological, clinical and technical studies, which forms the basis for clinical implementation of biology-guided adaptive radiotherapy.

This final scientific report concerns the activities and results obtained during the 5 years and 5 months (February 1, 2009 – June 30, 2014) of Lundbeck Foundation funded activity in CIRRO. In a collaboration between all Danish radiotherapy departments research was performed in 9 work packages (WP) for translational research, and 27 intervention protocols (IP) by which the clinical implementation of the various new methods in radiotherapy were evaluated in phase I, II, and III protocols. Initiated activities are still ongoing and CIRRO will continue to exist as a national framework for the research in radiotherapy, including research in particle therapy.

The Lundbeck Foundation supported CIRRO with a 30 mio. DKK grant. Substantial external funding from a number of public and private sources resulted in a total budget of around 100 mio. DKK. Most of the budget from the Lundbeck Foundation grant was allocated to PhD grants, fellowships and postdoc positions.

The CIRRO framework incorporates a total of 68 PhD projects, of which 52 are successfully completed by January 2015. In addition, 47 senior scientists (post docs, fellows, consultants, associate professors, professors) are linked to the activities. CIRRO has been involved in a total of 27 clinical intervention protocols, with a total of 3800 patients included so far in Denmark. By January 2015, a total of 421 scientific papers have been published or accepted in peer reviewed international journals and more than 600 presentations (oral and posters) have been presented at international meetings. CIRRO has been involved in the organization of several international meetings and workshops as well as PhD courses in radiotherapy.

The research in CIRRO has resulted in an extensive expansion of the academic activities in the radiotherapy community and a large proportion of the new knowledge has already resulted in improvements in radiotherapy, but also in the future new guidelines will result from the research conducted in CIRRO.

Altogether, CIRRO research has significantly improved the radiotherapy treatment of cancer patients in Denmark, which is now in the forefront in the world. We therefore believe that the initial major goal of research in the center, which was to improve the individualized treatment of cancer patients by radiotherapy, has been achieved. Furthermore, the center has created a national platform for research collaboration in radiotherapy. CIRRO also serves as a platform for research in the Danish Center for Particle Therapy (DCPT) which will be hosted at Aarhus University Hospital and Aarhus University.

We believe that the scientific achievements of CIRRO are at an international, highly competitive level, and the high expectations and aims have been fulfilled. We would like to thank the Lundbeck Foundation for supporting the research center and for the confidence you have shown the project. Also, the very smooth collaboration we have experienced with the foundation has been a pleasure.

January 2015 **Jens Overgaard** Director **Cai Grau** Director

Background and aim

Radiotherapy plays a central role in cancer treatment and approximately 50% of all cancer patients receive radiotherapy during their treatment. Radiotherapy is important in the loco-regional management of many cancer types and the number of cancer survivors is increasing. However, many cancer survivors experience long-term side effects influencing their quality of life, and the reduction of unwanted side effects is of great concern in radiation oncology. The major aim of all research in the Danish Center for Interventional Research in Radiation Oncology (CIRRO) has been to improve the individualised treatment of cancer patients by radiotherapy leading to better tumour control with fewer side effects for a large proportion of cancer patients. CIRRO is a highly interdisciplinary research center involving physicians, biologists, physicists, computer scientists and engineers conducting research in the biology of tumor and normal cells, improved imaging and target definition as well as delivery of radiotherapy. The center has created a national platform for research in radiotherapy.

Workpackages

The status of the pre-clinical and translational research conducted in the nine WP's is outlined in the sections below. The vast majority of milestones and deliverables have been achieved within the 5 year timeframe and few are still underway. *Numbers of papers published refer to the publication list given in Appendix 1.*

WP01 - Individual radiosensitivity

The biology of tumour response to radiotherapy is studied using preclinical models and large high quality clinical material. Techniques to quantify DNA, RNA and protein level are applied in order to identify factors that can form the basis for individualized therapeutic intervention. Tumour microenvironment conditions affecting response to radiotherapy such as oxygen concentration, metabolism, and blood supply can be very heterogeneous between individual patients. Our preclinical studies have led to the development of a gene expression profile identifying hypoxic tumors in head and neck cancer. The hypoxia marker has been validated retrospectively, and by combining it with information on HPV status, it is possible to identify patients benefitting from a hypoxia-targeted therapy. The gene expression profile is now used in a large European trial to identify patients who will benefit from hypoxic modification in order to sensitize tumor cells to the radiation therapy. Currently, the hypoxia marker is being tested in other cancer types as well as other markers for characterizing tumour microenvironmental conditions are being developed. Late morbidity like radiation-induced fibrosis greatly influences the quality of life of long term survivors of radiotherapy. Ability to predict the risk of morbidity is important to individualize radiotherapy treatment. The risk of radiation-induced morbidity varies between individuals and has a genetic component. A preclinical model for radiation-induced fibrosis has been developed. Furthermore, a gene expression signature for predicting risk of radiation-induced fibrosis has been validated in an independent clinical dataset. Ongoing genetic association studies have identified a number of single nucleotide morphisms (SNPs) that can identify patients with an increased risk of radiation-induced fibrosis. This work will be validated in an independent patient cohort.
Publications: 2, 5, 8, 12, 18, 20, 21, 35, 43, 54, 55, 58, 59, 63, 69, 81, 90, 92, 95, 105, 106, 110, 111, 135, 149, 162, 201, 225, 226, 233, 236, 254, 267, 284, 285, 303, 316, 317, 322, 325, 370, 379, 380, 394, 402.

WP02 - Bioimaging – from experimental tool to clinical applicability

Tumour hypoxia is common and adversely affects outcome since hypoxic cells are radio-resistant. PET tracers like ^{18}F-FAZA and ^{64}Cu-ATSM allow imaging of hypoxia, which may assist individualized treatment that modifies or targets tumor hypoxia.
A range of studies were successfully performed in mice and canine tumor models and in human tumors using PET hypoxia imaging, pimonidazole immunohistochemistry and endogenous hypoxia markers. A new PET

hypoxi tracer ^{18}F pimonidazole was tested, and further chemical development is ongoing to optimize this agent.
The major findings showed, that ^{18}F FAZA when validated is a robust measure of hypoxia and hypoxic modification in several animal models. Hypoxia imaging by PET was feasible in human head and neck tumors. These findings are in general supported by parallel clinical results using other hypoxia specific tracers such as FMISO and HX4.
^{18}F FAZA studied at baseline was less feasible in a small sample of rectal cancers mainly due to signal contamination from tracer excretion into the bladder.
While ^{18}F FAZA production and distribution worked out between more centers, quality assurance of PET imaging in general showed to be a major challenge, and a QA project is still ongoing.
Dynamic imaging scans were unaccomplished as such scan protocols were judged too demanding for patients running an intensive diagnostic workup to comply with accelerated diagnostic workup and early treatment initiatives in Denmark.
In summary despite its obvious inherent limitations, PET hypoxia can provide information that is relevant to outcome and selection of patients that benefit from hypoxia-targeting treatment, and PET is currently the most promising and clinically attractive technology for the detection of tumor hypoxia. Further research is required to reveal the full potential of hypoxia PET in patient stratification.
Publications: 7, 15, 30, 57, 120, 121, 122, 141, 144, 186, 195, 211, 244, 245, 246, 260, 262, 388.

WP03 – Image management
This work package addressed the related problems of quantifying anatomical motion over time and reconstructing motion resolved images:

1. Development and evaluation of new methods for 3D registration of volumetric anatomy, e.g. to resolve the geometric deformations of the bladder between treatment fractions. We proposed several new methods based on non-linear modeling of the biomechanical properties of elastic tissue. Using the new registration methods we were able to accurately evaluate the maximum radiation doses received by the healthy organs at risk during brachytherapy. We demonstrated that a more accurate hotspot dose evaluation of the healthy organs could be obtained by deformable registration. While this approach could potentially be used to escalate the tumor dose while sparring the healthy tissue, we demonstrated that this was in fact not necessary, since the established methods (not considering deformable registration) result in irradiation doses very similar to those delivered when optimizing the dose using deformable registration.
2. Integration of image registration and image reconstruction in order to improve the reconstruction quality for temporally resolved imaging. We proposed a new method for four-dimensional CBCT reconstruction based on the data obtained for a conventional 3D CBCT. We are thus able to reconstruct 10 temporal phases instead of just one. We are currently evaluating this reconstruction technique to resolve the respiratory motion for the treatment of lung cancer patients. In this scenario 4D CBCT provides a method to monitor and compare the respiratory motion at the time of each treatment fraction to the motion that was observed at the time of the planning CT – and to adapt the treatment if differences are observed.
3. Integration of image registration and image segmentation for better segmentation results of dynamic image series. We developed a new methodology to segment entire image series at a time instead of the often-used approach of segmenting images one by one. The method was evaluated on dynamic MRI time series.

4. Real-time reconstruction of two-dimension magnetic resonance imaging. In preparation for MR-Linacs becoming commercially available, we are currently performing volunteer and patient studies to quantify, in real time, the respiratory motion of the liver as well as tumors and lymph nodes in the lungs. We have demonstrated a technique to accurately track the 3D motion of the liver based on 2D imaging and we are currently adapting this technique for a motion quantification study of lung tumors.
5. New reconstruction techniques for limited angle proton CT. Normally such reconstructions exhibit severe aliasing artifacts due to the missing projections, but we have demonstrated that dual-modality reconstruction, combining proton CT with CBCT can remove this aliasing in clinically realistic settings.

Publications: 61, 82, 144, 173, 251, 358, 359, 396, 407.

WP04 – Functional imaging

Studies in WP4 focus on functional imaging in preclinical and clinical settings. Characterisation of tumours and microenvironment is performed through analysis of tumour biology and response to radiotherapy.

High resolution imaging of oxygen levels, hypoxia, metabolism and targeted nano-particles has been obtained by ultra-high-field (16.4T) MRI experiments. Our work has so far led to the establishment of ultra-high-field ^{19}F MRI utilizing different ^{19}F labeled contrast agents. ^{19}F MRI oximetry based on hexafluorobenzene signal has been established with novel nanoparticles. DWI, DCE-MRI, and susceptibility imaging with USPIO nano-particles have been established at ultra-high-field. In vivo experiments in a novel and standardised murine angiogenesis model visualised angiogenesis in agreement with histology. USPIO particles have been developed at Aarhus University. The accumulation has been tested in murine tumours and an angiogenesis model, and uptake dependency on particle size and particle core size has been characterised. The USPIO particles have been used to assess the effect of antivascular treatment on blood volume and vessel size with histological validation. Repeated DCE-MRI and blood oxygenation dependent MRI at ultra-high field in a murine tumour model were evaluated for identifying acute hypoxia and its reduction after nicotinamide treatment, but only an indirect effect of nicotinamide induced larger blood volume was found. DCE-MRI has been compared with invasive measurements including necrotic fraction and interstitial fluid pressure in a study investigating the effect of antivascular treatment. DCE-MRI and PET hypoxia comparison is being performed in human tumour xenografts and murine tumours following promising pilot studies indicating correlations.

Optimization of clinical DWI and DCE sequences has been performed, and cervix cancer patients have been enrolled in prospective clinical imaging studies, with repetitive DWI (77 pts) and DCE-MRI (22 pts) imaging. Repetitive DWI has shown correlation between restricted diffusion regions and radiotherapy target volumes based on anatomical MRI, and a significant correlation between persistent DWI volumes and risk of local failure has been established. Motivated by these promising results, methods have been developed for automatic segmentation and fusion of DWI images and anatomical MRI. This paves the way for radiotherapy treatment planning based on multimodality imaging and differential administration of dose according to risk of recurrence (dose painting). Based on clinical results from EMBRACE (IP12), a dose and effect relationship has been established for local control in cervix cancer. The next step is to install differential dose prescription according to risk of recurrence in a prospective clinical multicenter study on locally advanced cervical cancer (EMBRACE II). EMBRACE II will initiate enrollment of patients by beginning of 2015, and plan to enroll 600 pts from >30 institutions. DWI has been used to assess the position of lymph nodes for improved definition of the elective radiotherapy target volume in cervix cancer by combining CT and MRI. Availability of USPIO is still pending for clinical use and this work is therefore delayed.

Publications: 9, 29, 41, 42, 49, 50, 60, 83, 84, 113, 117, 119, 155, 182, 204, 228, 232, 264, 268, 278, 286, 288, 292, 299, 306, 329, 350, 361, 365, 392, 404.

WP05 – Organ motion - 4D imaging and treatment
Knowledge of tumour position is vital to the exact delivery of the prescribed radiation dose. Tumours move during a treatment course on different time scale. Technologies exist to monitor tumour position during the treatment course (4D imaging) and delivery techniques which account for these movements are available at a research stage. The objectives are to further develop 4D treatment techniques and to implement these in clinical routine practice.
Seconds: Image quality of 4D CT and 4D CBCT has been studied to define proper treatment margins which also include image uncertainty. Based on these results national recommendation of patient specific treatment lung cancer margins based on the specific size of the respiration has been agreed upon and is currently implemented in most clinics. Introduction of 4D CT and 4D CBCT has reduced the treated volume significantly. However, for a subgroup of the patients with very large respiration motions (~5% of the patients) dynamic tracking of the tumor during treatment are able to reduce the treated volume even further than what is possible by use only of 4D CT and 4D CBCT. Dynamic tracking has been a part of WP5, and has been demonstrated to be possible for mammals (pigs). However, due to the complexity in ensuring that the phase of the tracking stays in perfect phase with the actual tumor motion clinical implementation for humans has not been performed yet. Alternatively there has been worked on use of deep breath hold as a way to reduce the respiration motion.
Minutes: Tracking of seeds during treatment is of interest not only due to the respiration, but also due to motion of flatulence and bladder filling. There has been a large research activity in WP05 on the possibility to track seeds inside a patient during radiotherapy based on Cone Beam CT. It has been shown that it is possible to track different types of seeds on-line both in liver and prostate. The tracking of the seeds can be used either as a tracking signal or to interrupt the treatment if the detected position is outside predefined levels.
Days/Months: Changes in anatomy can potentially change the dose distribution and thus calls for adaptive re-planning which is one of the aims of WP6. In WP5 the focus has been on the ability to measure the patient specific response to radiotherapy both in relation to tumor and normal tissue. There exist a large inter-patient variation in response to radiation which is not known prior to treatment and therefore hampers an optimal balance between tumor control and toxicity. Within the CIRRO project it has been investigated whether CBCT images could be used early during the treatment course to measure the patient specific response. It has been shown that density changes within the healthy lung tissue during the first one third of the treatment is correlated to local delivered dose and is also correlated to the density changes at end of treatment. Currently the strength of the correlation between lung density changes during treatment and within follow-up CT is investigated. Large CBCT measured lung tumor regression during the initial part of treatment has somewhat counter-intuitively been shown to correlate with a reduced overall survival. If these findings related to tumor control and toxicity can be reproduced in independent studies, evaluation of CBCT images might paver the road to introduction of patient specific biological adaptive radiotherapy.
Publications: 16, 36, 38, 62, 70, 71, 72, ,74, 75, 76, 97, 99, 108, 114, 115, 132, 137, 150, 152, 153, 175, 202, 213, 218, 219, 231, 238, 239, 240, 241, 295, 296, 300, 307, 308, 323, 324, 334, 335, 348, 349, 356, 373, 389, 391, 406, 409.

WP06 – Adaptive image-guided modulated radiotherapy
Both tumour and normal tissues undergo significant changes in size, shape, and position during a treatment course. A way to improve individualized radiotherapy is by adapting treatment plans with regard to the anatomical changes based on in-room imaging strategies. The issue of this work package is the development of methods enabling use of in-room imaging to adapt treatment.

The methods under development were directed towards broad implementation in clinical practice. During the advancement of this project, treatment practice has undergone vast changes with respect to use of in-room volumetric imaging, as well as dynamic volumetric treatment.
For treatment delivery, implementation of high precision planning and delivery techniques has been pursued, as well as dosimetric measurements matching the high precision. Volumetric modulated arc therapy has by now to a large degree replaced fixed field IMRT as "state of the art". Activities in this work package enabling this transition has included:

- In silico planning studies for exploration and verification of the potential of the technique for various treatment sites, and clinical implementations.
- Dosimetric phantom measurement studies for verification of delivery capability, including time resolved measurements.
- Development of dedicated quality assurance tools for implementation into clinical practice.

For future perspectives, the combination of volumetric modulated arc therapy with both motion management [WP5] and with dose painting strategies is presently under active investigation.
For imaging, use of 3D volumetric in-room imaging has been implemented into clinical practice. By now, image guided radiation therapy using on-board cone-beam CT scanning has become standard for several treatment sites in clinical practice. Enabling activities in the work package has included:

- Investigations into and refining of image quality in cone-beam CT scans, including contour delineation and dose calculation.
- Implementation of CBCT image guidance protocols into clinical practice, with various action level approaches.
- Investigations of criteria for replanning strategies for various treatment sites.

Future perspectives being pursued include the use of cone-beam CT images in motion management [WP5], and the newer technology of MR imaging with MRI-Linacs.
Some of the techniques under investigation in the work package are not yet matured to a stage adequate for standard clinical implementation, and are being further investigated. This includes dose calculation based on CBCT scans, deformable image registration for accumulation of doses in consecutive CBCT scans, true plan-of-the-day strategies (including decision strategies), and biological optimization (dose planning).
Publications: 1, 10, 17, 19, 22, 23, 28, 34, 39, 51, 53, 65, 66, 66, 86, 87, 88, 89, 91, 93, 94, 100, 128, 131, 143, 145, 148, 160, 161, 199, 258, 283, 289, 290, 309, 310, 311, 312, 313, 314, 318, 330, 362, 376, 413, 414.

WP07 - Implantable markers for Image guided radiotherapy
The ability to deliver radiation dose accurately requires that the target is easily localized in the patient. Studies in this work package aimed at developing and investigating the use of inserted Ni-Ti memory shape metal stent as surrogate of prostate or lung tissue to ensure correct positioning radiotherapy treatment.
The current status is that a clinical feasibility study using the Ni-Ti stent as a fiducial marker in prostate cancer radio-therapy has completed and the first results demonstrating low frequencies in late toxicity in both bladder and rectum have been published (M7.3). A study comparing patients with Ni-Ti stent as fiducial with a consecutive group of patients with gold seeds as fiducial at 3 years post radiotherapy demonstrated no difference in overall survival or in PSA-relapse free survival. The use of Ni-Ti stent and MRI delineation lead to a significantly reduced clinical target volume. Significantly lower urinary frequency and urinary retention toxicity scores were observed following MRI delineation. The study did not find significant differences in overall urinary or rectal toxicity between the two groups.

A semi-automatic method using mutual information and a rigid co-registration of planning CT and MR image sets has been demonstrated to give good results in image sets from ten different patients on a qualitative basis. Co-registration combined with active appearance model auto-segmentation of the prostate on T2-weighted magnetic resonance (MR) scans provided mean and median dice similarity coefficient of 0.84 and 0.86, respectively. A different approach using atlas registration is combined with intensity information in a graph cut segmentation gave a mean dice coefficient of 0.88. Both methods were comparable to other methods performing prostate segmentation in MR. A theoretical planning study has been looking into the possibility of sparing the urethra if radiation dose in external beam therapy is to be increased. The preliminary results estimate that if IMRT techniques are used the dose to the urethra may be lower than the intended target dose.
A first pre-clinical animal study of a prototype for a small lung Ni-Ti stent revealed that further development of the instrumentation was needed. A second preclinical animal study using technologically more advanced instrumentation has been completed and the new instrumentation was demonstrated to overcome the previous problems. 23 stents were inserted in 10 animals without toxicity in terms of induced pneumothorax. No inserted stent migrated during the four week observation period implying that the stent may be used as fiducial. The study also investigated the possibility to apply apnoeic respiration as an alternative to compensate motion in lung cancer radiotherapy. Significant motion however was seen in several animals during apnoeic respiration – possibly caused by incomplete muscle relaxation. *In vivo* treatment using MLC tracking was attempted as well. In eleven of fifteen beams tracking was successful. The stent either has to be optimized for high voltage or kilo voltage images should be used instead. A virtual bronchoscope method to estimate the expected optimal position of the stent relative to a given tumour in the lung has been developed using segmentation of the bronchial tree on CT with region growing using wave propagation. A study using in-house moving phantoms have been evaluating the accuracy and precision of the fiducial marker in the lung, including reconstruction errors in respiration resolution scans (4D CT and 4D PET). The phantom studies demonstrated that clinical use of fiducial in combination with treatment planning on mid-ventilation CT phase for moving target should include margins up to 5.5 mm due to potential systematic position errors.
It is assumed that the lung stent method combined with electromagnetic bronchoscope navigation is ready for a human feasibility test. Protocol for LMS approval is, depending on further funding, expected in 2015-2016.
Publications: 31, 80, 107, 129, 177, 217, 265, 266, 287, 297, 341, 395.

WP08 - Dose verification
The prime hypothesis for this work package has been that new dose verification procedures will improve safety and precision of individualized radiotherapy, and to this end we have developed new tools and procedures, and these have been tested in the clinic. The main focus areas have been (i) real-time *in vivo* dosimetry in brachytherapy, and (ii) Monte-Carlo based treatment planning and reference dosimetry for advanced external beam radiotherapy.
A unique instrumentation for real-time *in vivo* dosimetry in brachytherapy has been developed. This system is based on radioluminescence dosimetry using thin optical fiber cables that can be placed directly in (or nearby) the tumor region using standard brachytherapy applicators. Detailed monitoring of more than 20 cervical cancer patients undergoing pulse-dose rate (PDR) brachytherapy have been completed, and the measurements could in principle be performed routinely as an integrated part of the treatment procedure. The study was designed to directly quantify the specificity and sensitivity of the methodology to detect treatment errors or accidents. The key result is a new data-driven algorithm that solves a long-standing problem

in *in vivo* brachytherapy dosimetry: to discriminate false from true treatment errors and to make the conclusion without prior knowledge about the detector position. The new algorithm has general applicability for *in vivo* brachytherapy dosimetry, and it is not specific for the detector system used in this work package. The method could be implemented in a commercial product, which would make the results available for large number of patients. Given the improved quality and the minimized workload associated with the developed methods, it will be easier to recommend that *in vivo* dosimetry be carried out routinely for brachytherapy.
The work related to Monte Carlo calculation of treatment plans for dynamic radiotherapy (e.g. IMRT and Rapid Arc) has focused on clinical use and consolidation of the developed system - in particular with respect to the problem of obtaining best and most accurate representation of the linear accelerator. Detailed modelling with the system indicates that fiber-coupled organic plastic scintillators in combination with alanine dosimetry, also developed within this work package, are excellent candidates for improved reference dosimetry in small, composite MV photon beams. A key issue for dosimetry in external beam radiotherapy is the ability to correctly measure doses in small fields. To verify the consistence of small-field dosimetry, a comparison was therefore made at six Danish radiotherapy clinics using techniques developed during this work package. These techniques were also applied as reference in a study designed by the IAEA, and these results have enabled computation of correction factors for a range of commercially available detectors normally used clinically. Given the impact of recommendations from IAEA within this field, this work package has therefore directly contributed to an improved accuracy in treatment delivery on a worldwide basis.
Publications: 3, 4, 6, 24, 25, 26, 27, 32, 40, 44, 47, 48, 50, 77, 79, 96, 98, 124, 133, 134, 138, 139, 156, 157, 158, 168, 172, 187, 188, 190, 194, 198, 206, 207, 220, 301, 305, 331, 332, 366, 367, 374, 393.

WP09 – Tools for dose plan evaluation and reporting
A database capable of accepting radiotherapy (RT) treatment plans from all Danish RT centers has been established. A national Danish secure data network (Sundhedsdatanettet) is used for all transactions. It was necessary to build a custom IT infrastructure to compensate for the lack of access/logging capabilities of the medical information data exchange protocol, DICOM. Such a system has been developed and is implemented in a stable version with log of access activities. Data protection authority approval has been obtained (Protocol no. 2008-58-0035). The structure of the IT has been described in a publication (appendix 1, #399) .
A web interface to access and analyze the stored data has been developed. The challenge of varying naming conventions for delineated organs between - and even within - institutions has been addressed through catalogues of aliases, which may be customized for each institution and each research protocol.
The database has been used to store all dose plans involved in the lung cancer trials NARLAL/TARLAL (IP02) and breast cancer trials (IP03). Furthermore the database has been used for an RT quality assurance program prior to initiation of a head and neck cancer trial, DAHANCA 19.
The IT structure has been used for a PhD project involving testing and validating a combined risk metric derived from radiation dosimetry data and clinical risk factors using data from several institutions.
Finally, an *ad hoc* data exchange protocol has been established, where all institutions have full access. This protocol solves a practical problem in the clinical routine; when a previously irradiated patient need another radiation course (typically palliative patients) and is referred to a different hospital than the originally treating institution, an exchange of plan information is necessary. The *ad hoc* protocol gives an opportunity to exchange such data in a fast and secure manner, which is in accordance with data protection rules. The same protocol can be used to exchange data in relation to patients referred for treatment at the upcoming national proton center in Aarhus.
Publication: 399.

Intervention protocols

The aim of the clinical intervention protocols has been to test the biological and technical developments in phase I, II and III clinical multicenter trials on a national scale.
CIRRO is involved in a total of 27 clinical intervention protocols covering major disease sites. 14 of these protocols have finished recruiting patients and results from these have been or are currently being investigated. More than 3800 patients have been included in the clinical protocols (for patient accrual status see figure 1 below). Two protocols have been delayed due to technical difficulties; however these are expected to start during 2015. For a more detailed status of the intervention protocols please see appendix 5.

The clinical intervention protocols together with results from the translational research have resulted in updated guidelines and treatment protocols for treatment of a large number of patients. The results of the research projects have furthermore contributed to a more optimal use of resources in radiotherapy.
In particular, it is worth mentioning the improvements in treatment of breast cancer. The two very large clinical trials conducted within CIRRO, Partial Breast Irradiation (PBI) and Hypofractionation (Hypo) recruiting more than 2500 patients in total, has led to altered guidelines for breast cancer treatment. These new guidelines are not only beneficial for the patients but also save resources as the number of treatment fractions is reduced.
In imaging there have been a large number of studies on bioimaging and functional imaging. New improved imaging techniques have already been implemented in the clinic and others are currently being further investigated. The improved imaging has led to the introduction of adaptive treatment planning in the clinic in e.g. bladder cancer.
Investigations in tumor microenvironment are important as heterogeneity in the tumor microenvironment can cause different responses to radiotherapy treatment. One key parameter in the tumor microenvironment is hypoxia, which leads to resistance to radiation therapy. It is therefore essential to be able to identify hypoxic tumors in order to individualize treatment. Research in CIRRO has led to the development of a gene expression profile identifying hypoxic tumors in head and neck cancer. This profile is now used in a large European trial to identify patients who will benefit from hypoxic modification in order to sensitize tumor cells to the radiation therapy. Imaging techniques (e.g. FAZA-PET) can also be used to identify hypoxic tumors. The predictive and prognostic value of FAZA-PET has been tested in clinical trials in head and neck cancer as well as rectum cancer.
Another important issue when considering radiotherapy treatment is the risk of radiation induced morbidity. In particular, late morbidity such as radiation induced fibrosis (RIF) can lead to a reduced quality of life in long term survivors. Therefore, in this context there is a need to individualize treatment. A gene expression profile has been developed and validated by which it is possible to divide patients into groups of high and low risk of developing RIF.
A major achievement in CIRRO is the development of the “Danish national doseplan databank” in which IT infrastructure is built to collect 3D treatment plans as well as baseline data and treatment outcome. Currently, this databank is used for sharing data from patients participating in clinical protocols, but the goal is to collect all radiotherapy treatment plans in Denmark. The databank is a very valuable tool when conducting multi institutional clinical trials.

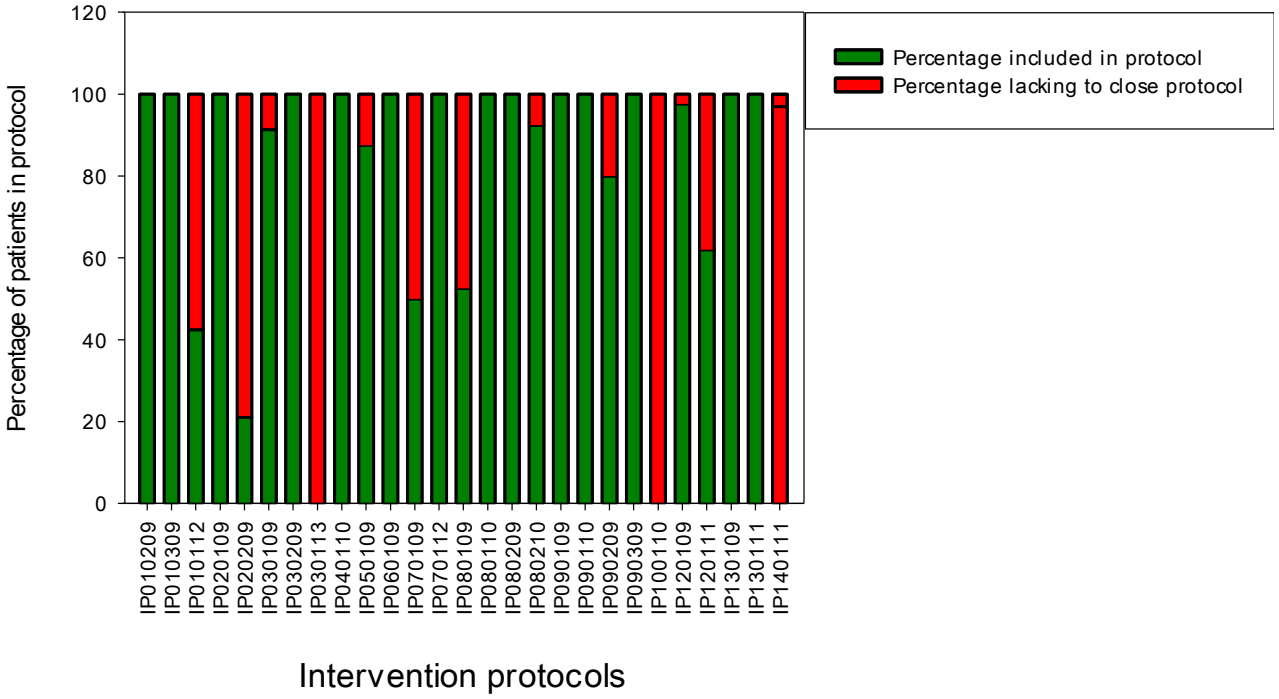

Figure 1. Status of patient accrual in CIRRO intervention protocols. Green: percentage of patients included in study. Red: percentage of patients needed to complete study. For actual numbers of patients see appendix 5.

Structure and organisation

The organizational structure presented in the original application has been implemented, with the formation of WPs, IPs, and a Project Coordinating Committee (PCC). An academic coordinator was appointed in March 2009. The administrative coordination has been strengthened by including CIRRO responsible contact persons from the participating centers. This reflected the need for smooth connection to the centers on a daily basis, which was not possible with the much larger PCC. The PCC has met three times. The International Advisory Committee (IAC) has met twice, in August 2010 and June 2013.

Publications

By January 2015 a total of 421 papers have been published or accepted for publication (see appendix 1). More than 600 oral presentations and posters have been presented at international conferences.

PhD projects

A total of 68 PhD projects (52 completed and 16 on-going) are linked to the activities (WP or IP) in CIRRO, see appendix 2 and 3.

CIRRO PhD students are all affiliated with DAFKO (Danish Graduate School in Clinical Oncology). Together with DAFKO, CIRRO has organized two one-week PhD courses in radiation oncology.

Meetings and seminars

In addition to funding scientific projects CIRRO has organised, sponsored or supported a number of activities.

A **kick-off meeting** was organized at Koldkærgård Conference Center in Aarhus February 17-18 2009 with 35 participants. The focus was to present and discuss the planned activities of the centre.

Three annual CIRRO meetings have been held. Two at Koldkærgård Conference Center in Aarhus (November 2009 and November 2010), and one at Hotel Nyborg Strand in connection with the annual meeting in 'Dansk Selskab for Klinisk Onkologi' (DSKO) in April 2012. The annual meetings have had around 65 participants and the ongoing and future activities in the center were presented and discussed.

In conjunction with the annual meetings at Koldkærgård, CIRRO has in collaboration with the Danish Graduate School in Clinical Oncology (DAFKO) organized **two PhD courses**. The first was a basic course on biology, imaging and technology in radiation oncology held in November 2009 and the second was a course in advanced radiotherapy held in November 2010. Around 30 students attended each course.

The international Tumour Microenvironment Workshop in Toronto, May 2-5 2010 was sponsored and co-organized by CIRRO, which was also represented with nine oral presentations. Other co-organizers included two research centers similar to CIRRO, namely the German "Center for Radiation Research in Oncology (OncoRay)" and the Canadian center "Spatio-Temporal Targeting and Amplification of Radiation Response (STTARR)".

CIRRO was co-organizer of two **Acta Oncologica symposia, the BiGART2010** (Biology Guided Adaptive Radiotherapy) and **BiGART2013** both held in Aarhus. These international meetings had a strong international faculty and attracted more than 140 participants each. The proceedings of the meetings are published as special issues of Acta Oncologica. The next symposia in the series will be BiGART2015 in June 2015.

CIRRO sponsored and co-organized the **4th Danish workshop for Proton and Heavy-Ion Dosimetry** in Aahus, November 16-18, 2009, a one-day meeting about the **Danish Center for Particle Therapy** at Hotel Nyborg Strand, March 27, 2014, and the **13th International Conference on Electronic Patient Imaging** (EPI2k14) in Aarhus, August 31 – September 3, 2014.

Other activities included a seminar in radiation injuries in the pelvic region (April 8, 2010), a number of WP09 user meetings, a national workshop with the purpose of harmonizing lung toxicity follow up and scoring systems (August 2011), two MR workshop in which experiences with MRI were shared (March 2012 and June 2013), and meetings with CIRRO responsible contact persons (CAK) from the participating departments (four per year).

Homepage

CIRRO launched the homepage www.cirro.dk in April 2009. The website has been the preferred platform of information both for members of CIRRO and the public. The website gives an overview of the research activities within the center as well as listing news, publications, events etc.

Economy

The Lundbeck Foundation was the main contributor to the budget of the CIRRO center with 30 mio. DKK. Substantial external funding has been obtained from institutional support to permanent staff, establishment of new research positions and external grants from a large number of private and public sources. Among major co-sponsors are:

- Danish Council for Strategic Research (Programme on Health, Food, and Welfare)
- Danish Council for Independent Research
- Danish Cancer Society
- Varian Medical Systems
- Elekta AB
- Aarhus University Hospital
- Aarhus University
- University of Southern Denmark
- Danish Technical University
- Copenhagen University

The grant from the Lundbeck Foundation was allocated mainly to salary for scientific personnel. In outline the expenses in CIRRO follows the original budget. The diagram in figure 2 shows the distribution of expenses with salaries (primarily co-financed ph.d. projects) constituting 85% of the total budget.

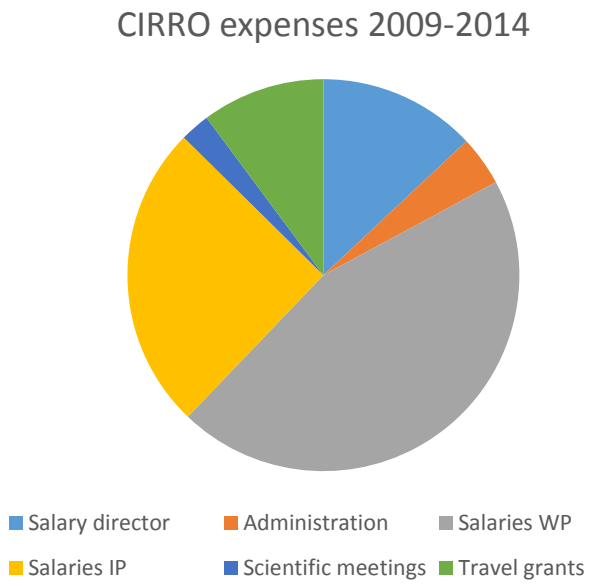

Figure 2. Distribution of expenses in CIRRO 2009-2014.

Travel support program

CIRRO has had a very successful exchange and travel support program to strengthen internationalization. In total 143 travel grants have been awarded. 117 of these were for participation in international conferences with presentation of work within CIRRO or participation in international courses. 26 grants were awarded to invite guest professors to Danish institutions or for CIRRO affiliates to visit international institutions.

Concluding remarks

The research in CIRRO has resulted in an extensive expansion of the academic activities in the radiotherapy community and a large proportion of the new knowledge has already resulted in improvements in radiotherapy, but also in the future new guidelines will result from the research conducted in CIRRO.

Altogether, CIRRO research has significantly improved the radiotherapy treatment of cancer patients in Denmark, which is now in the forefront in the world. We therefore believe that the initial major goal of research in the center, which was to improve the individualized treatment of cancer patients by radiotherapy, has been achieved. Furthermore, the center has created a lasting national platform for research collaboration in radiotherapy.

Appendix 1: Scientific publications from CIRRO, per January 2015

2009

1. Aarup LR, Nahum AE, Zacharatou C, Juhler-Nøttrup T, Knöös T, Nyström H, Specht L, Wieslander E, Korreman SS. The effect of different lung densities on the accuracy of various radiotherapy dose calculation methods: implications for tumour coverage. Radiother Oncol. 91: 405-14, 2009.
2. Agarwal R, Gonzalez-Angulo AM, Myhre S, Carey M, Lee JS, Overgaard J, Alsner J, Stemke-Hale K, Lluch A, Neve RM, Kuo WL, Sorlie T, Sahin A, Valero V, Keyomarsi K, Gray JW, Borresen-Dale AL, Mills GB,Hennessy BT. Integrative analysis of cyclin protein levels identifies cyclin b1 as a classifier and predictor of outcomes in breast cancer. Clin Cancer Res. 15: 3654-62, 2009.
3. Andersen CE, Nielsen SK, Greilich S, Helt-Hansen J, Lindegaard JC, Tanderup K. Characterization of a fiber-coupled Al2O3:C luminescence dosimetry system for online in vivo dose verification during 192Ir brachytherapy. Med Phys. 36: 708-18, 2009.
4. Andersen CE, Nielsen SK, Lindegaard JC, Tanderup K. Time-resolved in vivo luminescence dosimetry for online error detection in pulsed dose-rate brachytherapy. Med Phys. 36: 5033-43, 2009.
5. Andreassen CN, Alsner J. Genetic variants and normal tissue toxicity after radiotherapy: A systematic review. Radiother Oncol. 92: 299-309, 2009.
6. Bassler N, Holzscheiter M. Calculated LET Spectrum from Antiproton Beams Stopping in Water. Acta Oncol. 48: 223-226, 2009.
7. Busk M, Horsman MR, Jakobsen S, Hansen KV, Bussink J, van der Kogel A, Overgaard J. Can hypoxia-PET map hypoxic cell density heterogeneity accurately in an animal tumor model at a clinically obtainable image contrast? Radiother Oncol. 92: 429-36, 2009.
8. Eriksen JG, Overgaard M. Late onset of skin toxicity induced by EGFr-inhibitors. Radiother Oncol. 90: 280-281, 2009.
9. Haack S, Nielsen SK, Lindegaard JC, Gelineck J, Tanderup K. Applicator reconstruction in MRI 3D image-based dose planning of brachytherapy for cervical cancer. Radiother Oncol. 91: 187-193, 2009.
10. Karlsdottir A, Muren LP, Wentzel-Larsen T, Johannessen DC, Haukaas SA, Halvorsen OJ, Dahl O. Outcome in intermediate or high risk prostate cancer patients receiving radiation dose and hormone therapy. Acta Oncol. 48: 874-881, 2009.
11. Kopek N, Paludan M, Petersen J, Hansen AT, Grau C, Høyer M. Co-morbidity index predicts for mortality after stereotactic body radiotherapy for medically inoperable early-stage non-small cell lung cancer. Radiother Oncol. 93: 402-407, 2009.
12. Lassen P, Eriksen JG, Hamilton-Dutoit S, Tramm T, Alsner J, Overgaard J. Effect of HPV-associated p16INK4A expression on response to radiotherapy and survival in squamous cell carcinoma of the head and neck. J Clin Oncol. 27: 1992-1998, 2009.
13. Offersen BV, Overgaard M, Kroman N, Overgaard J. Accelerated partial breast irradiation as part of breast conserving therapy of early breast carcinoma: a systematic review. Radiother Oncol. 90: 1-13, 2009.

14. Overgaard J. Chemoradiotherapy of head and neck cancer – Can the bumble bee fly? Radiother Oncol. 92: 1-3, 2009.
15. Petit SF, Dekker AL, Seigneuric R, Murrer L, van Riel NA, Nordsmark M, Overgaard J, Lambin P, Wouters BG. Intra-voxel heterogeneity influences the dose prescription for dose-painting with radiotherapy: a modelling study. Phys Med Biol. 54: 2179-2196, 2009.
16. Poulsen PR, Cho B, Keall PJ. Real-time prostate trajectory estimation with a single imager in arc radiotherapy: a simulation study. Phys Med Biol. 54: 4019-35, 2009.
17. Søndergaard J, Høyer M, Petersen JB, Wright P, Grau C, Muren LP. The normal tissue sparing obtained with simultaneous treatment of pelvic lymph nodes and bladder using intensity-modulated radiotherapy. Acta Oncol. 48: 238-244, 2009.
18. Sørensen BS, Horsman MR, Vorum H, Honoré B, Overgaard J, Alsner J. Proteins upregulated by mild and severe hypoxia in squamous cell carcinomas in vitro identified by proteomics. Radiother Oncol. 92: 443-449, 2009.
19. Wright P, Redpath AT, Høyer M, Muren LP. A method to individualize adaptive planning target volumes for deformable targets. Phys Med Biol. 54: 7121-7133, 2009.

2010

20. Alsner J, Besenbacher F, Howard K, Kjems J, Nawroth I, Overgaard J (Inventors). Use of a TNF-alpha antagonist in the treatment or prevention of radiation induced fibrosis, and for increasing the acceptable dose of radiation. Patent Number: WO2010085959-A1 (2010).
21. Andreassen CN. Searching for genetic determinants of normal tissue radiosensitivity–Are we on the right track? Radioter Oncol. 97: 1-9, 2010.
22. Aznar MC, Korreman SS, Pedersen AN, Persson GF, Josipovic M, Specht L. Evaluation of dose to cardiac structures during breast irradiation. Br J Radiol. 2010 (in press).
23. Aznar MC, Petersen PM, Logadottir A, Lindberg H, Korreman SS, Kjær-Kristoffersen F, Engelholm SA. Rotational radiotherapy for prostate cancer in clinical practice. Radiother Oncol. 97: 480-484, 2010.
24. Bassler N, Holzscheiter MH, Petersen JB. Neutron Fluence in Antiproton Radiotherapy, Measurements and Simulations. Acta Oncol. 49: 1149-59, 2010.
25. Bassler N, Jäkel O, Søndergaard CS, Petersen JB. Dose-and LET-painting with particle therapy. Acta Oncol. 49: 1170-76, 2010.
26. Bassler N, Kantemiris I, Karaiskos P, Engelke J, Holzscheiter MH, Petersen JB. Comparison of optimized single and multifield irradiation plans of antiproton, proton and carbon ion beams. Radiother Oncol. 95: 87-93, 2010.
27. Bassler N. Radiation damage in charge-coupled devices. Radiat Environ Biophys. 49: 373-378, 2010.
28. Bertelsen A, Hansen CR, Johansen J, Brink C. Single Arc Volumetric Modulated Arc Therapy of head and neck cancer. Radiother Oncol. 95: 142-8, 2010.

29. Buhl SK, Duun-Christensen AK, Kristensen BH, Behrens CF. Clinical evaluation of 3D/3D MRI-CBCT automatching on brain tumors for online patient setup verification – A step towards MRI-based treatment planning. Acta Oncol. 49: 1085-91, 2010.
30. Busk M, Munk OL, Jakobsen S, Wang T, Skals M, Steiniche T, Horsman MR, Overgaard J.Assessing hypoxia in animal tumor models based on pharmacokinetic analysis of dynamic FAZA PET. Acta Oncol. 49: 922-33, 2010.
31. Carl J, Jensen HK, Nielsen J, Nielsen MS, Schmid M, Loeschke S. Bronchoscopic insertion and removal of a new fiducial Nine Ten stent fields in the Göttingen mini-pig lung: A feasibility study-I. The method. Scandinavian Journal of Laboratory Animal Science, 2010.
32. Ceberg S, Gagne I, Gustafsson H, Scherman JB, Korreman S, Kjær-Kristoffersen F, Hilts M and Bäck SÅJ. RapidArc treatment verification in 3D using polymer gel dosimetry and Monte Carlo simulation. Physics in Medicine and Biology 55:4885-489, 2010
33. Due AK, Korreman S, Bentzen SM, Tomé W, Bender E, Aznar M, Vogelius I, Berthelsen AK, Kristensen CA, Specht L. Localizing loco-regional hypopharyngeal carcinoma recurrences in relation to FDG-PET positive and clinical radiation therapy target volumes. Acta Oncol. 49: 984-90, 2010.
34. Elstrøm UV, Wysocka BA, Muren LP, Petersen JB, Grau C. Daily KV cone-beam CT and deformable image registration as a method for studying dosimetric consequences of anatomic changes in adaptive IMRT of head and neck cancer. Acta Oncol. 49: 1101-1108, 2010.
35. Eriksen JG, Lassen P, Overgaard J. Do all patients with head and neck cancer benefit from radiotherapy and concurrent cetuximab? Lancet Oncol. 11: 312-13, 2010.
36. Falk M, Af Rosenschöld PM, Keall P, Cattell H, Cho BC, Poulsen P, Povzner S, Sawant A, Zimmerman J, Korreman S. Real-time dynamic MLC tracking for inversely optimized arc radiotherapy. Radiother Oncol. 94: 218-223, 2010.
37. Fredh A, Korreman S, Rosenschöld PM. Automated analysis of images acquired with electronic portal imaging device during delivery of quality assurance plans for inversely optimized arc therapy Radiother Oncol. 94: 195-198, 2010.
38. Gottlieb KL, Hansen CR, Hansen O, Westberg J, Brink C. Investigation of respiration induced intra- and inter-fractional tumour motion using a standard Elekta Cone Beam CT. Acta Oncol. 49: 1192-98, 2010.
39. Grau C, Olsen DR, Overgaard J, Høyer M, Lindegaard JC, Muren LP. Biology-guided adaptive radiation therapy - presence or future? Acta Oncol. 49: 884-887, 2010.
40. Greilich S, Grzanka L, Bassler N, Andersen CE, and Jäkel O. Amorphous track models: a numerical comparison study Radiation Measurements. 45:1406-09, 2010.
41. Haack S, Pedersen EM, Jespersen SN, Kallehauge JF, Lindegaard JC, Tanderup K. Apparent diffusion coefficients in GEC ESTRO target volumes for image guided adaptive brachytherapy of locally advanced cervical cancer. Acta Oncol. 49: 978-83, 2010.
42. Hellebust TP, Kirisits C, Berger D, Pérez Calatayud J, De Brabandere M, De Leeuw A, Dumas I, Hudej R, Lowe G, Wills R, Tanderup K. Recommendations from Gynaecological (GYN) GEC-ESTRO working group: considerations and pitfalls in commissioning and applicator reconstruction in 3D image-based treatment planning of cervix cancer brachytherapy. Radiother Oncol. 96: 153-60, 2010.

43. Henessy BT, Lu Y, Gonzalez-Angulo AM, Carey MS, Myhre S, Ju Z, Davies MA, Liu W, Coombes K, Meric-Bernstam F, Bedrosian I, McGahren M, Agarwal R, Zhang F, Overgaard J, Alsner J, Neve RM, Kuo W, Gray JW, Borresen-Dale A, Mills GB. A technical assessment of the utility of reverse phase protein arrays for the study of the functional proteome in non-microdissected human breast cancer. Clin Proteom. 6: 129-151, 2010.
44. Herrmann R, Carl J, Jäkel O, Petersen JB, Bassler N. Investigation of the dosimetric impact of a Ni-Ti fiducial marker in carbon and proton beams. Acta Oncol. 49: 1160-1164; 2010.
45. Hokland SL, Nielsen T, Busk M, Horsman MR. Imaging tumour physiology and vasculature to predict and assess response to heat. Int J Hyperthermia. 26: 264-72, 2010.
46. Horsman MR, Bohn AB, Busk M. Vascular targeting therapy: potential benefit depends on tumor and host related effects. Exp Oncol. 32: 143-148, 2010.
47. Kaiser FJ, Bassler N, Jäkel O. COTS Silicon diodes as radiation detectors in proton and heavy charged particle radiotherapy . Radiat Environ Biophys. 49: 365-71; 2010.
48. Kaiser F-J, Bassler N, Tölli H, Jäkel O. Liquid ionization chambers for LET determination. Radiation Measurements 45:1109-1111, 2010.
49. Kallehauge JF, Tanderup K, Haack S, Nielsen T, Fokdal L, Lindegaard JC, Pedersen EM. Apparent Diffusion Coefficient (ADC) as a quantitative parameter in diffusion weighted MR imaging in gynecologic cancer: Dependence on b-values used. Acta Oncol. 49: 1017-22, 2010.
50. Kantemiris I, Angelopoulos A, Bassler N, Giokaris N, Holzscheiter MH, Karaiskos P, Kalogeropoulos TE et al. Real-time imaging for dose evaluation during antiproton irradiation. Phys. Med. Biol. 55: N123-N131, 2010.
51. Knap MM, Hoffmann L, Nordsmark M, Vestergaard A. Daily cone-beam computed tomography used to determine tumour shrinkage and localization in lung cancer patients. Acta Oncol. 49: 1077-84, 2010.
52. Kopek N, Holt MI, Hansen AT, Høyer M. Stereotactic body radiotherapy for unresectable cholangiocarcinoma Radiother Oncol. 94: 47-52, 2010.
53. Korreman SS, Ulrich S, Bowen S, Deveau M, Bentzen SM, Jeraj R. Feasibility of dose painting using volumetric modulated arc optimization and delivery. Acta Oncol. 49: 964-71; 2010.
54. Lassen P, Eriksen JG, Hamilton-Dutoit S, Tramm T, Alsner J, Overgaard J. HPV-associated p16-expression and response to hypoxic modification of radiotherapy in head and neck cancer. Radiother Oncol. 94: 30-35, 2010.
55. Lassen P. The role of Human papillomavirus in head and neck cancer and the impact on radiotherapy outcome. Radiother Oncol. 95: 371-380, 2010.
56. Maeda Y, Høyer M, Lundby L, Buntzen S, Laurberg S. Temporary sacral nerve stimulation for faecal incontinence following pelvic radiotherapy Radiother Oncol. 97: 108-112, 2010.
57. Mortensen LS, Buus S, Nordsmark M, Bentzen LN, Munk OL, Keiding S, Overgaard J. Identifying hypoxia in human tumors: a correlation study between FMISO PET and the Eppendorf oxygen electrode. Acta Oncol. 49: 934-40, 2010.

58. Myhre S, Mohammed H, Tramm T, Alsner J, Finak G, Park M, Overgaard J, Børresen-Dale AL, Frigessi A, Sørlie T. In silico ascription of gene expression differences to tumor and stromal cells in a model to study impact on breast cancer outcome. PLoS One. 5: e14002, 2010.
59. Nawroth I, Alsner J, Behlke MA, Besenbacher F, Overgaard J, Howard KA, Kjems J. Intraperitoneal administration of chitosan/DsiRNA nanoparticles targeting TNFα prevents radiation-induced fibrosis. Radiother Oncol. 97: 143-148; 2010.
60. Nielsen T, Murata R, Maxwell RJ, Stødkilde-Jørgensen H, Østergaard L, Ley CD, Kristjansen PEG, Horsman MR. Non-invasive imaging of combretastatin activity in two tumour models: association with invasive estimates. Acta Oncol. 49: 906-913, 2010.
61. Noe KØ, T.S. Sørensen Solid Mesh Registration for Radiotherapy Treatment Planning. Lecture Notes in Computer Science. 5958: 59-70, 2010.
62. Nygaard DE, Persson GF, Munck af Rosenschöld P, Specht L, Roed AP, Korreman SS. Evaluation of a semi-automatic and a manual visual method for selecting the midventilation bin in 4DCT scans of lung cancer patients. ICCR proceedings, 2010.
63. Offersen BV, Knap MM, Horsman MR, Verheijen J, Hanemaaijer R, Overgaard J. Matrix metalloproteinase-9 measured in urine from bladder cancer patients is an independent prognostic marker of poor survival Acta Oncol. 49: 1283-1287, 2010.
64. Olsen DR, Overgaard J. Leveraging clinical performance by technological excellence - The case of particle therapy. Radiother Oncol. 95: 1-2, 2010.
65. Ottosson RO, Karlsson A, Behrens CF Pareto front analysis of 6 and 15 MV dynamic IMRT for lung cancer using pencil beam, AAA and Monte Carlo. Phys Med Biol. 55: 4521-33, 2010.
66. Ottosson W, Baker M, Hedman M, Behrens CF, Sjöström D. Evaluation of setup accuracy for NSCLC patients; studying the impact of different types of cone-beam CT matches based on whole thorax, columna vertebralis, and GTV. Acta Oncol. 49: 1184-91; 2010.
67. Overgaard J, Mohanti BK, Begum N, Ali R, Agarwal JP, Kuddu M, Bhasker S, Tatsuzaki H, Grau C. Five versus six fractions of radiotherapy per week for squamous-cell carcinoma of the head and neck (IAEA-ACC study): a randomised, multicentre trial. Lancet Oncol. 11: 553-560, 2010.
68. Partridge M, Yamamoto T, Grau C, Høyer M, Muren LP. Imaging of normal lung, liver and parotid gland function for radiotherapy. Acta Oncol. 49: 997-1011, 2010.
69. Pedersen K, Wiechec E, Madsen BE, Overgaard J, Hansen LL. A simple way to evaluate self-designed probes for tumor specific Multiplex Ligation-dependent Probe Amplification (MLPA). BMC Res Notes. 2010 Jun 26;3:179
70. Persson G, Nygaard DE, Brink C, Jahn JW, Munck af Rosenschöld P, Specht L and Korreman S. Deviations in delineated GTV caused by artefacts in 4DCT. Radiother Oncol. 96: 61-66; 2010.
71. Poulsen PR, Cho B, Keall PJ. Prediction of position estimation errors for 3D target trajectories estimated from cone-beam CT projections. Proceedings of XVIth ICCR, Amsterdam 2010.
72. Poulsen PR, Cho B, Ruan D, Sawant A, Keall PJ. Dynamic multileaf collimator tracking of respiratory target motion based on a single kilovoltage imager during arc radiotherapy Int J Radiat Oncol Biol Phys. 77: 600-607, 2010.

73. Poulsen PR, Cho B, Sawant A, Keall PJ. Implementation of a new method for dynamic multileaf collimator tracking of prostate motion in arc radiotherapy using a single kV imager. Int J Radiat Oncol Biol Phys. 76: 914-23, 2010.
74. Poulsen PR, Cho B, Sawant A, Ruan D, Keall PJ. Detailed analysis of latencies in image-based dynamic MLC tracking. Med Phys. 37: 4998-5005, 2010.
75. Poulsen PR, Cho B, Sawant A, Ruan D, Keall PJ. Dynamic MLC tracking of moving targets with a single kV imager for 3D conformal and IMRT treatments. Acta Oncol. 49: 1092-1100, 2010.
76. Rosenschöld PM, Aznar MC, Nygaard DE, Persson GF, Korreman SS, Engelholm SA, Nyström H. A treatment planning study of the potential of geometrical tracking for intensity modulated proton therapy of lung cancer. Acta Oncol. 49: 1141-1148, 2010.
77. Schmitz T, Blaickner M, Schütz C, Wiehl N, Kratz JV, Bassler N, Holzscheiter MH, Palmans H, Sharpe P, Otto G, Hampel G. Dose calculation in biological samples in a mixed neutron-gamma field at the TRIGA reactor of the University of Mainz. Acta Oncol. 49: 1165-69, 2010.
78. Schytte T, Hansen O, Stohlberg-Rohr T, Brink C. Cardiac Toxicity and Radiation Dose to the Heart in Definitive treated Non-Small Cell Lung Cancer. Acta Oncol. 49: 1058-60, 2010.
79. Skyt PS, Balling P, Petersen JB, Yates ES, and Muren LP. Effect of irradiation and storage temperature on PRESAGE™ dose response. Journal of Physics:Conference Series 250 (2010)
80. Søndergaard J, Olsen KO, Muren LP, Elstrøm UV, Grau C, Høyer M. A study of image-guided radiotherapy of bladder cancer based on lipiodol injection in the bladder wall. Acta Oncol. 49: 1109-1115, 2010.
81. Sørensen BS, Toustrup K, Horsman MR, Overgaard J, Alsner J. Identifying pH independent hypoxia induced genes in human squamous cell carcinomas in vitro. Acta Oncol. 49: 895-905, 2010.
82. Sørensen TS, Noe KØ, Christoffersen C, Kristiansen M, Mouridsen K, Østerby O, Brix L. Active Contours in Optical Flow Fields for Image Sequence Segmentation. IEEE International Symposium on Biomedical Imaging (ISBI) 2010 pp. 916-919.
83. Tanderup K, Georg D, Pötter R, Kirisits C, Grau C, Lindegaard JC. Adaptive management of cervical cancer radiotherapy. Semin Radiat Oncol. 20: 121-129, 2010.
84. Tanderup K, Nielsen SK, Nyvang GB, Pedersen EM, Røhl L, Aagaard T, Fokdal L, Lindegaard JC. From point A to the sculpted pear: MR image guidance significantly improves tumour dose and sparing of organs at risk in brachytherapy of cervical cancer. Radiother Oncol. 94: 173-180, 2010.
85. Tanderup K, Pötter R, Lindegaard JC, Berger D, Wambersie A, Kirisits C. PTV margins should not be used to compensate for uncertainties in 3D image guided intracavitary brachytherapy. Radiother Oncol. 97: 495-500, 2010.
86. Thor M, Væth M, Karlsdottir A, Muren LP. Rectum motion and morbidity prediction: Improving correlation between late morbidity and DVH parameters through use of rectum planning organ at risk volumes. Acta Oncol. 49: 1061-1068, 2010.
87. Thörnqvist S, Petersen JB, Høyer M, Bentzen LN, Muren LP. Propagation of target and organ at risk contours in radiotherapy of prostate cancer using deformable image registration. Acta Oncol. 49: 1023-1032, 2010.

88. Vestergaard A, Søndergaard J, Petersen JB, Høyer M, Muren LP. A comparison of three different adaptive strategies in image-guided radiotherapy of bladder cancer. Acta Oncol. 49: 1069-1076, 2010.
89. Vogelius IS, Westerly DC, Cannon GM, Bentzen SM. Hypofractionation does not increase radiation pneumonitis risk with modern conformal radiation delivery techniques. Acta Oncol. 49: 1052-1057, 2010.
90. West C, Rosenstein BS, Alsner J, Azria D, Barnett G, Begg A, Bentzen S, Burnet N, Chang-Claude J, Chuang E, Coles C, De Ruyck K, De Ruysscher D, Dunning A, Elliott R, Fachal L, Hall J, Haustermans K, Herskind C, Hoelscher T, Imai T, Iwakawa M, Jones D, Kulich C; EQUAL-ESTRO, Langendijk JH, O'Neils P, Ozsahin M, Parliament M, Polanski A, Rosenstein B, Seminara D, Symonds P, Talbot C, Thierens H, Vega A, West C, Yarnold J. Establishment of a Radiogenomics Consortium. Int J Radiat Oncol Biol Phys. 76:1295-1296, 2010.
91. Westberg J, Jensen HR, Bertelsen A, Brink C. Reduction of Cone-Beam CT scan time without compromising the accuracy of the image registration in IGRT. Acta Oncol. 49: 225-229, 2010.
92. Wojdacz TK, Møller TH, Thestrup BB, Kristensen LS, Hansen LL. Limitations and advantages of MS-HRM and bisulfite sequencing for single locus methylation studies. Expert Rev Mol Diagn. 10: 575-580, 2010.
93. Worm ES, Hansen AT, Petersen JB, Muren LP, Præstegaard LH, Høyer M. Inter- and intra-fractional localisation errors in cone-beam CT guided stereotactic radiation therapy of tumors in the liver and lung. Acta Oncol. 49: 1177-1183, 2010.
94. Wright P, Muren LP, Høyer M, Malinen E. Evaluation of adaptive radiotherapy of bladder cancer by image-based tumour control probability modelling. Acta Oncol. 49: 1045-1051, 2010.

2011

95. Alsner J, Toustrup K, Sørensen BS, Wiuff C, Nordsmark M, Overgaard J. Method for determining clinically relevant hypoxia in cancer. Patent Number: PA 2011 70212 (2011).
96. Andersen CE, Damkjær SMS, Kertzscher G, Greilich S and Aznar MC. Fiber-coupled radioluninescence dosimetry with saturated AI2O3:C crystals: Characterization in 6 and 18 MV photon beams. Radiation Measurements 46:1090-98, 2011.
97. Baker M, Nielsen M, Hansen O, Jahn JW, Korreman S, and Brink C. Isotoxic dose escalation in the treatment of lung cancer by means of heterogeneous dose distributions in the presence of respiratory motion. Int J Radiat Oncol Biol Phys. 81: 849-55, 2011.
98. Beierholm AR, Ottosson RO, Lindvold LR, Behrens CF, Andersen CE. Characterizing a pulse-resolved dosimetry system for complex radiotherapy beams using organic scintillators. Phys Med Biol. 56: 3033-45, 2011.
99. Bertelsen A, Lorenzen EL, and Brink C. Validation of a new control system for Elekta accelerators facilitating continuously variable dose rate. Med Phys. 38:4802-10, 2011.
100. Bertelsen A, Schytte T, Bentzen SM, Hansen O, Nielsen M, Brink C. Radiation dose response of normal lung assessed by Cone Beam CT - A potential tool for biologically adaptive radiation therapy. Radiother Oncol. 100:351-5, 2011.

101. Bertelsen LB, Shen YY, Nielsen T, Stødkilde-Jørgensen H, Lloyd GK, Siemann DW, Horsman MR. Vascular effects of plinabulin (NPI-2358) and the influence on tumour response when given alone or combined with radiation. Int J Radiat Biol. 87:1126-34, 2011.
102. Boejen A, Grau C. Virtual reality in radiation therapy training. Surg Oncol. 20: 185-8, 2011.
103. Brodin NP, af Rosenschöld PM, Aznar MC, Kiil-Berthelsen A, Vogelius IR, Nilsson P, Lannering B, Björk-Eriksson T. Radiobiological risk estimates of adverse events and secondary cancer for proton and photon radiation therapy of paediatric medulloblastoma. Acta Oncol. 50: 806-16, 2011.
104. Busk M, Bohn AB, Skals M, Wang T, Horsman MR. Combretastatin-induced hypertension and the consequences for its combination with other therapies. Vascul Pharmacol. 54: 13-17, 2011.
105. Busk M, Toustrup K, Soerensen BS, Alsner J, Horsman MR, Jakobsen S, Overgaard J. In vivo Identification and Specificity assessment of mRNA markers of hypoxia in human and mouse tumors. BMC Cancer. 11: 63, 2011.
106. Busk M, Walenta S, Müeller-Klieser W, Steiniche T, Jakobsen S, Horsman MR, Overgaard J. Inhibition of tumor lactace oxidation: Consequences for the tumor microenvironment. Radiother Oncol. 99: 404-11, 2011.
107. Carl J, Nielsen J, Holmberg M, Larsen EH, Fabrin K, Fisker RV. Clinical results from first use of prostate stent as fiducial for radiotherapy of prostate cancer. Acta Oncol. 50: 547-54, 2011.
108. Cho B, Poulsen PR, Sawant A, Ruan D, and Keall PJ. Real-time target position estimation using stereoscopic kV/MV imaging and external respiratory monitoring for dynamic MLC tracking. Int J Rad Onc Biol Phys. 2011: 79; 269-278.
109. Christensen BO, Overgaard J, Kettner LO, Damsgaard TE. Long-term Evaluation of Postmastectomy Breast Reconstruction. Acta Oncol. 50: 1053-61, 2011.
110. Christensen BO, Overgaard J, Sørensen BS, Danielsen CC, Damsgaard TE. The effect of irradiation on collagen, matrix metalloproteinases and their inhibitors in wound repair. A study of patients with breast reconstruction using the TRAM flap. JPRAS 2011 (in press)
111. D'Andrea FP, Safwat A, Kassem M, Gautier L, Overgaard J, Horsman MR. Cancer Stem Cell overexpression of nicotinamide N-methyltransferase enhances cellular radiation resistance. Radiother Oncol. 99:373-8, 2011.
112. Elstrøm UV, Muren LP, Petersen JBB and Grau C. Evaluation of image quality for different kV cone-beam CT acquisition and reconstruction methods for the head and neck region. Acta Oncol. 50: 908-17, 2011.
113. Fenkell L, Assenholt M, Nielsen SK, Haie-Meder C, Pötter R, Lindegaard J, Tanderup K. Parametrial boost using midline shielding results in an unpredictable dose to tumor and organs-at-risk in combined external beam radiotherapy and brachytherapy for locally advanced cervical cancer. Int J Radiat Oncol Biol Phys. 79: 1572-9, 2011.
114. Fledelius W, Keall PJ, Cho B , Yang X, Morf D, Scheib S, and Poulsen PR. Tracking latency in image-based dynamic MLC tracking with direct image access. Acta Oncol. 50: 952-9, 2011.
115. Fledelius W, Worm E, Ulrik V. Elstrøm, Jørgen B. Petersen, Cai Grau, Morten Høyer, and Per R. Poulsen. Robust Automatic Segmentation of Multiple Implanted Cylindrical Gold Fiducial Markers in Cone-Beam CT Projections. Medical Physics 38: 6351-61, 2011.

116. Fog LS, Rasmussen JF, Aznar M, Kjær-Kristoffersen F, Vogelius IR, Engelholm SA, Bangsgaard JP. A closer look at RapidArc® radiosurgery plans using very small fields. Phys Med Biol. 56: 1853-63, 2011.
117. Fokdal L, Tanderup K, Nielsen SK, Christensen HK, Røhl L, Pedersen EM, Schønemann NK, Lindegaard JC. Image and laparoscopic guided interstitial brachytherapy for locally advanced primary or recurrent gynaecological cancer using the adaptive GEC ESTRO target concept. Radiother Oncol. 100:473-9, 2011.
118. Gonzalez-Angulo AM, Hennessy BY, Meric-Bernstam F, Sahin A, Liu W, Ju Z, Carey MS, Myhre S, Speers C, Lei D, Broaddus R, Lluch AM, Aparicio S, Brown P, Pusztai L, Symmans F, Alsner J, Overgaard J, Borresen-Dale AL, Hortobagyi GN, Coombes KR, Mills GB. Functional proteomics can define prognosis and predict pathologic complete response in patients with breast cancer. Clin Proteomics. 8:11, 2011.
119. Haack S, Jespersen SN, Fokdal L, Lindegaard JC, Kallehauge JF, Tanderup K, Pedersen EM. Diffusion Weighted MRI (DWI) for brachytherapy in locally advanced cervical cancer – determining the degree of distortion at 1.5T and 3T MRI. IFMBE Proceedings 34, pp. 172–175, 2011.
120. Hansen AE, Kristensen AT, Law I, Jørgensen JT, Engelholm SA. Hypoxia-inducible factors--regulation, role and comparative aspects in tumourigenesis. Vet Comp Oncol. 9:16-37, 2011.
121. Hansen AE, McEvoy F, Engelholm SA, Law I, Kristensen AT. FDG PET/CT imaging in canine cancer patients. Vet Radiol Ultrasound. 52: 201-6, 2011.
122. Hansen AE, Kristensen AT, Law I, Jørgensen JT, McEvoy FJ, Busk M, van der Kogel AJ, Bussink J, Kjær A, Engelholm SA. Initial non-invasive and invasive experiences using [64Cu]ATSM in spontaneous canine tumors. Cancer Imaging. 11 Spec No A:S42-3, 2011.
123. Havelund BM, Sørensen FB, Lindebjerg J, Spindler KG, and Jakobsen A. Pretreatment HIF-1α and GLUT-1 Expressions Do Not Correlate with Outcome after Preoperative Chemoradiotherapy in Rectal Cancer. Anticancer Res. 31:1559-65, 2011.
124. Herrmann R, Jäkel O, Palmans H, Sharpe P, Bassler N Dose response of alanine detectors irradiated with carbon ion beams. Med Phys. 38:1859-66, 2011.
125. Hoff CM , Lassen P, Eriksen JG, Hansen HS, Specht L, Overgaard M, Grau C, Johansen J, Bentzen J, Andersen L, Evensen JF and Overgaard J. Does transfusion improve the outcome for HNSCC patients treated with radiotherapy? – Results from the randomized DAHANCA 5 and 7 trials. Acta Oncol. 50:1006-14, 2011.
126. Hoff CM, Hansen HS, Overgaard M, Grau C, Johansen J, Bentzen J, Overgaard J. The importance of haemoglobin level and effect of transfusion in HNSCC patients treated with radiotherapy - Results from the randomized DAHANCA 5 study. Radiother Oncol. 98: 22-33, 2011.
127. Hysing LB, Söhn M, Muren LP, Alber M. A coverage probability based method to estimate patient-specific small bowel planning volumes for use in radiotherapy. Radiother Oncol. 100:407-11, 2011.
128. Høyer M, Thor M, Thörnqvist S, Søndergaard J, Lassen-Ramshad Y, Paul Muren L. Advances in radiotherapy: from 2D to 4D. Cancer Imaging. 11 Spec No A:S147-52, 2011.

129. Jensen I, Carl J, Lund B, Larsen EH, Nielsen J. Radiobiological impact of reduced margins and treatment technique for prostate cancer in terms of tumor control probability (TCP) and normal tissue complication probability (NTCP). Med Dosim. 36: 130-7, 2011.
130. Johansen J, Petersen H, Godballe C, Loft A, Grau C. FDG-PET/CT for detection of the unknown primary head and neck tumor. Q J Nucl Med Imaging 55: 500-508, 2011.
131. Jørgensen MK, Hoffmann L, Petersen JB, Praestegaard LH, Hansen R, Muren LP. Tolerance levels of EPID-based quality control for volumetric modulated arc therapy. Med Phys. 38: 1425-34, 2011.
132. Keall PJ, Sawant A, Cho B. Ruan D. Wu J, Poulsen P, Petersen J, Newell LJ, Cattell H, and Korreman S. Electromagnetic-guided DMLC tracking enables motion management for intensity modulated arc therapy. Int J Rad Onc Biol Phys. 79: 312-320, 2011.
133. Kertzscher G, Andersen CE, Edmund J, and Tanderup K. Stem signal suppression in fiber-coupled Al2O3:C dosimetry for 192Ir brachytherapy. Radiation Measurements 46: 2020-2024, 2011.
134. Kertzscher G, Andersen CE, Siebert F-A, Nielsen SK, Lindegaard JC, Tanderup K. Identifying afterloading PDR and HDR brachytherapy errors using real-time fiber-coupled AI2O3:C dosimetry and a novel statistical error decision criterion. Radiother Oncol. 100:456-62, 2011.
135. Lassen P, Eriksen JG, Krogdahl A, Therkildsen MH, Ulhøi BP, Overgaard M, Specht L, Andersen E, Johansen J, Andersen LJ, Grau C, Overgaard J The influence of HPV-associated p16-expression on accelerated fractionated radiotherapy in head and neck cancer: Evaluation of the randomised DAHANCA 6&7 trial. Radiother Oncol. 100:49-55, 2011.
136. Lassen-Ramshad Y, Vestergaard A, Muren LP, Høyer M and Petersen JBB. Plan robustness in proton beam therapy of a childhood brain tumour. Acta Oncol. 50:791-6, 2011.
137. Logadóttir Á, Korreman S, Petersen PM. Comparison of the accuracy and precision of prostate localization with 2D-2D and 3D images. Radiother Oncol. 98: 175-80, 2011.
138. Lühr A, Hansen DC, Jäkel O, Sobolevsky N, Bassler N. Analytical expressions for water-to-air stopping-power ratios relevant for accurate dosimetry in particle therapy. Phys Med Biol. 56: 2515-33, 2011.
139. Lühr A, Hansen DC, Sobolevsky N, Palmans H, Rossomme S, and Bassler N. Fluence Correction Factors and Stopping Power Ratios for Clinical Ion Beams. Acta Oncol. 50:797-805, 2011.
140. Maeda Y, Høyer M, Lundby L, Norton C. Faecal incontinence following radiotherapy for prostate cancer: A systematic review. Radiother Oncol. 98:145-53, 2011.
141. Mortensen LS, Busk M, Nordsmark M, Jakobsen S, Theil J, Overgaard J, Horsman MR. Accessing radiation response using hypoxia PET imaging and oxygen sensitive electrodes: a preclinical study. Radiother Oncol. 99:418-23, 2011.
142. Nielsen MB, Laurberg S, Holm T. Current management of locally recurrent rectal cancer. Colorectal Dis. 13:732-42, 2011.
143. Nielsen TB, Wieslander E, Fogliata A, Nielsen M, Hansen O, and Brink C. Influence of dose calculation algorithms on the predicted dose distributions and NTCP values for NSCLC patients. Med Phys. 38:2412-8, 2011.

144. Noe KØ, Tanderup K, and Sørensen TS. Surface Membrane Based Bladder Registration for evaluation of accumulated dose during brachytherapy in cervical cancer. IEEE International Symposium on Biomedical Imaging (ISBI) 2011. 4 pp. 1253-1256.
145. Nyeng TB, Kallehauge JF, Høyer M, Petersen JBB, Poulsen PR and Muren LP. Clinical validation of a 4D-CT based method for lung ventilation measurement in phantoms and patients. Acta Oncol. 50:897-907, 2011.
146. Offersen BV, Brodersen H-J, Nielsen MM, Overgaard J, Overgaard M on behalf of the DBCG Radiotherapy Committee. Should postmastectomy radiotherapy to the chest wall and regional lymph nodes be standard for patients with 1-3 positive lymph nodes? Breast Care 6:347-351, 2011.(Basel).
147. Offersen BV, Højris I, Overgaard M. Radiation-induced heart morbidity after adjuvant radio-therapy of early breast cancer – is it still an issue? Radiother Oncol 100: 157-159, 2011.
148. Ottosson RO and Behrens CF. CTCask; a new algorithm for conversion of CT numbers to tissue parameters for Monte Carlo dose calculations applying DICOM RS knowledge. Phys Med Biol. 56:N263-N274, 2011.
149. Overgaard J. Hypoxic modification of radiotherapy in squamous cell carcinoma of the head and neck - A systematic review and meta-analysis. Radiother Oncol. 100:22-32, 2011.
150. Persson GF, Nygaard DE, af Rosenschöld PM, Vogelius IR, Josipovic M, Specht L, Korreman SS. Artifacts in conventional computed tomography (CT) and free breathing four-dimensional CT induce uncertainty in gross tumor volume determination. Int J Radiat Oncol Biol Phys. 80:1573-80, 2011.
151. Petersen JBB, Lassen-Ramshad Y, Hansen AT, Muren LP, Grau C and Høyer M. Normal liver tissue sparing by intensity-modulated proton stereotactic body radiotherapy for solitary liver tumours.Acta Oncol. 50:823-8, 2011.
152. Poulsen PR, Fledelius W, Keall PJ, Weiss E, Lu J, Brackbill E, and Hugo GD. A method for robust segmentation of arbitrarily shaped radiopaque structures in cone-beam CT projections. Med. Phys. 38: 2151-2156, 2011.
153. Ravkilde T, Keall PJ, Højbjerre K, Fledelius W, Worm E, and Poulsen PR. Geometric accuracy of DMLC tracking with an implantable wired electromagnetic transponder. Acta Oncol. 50:944-51, 2011.
154. Rosenschöld PM, Engelholm S, Ohlhues L, Law I, Vogelius IR, Engelholm SA. Photon and proton therapy planning comparison for malignant glioma based on CT, FDG-PET, DTI-MRI and fiber tracking. Acta Oncol. 50:777-83, 2011. .
155. Rylander S, Thörnqvist S, Haack S, Pedersen EM and Muren LP. Intensity profile based measurement of prostate gold marker impact on 1.5T and 3.0T diffusion-weighted MR images. Acta Oncol. 50:866-72, 2011. .
156. Schmitz T, Blaickner M, Ziegner M, Bassler N, Grunewald C, Kratz J-V, Schütz C, Langguth P, Sharpe P, Palmans H, Holzscheiter MH, Otto G, Hampel G. Dose Determination using alanine detectors in a Mixed Neutron and Gamma Field for Boron Neutron Capture Therapy of Liver Malignancies. Acta Oncol 50: 817-822, 2011.

157. Skyt PS, Balling P, Petersen JB, Yates ES and Muren LP. Temperature dependence of the dose response for a solid-state radiochromic dosimeter. Med Phys. 38:2806-11, 2011. .
158. Sørensen BS, Overgaard J, Bassler N. In vitro RBE-LET dependence for multiple particle types. Acta Oncol. 50:757-62, 2011.
159. Sørensen BS, Vestergaard A, Overgaard J, Præstegaard LH. Dependence of cell survival on instantaneous dose rate of a linear Accelerator. Radiother Oncol 101: 223-225, 2011.
160. Thor M, Petersen JBB, Bentzen L, Høyer M and Muren LP. Deformable image registration for contour propagation from CT to CBCT in radiotherapy of prostate cancer. Acta Oncol. 50:918-25, 2011.
161. Thörnqvist S, Bentzen LN, Hysing LB, Petersen JBB and Muren LP. Plan robustness in simultaneous integrated boost radiotherapy of prostate and lymph nodes for different image-guidance and delivery techniques. Acta Oncol. 50:926-34, 2011.
162. Toustrup K, Sørensen BS, Nordsmark M, Busk M, Lassen P, Wiuf C, Alsner J, Overgaard J. Development of a hypoxia gene expression classifier with predictive impact for hypoxic modification of radiotherapy in head and neck cancer. Cancer Res. 71:5923-31, 2011.
163. Toustrup K, Lambertsen K, Birke-Sørensen H, Ulhøi B, Sørensen L, Grau C. Reduction in waiting time for diagnosis and treatment of head and neck cancer - a fast track study. Acta Oncologica 50:636-41, 2011.
164. Tramm T, Kim JY, Tavassoli FA. Diminished number or complete loss of myoepithelial cells associated with metaplastic and neoplastic apocrine lesions of the breast. Am J Surg Pathol. 35:202-11, 2011
165. Vogelius IR, Bentzen SM, Maraldo MV, Petersen PM, Specht L. Risk factors for radiation induced hypothyroidism: A literature based meta-analysis. Cancer 117: 5250-60, 2011.
166. Vogelius IR, Westerly DC, Aznar MC, Cannon GM, Korreman SS, Mackie TR, Mehta MP, Bentzen SM. Estimated radiation pneumonitis risk after photon versus proton therapy alone or combined with chemotherapy for lung cancer. Acta Oncol. 50:772-6, 2011.
167. Vogelius IS, Westerly DC, Cannon GM, Mackie TR, Mehta MP, Sugie C, Bentzen SM. Intensity-Modulated Radiotherapy Might Increase Pneumonitis Risk Relative to Three-Dimensional Conformal Radiotherapy in Patients Receiving Combined Chemotherapy and Radiotherapy: A Modeling Study of Dose Dumping. Int J Radiat Oncol Biol Phys. 80:893-9, 2011.
168. Waldeland E, Helt-Hansen J, Malinen E. Characterization of lithium formate EPR dosimeters for high dose applications - Comparison with alanine Radiation Measurements. 46: 213-218, 2011.
169. Wiechec E, Wiuf C, Overgaard J, Hansen LL. High Resolution Melting (HRM) analysis for mutation screening of RGSL1, RGS16 and RGS8 in breast cancer. Cancer Epidemiol Biomarkers Prev. 20: 397-407, 2011.
170. Wojdacz TK, Thestrup BB, Cold S, Overgaard J, Hansen LL. No difference in the frequency of constitutional locus specific methylation in peripheral blood DNA of women diagnosed with breast cancer and age matched controls. Future Oncol 7: 1451-5, 2011.
171. Wojdacz TK, Thestrup BB, Overgaard J, Hansen LL. Methylation of cancer related genes in tumor and peripheral blood lymphocyte DNA from the same breast cancer patient as two independent events. Diagn Pathol. 30:6, 2011.

172. Yates ES, Balling P, Petersen JB, Nesarizadeh M, Skyt P, Bassler N, Kaiser F-J, and Muren LP. Characterization of the optical properties and stability of PRESAGE following irradiation with photons and carbon ions. Acta Oncol. 50:829-34, 2011.

2012

173. Andersen ES, Muren LP, Sørensen TS, Noe KO, Thor M, Petersen JB, Høyer M, Bentzen L, Tanderup K. Bladder dose accumulation based on a biomechanical deformable image registration algorithm in volumetric modulated arc therapy for prostate cancer. Phys Med Biol. 57:7089-100, 2012.
174. Appelt AL, Vogelius IR. A method to adjust radiation dose-response relationships for clinical risk factors. Radiother Oncol. 102:352-4, 2012.
175. Bertelsen A, Hansen O, Brink C. Does VMAT for treatment of NSCLC patients increase the risk of pneumonitis compared to IMRT? - A planning study. Acta Oncol. 51:752-8, 2012.
176. Brodin NP, Vogelius IR, Maraldo MV, et al. Life Years Lost - Comparing potentially fatal late complications after radiotherapy on a common scale. Cancer 118:5432-40, 2012.
177. Carl J, Nielsen J, Nielsen MS, Zepernick PR, Kjaergaard B and Jensen HK. A new lung stent tested as fiducial marker in a porcine model. Radiother Oncol. 102: 297-302, 2012.
178. D'Andrea FP. Intrinsic radiation resistance of mesenchymal cancer stem cells and implications for treatment response in a murine sarcoma model. Dan Med J. 59:B4388, 2012.
179. D'Andrea FP, Horsman MR, Kassem M, Overgaard J, Safwat A. Tumourigenicity and radiation resistance of mesenchymal stem cells. Acta Oncol. 51:669-79, 2012.
180. D'Andrea FP, Safwat A, Burns JS, Kassem M, Horsman MR, Overgaard J. Tumour microenvi-ronment and radiation response in sarcomas originating from human derived tumourigenic mesenchymal stem cell. Int J Radiat Biol. 88:457-65, 2012.
181. Dieperink KB, Hansen S, Wagner L, Johansen C, Andersen KK, Hansen O. Living alone, obesity and smoking: important factors for quality of life after radiotherapy and androgen deprivation therapy for prostate cancer. Acta Oncol. 51:722-9, 2012.
182. Dimopoulos JC, Petrow P, Tanderup K, Petric P, Berger D, Kirisits C, Pedersen EM, van Limbergen E, Haie-Meder C, Pötter R. Recommendations from Gynaecological (GYN) GEC-ESTRO Working Group (IV): Basic principles and parameters for MR imaging within the frame of image based adaptive cervix cancer brachytherapy. Radiother Oncol. 103:113-22, 2012.
183. Due AK, Vogelius IR, Aznar MC, Bentzen SM, Berthelsen AK, Korreman SS, Kristensen CA, Specht L. Methods for estimating the site of origin of locoregional recurrence in head and neck squamous cell carcinoma. Strahlenther Onkol. 188:671-6, 2012.
184. Emmertsen K, and Laurberg S. Low Anterior Resection Syndrome Score. Development and validation of a symptom-based scoring system for bowel dysfunction after low anterior resection for rectal cancer. Ann Surg. 255:922-8, 2012.
185. Frandsen SK, Gissel H, Hojman P, Tramm T, Eriksen J, Gehl J. Direct Therapeutic Applications of Calcium Electroporation to Effectively Induce Tumor Necrosis. Cancer Res. 72:1336-41, 2012.

186. Hansen AE, Kristensen AT, Law I, McEvoy F, Engelholm SA. Multimodality functional imaging of spontaneous canine tumors using 64Cu-ATSM and 18FDG PET/CT and dynamic contrast enhanced perfusion CT. Radiother Oncol. 102: 424-8, 2012.
187. Hansen DC, Lühr A, Herrmann R, Sobolevsky N, and Bassler N. Recent Improvements in the SHIELD-HIT Code. Int J Radiat Biol. 88:195-9, 2012.
188. Hansen DC, Lühr A, Sobolevsky N, Bassler N. Optimizing SHIELD-HIT for carbon ion treatment. Phys Med Biol. 57:2393-409, 2012.
189. Havelund BM, Spindler KL, Ploen J, Andersen RF, Jakobsen A. Single nucleotide polymorphisms in the HIF-1α gene and chemoradiotherapy of locally advanced rectal cancer. Oncol Lett. 4:1056-1060, 2012.
190. Herrmann, R, Greilich, S, Grzanka, L, and Bassler, N. Amorphous-track predictions in 'libamtrack' for alanine relative effectiveness in ion beams. Radiation Measurements 46: 1551-53, 2012.
191. Hoff CM, Grau C, Overgaard J. Effect of smoking on oxygen delivery and outcome in patients with head and neck squamous cell carcinoma - a prospective study. Radiother Oncol. 103: 38-44, 2012.
192. Hoff CM. Importance of hemoglobin concentration and its modification for the outcome of head and neck cancer patients treated with radiotherapy. Acta Oncol. 51: 419-32, 2012.
193. Hoffmann L, Jørgensen MK, Muren LP, Petersen JBB. Clinical validation of the Acuros XB photon dose calculation algorithm, a grid-based Boltzmann equation solver. Acta Oncol. 51: 376-85, 2012.
194. Holzscheiter MH, Bassler N, Dosanjh M, Sørensen BS, Overgaard J. A community call for a dedicated radiobiological research facility to support particle beam cancer therapy. Radiother Oncol. 105:1-3, 2012.
195. Horsman MR, Mortensen LS, Petersen JB, Busk M, Overgaard J. Imaging hypoxia to improve radiotherapy outcome. Nat Rev Clin Oncol. 9:674-87, 2012.
196. Høyer M, Muren LP. Stereotactic body radiation therapy - A discipline with Nordic origin and profile. Acta Oncol. 51:564-7, 2012.
197. Høyer M, Swaminath A, Bydder S, Lock M, Romero AM, Kavanagh B, Goodman K, O'Kunieff P, Dawson LA. Radiotherapy for Liver Metastases: a Review of Evidence. Int J Radiat Oncol Biol Phys. 82: 1047-57, 2012.
198. Kaiser FJ, Bassler N, Tölli H, Jäkel O. Initial recombination in the track of heavy charged particles: Numerical solution for air filled ionization chambers. Acta Oncol. 51: 368-75, 2012.
199. Korreman S, Persson G, Nygaard D, Brink C, Juhler-Nøttrup T. Respiration-correlated image guidance is the most important radiotherapy motion management strategy for most lung cancer patients. Int J Radiat Oncol Biol Phys. 83:1338-43, 2012.
200. Larsen EKU, Nielsen T, Wittenborn T, Rydtoft LM, Lokanathan AR, Hansen L, Østergaard L, Kingshott P, Howard K, Besenbacher F, Nielsen NC, Kjems J. Accumulation of magnetic iron oxide nanoparticles coated with different sized polyethylene glycol in murine tumors. Nanoscale 4:2352-61, 2012.
201. Lassen P, Overgaard J. Scoring and classification of oropharyngeal carcinoma based on HPV-related p16-expression. Radiother Oncol. 105:269-70, 2012.

202. Laursen LV, Elstrøm UV, Vestergaard A, Muren LP, Petersen JB, Lindegaard JC, Grau C, Tanderup K. Residual rotational set-up errors after daily cone-beam CT image guided radiotherapy of locally advanced cervical cancer. Radiother Oncol. 105:220-5, 2012.
203. Lievens Y, Grau C. Health Economics in Radiation Oncology: Introducing the ESTRO HERO project. Radiother Oncol. 103:109-12, 2012.
204. Lindegaard JC and Tanderup K Counterpoint: Time to retire the parametrial boost Brachytherapy 11:80-83, 2012.
205. Lock MI, Hoyer M, Bydder SA, Okunieff P, Hahn CA, Vichare A, Dawson LA. An international survey on liver metastases radiotherapy. Acta Oncol. 51:568-74, 2012.
206. Lühr A, Hansen DC, Teiwes R, Sobolevsky N, Jäkel O, Bassler N. The impact of modeling nuclear fragmentation on delivered dose and radiobiology in ion therapy. Phys Med Biol. 57:5169-85, 2012.
207. Lühr A, Toftegaard J, Kantemiris I, Hansen DC, Bassler N. Stopping power for particle therapy: The generic library libdEdx and clinically relevant stopping-power ratios for light ions. Int J Radiat Oncol Biol Phys. 88: 209-12, 2012.
208. Maraldo MV, Brodin NP, Vogelius IR, Aznar MC, Munck Af Rosenschöld P, Petersen PM, Specht L. Risk of Developing Cardiovascular Disease after Involved Node Radiotherapy versus Mantle Field for Hodgkin Lymphoma. Int J Radiat Oncol Biol Phys. 83:1232-7, 2012.
209. Mendez Romero A and Høyer M. Radiation therapy for liver metastases. Curr Opin Support Palliat Care. 6: 97-102, 2012.
210. Mortensen HR, Overgaard J, Specht L, Overgaard M, Johansen J, Evensen JF, Andersen LJ, Andersen E, Grau C. Prevalence and peak incidence of acute and late normal tissue morbidity in the DAHANCA 6&7 randomised trial with accelerated radiotherapy for head and neck cancer. Radiother Oncol. 103:69-75, 2012.
211. Mortensen LS, Johansen J, Kallehauge J, Primdahl H, Busk M, Lassen P, Alsner J, Sørensen BS, Toustrup K, Jakobsen S, Petersen J, Petersen H, Theil J, Nordsmark M, Overgaard J. FAZA PET/CT hypoxia imaging in patients with squamous cell carcinoma of the head and neck treated with radiotherapy: Results from the DAHANCA 24 trial. Radiother Oncol. 105:14-20, 2012.
212. Nielsen MB, Rasmussen P, Keller J, Laurberg S. Preliminary experience with external hemipelvectomy for locally advanced and recurrent pelvic carcinoma. Colorectal Dis. 14:152-6, 2012.
213. Nielsen TB, Hansen VN, Westberg J, Hansen O, Brink C. A dual centre study of setup accuracy for thoracic patients based on Cone Beam CT data. Radiother Oncol. 102: 281-6, 2012.
214. Norling R, Grau C, Nielsen MB, Homøe P, Sørensen JA, Lambertsen K, Bundgaard T, Mäkitie A et al. Radiological imaging of the neck for initial decision-making in oral squamous cell carcinomas--a questionnaire survey in the Nordic countries. Acta Oncol. 51:355-61, 2012.
215. Overgaard J and Bartelink H. Introduction: towards predicting outcome of radiotherapy-at last. Semin Radiat Oncol. 22:87-90, 2012.
216. Persson GF, Nygaard DE, Hollensen C, Munck af Rosenschöld P, Mouritsen LS, Due AK, Berthelsen AK, Nyman J, Markova E, Roed AP, Roed H, Korreman S, Specht L. Interobserver delineation variation in lung tumour stereotactic body radiotherapy. Br J Radiol. 85:654-60, 2012.

217. Poulsen PR, Carl J, Nielsen MS, Nielsen J, Thomsen JB, Jensen HK, Kjærgaard B, Zepernick PR, Worm E, Fledelius W, Cho B, Sawant A, Ruan D, Keall PJ. MV image-based dynamic MLC tracking of a NiTi stent in pig lungs on a linear accelerator. Int J Rad Onc Biol Phys. 82: 321-7, 2012.
218. Poulsen PR, Fledelius W, Byungchul Cho, and Keall PJ. Image-based dynamic MLC tracking of moving targets during intensity modulated arc therapy. Int J Radiat Oncol Biol Phys. 83:265-71, 2012.
219. Poulsen PR, Schmidt ML, Keall P, Worm ES, Fledelius W, Hoffmann L. A method of dose reconstruction for moving targets compatible with dynamic treatments. Med Phys. 39:6237-6246, 2012.
220. Skyt PS, Wahlstedt I, Muren LP, Petersen JB, Balling P. Temperature and temporal dependence of the optical response for a radiochromic dosimeter. Med Phys. 39:7232-7236, 2012.
221. Spindler KLG, Pallisgaard N, Vogelius IR, Jakobsen A. Quantitative Cell Free DNA, KRAS and BRAF mutations in Plasma from Patients with Metastatic Colorectal Cancer during Treatment with Cetuximab and Irinotecan. Clin Cancer Res. 18: 1177-85, 2012.
222. Thomsen JB, Arp DT, Carl J. Urethra sparing - potential of combined Nickel-Titanium stent and intensity modulated radiation therapy in prostate cancer. Radiother Oncol. 103:256-60, 2012.
223. Thor M, Benedek H, Knöös T, Engström P, Behrens CF, Hauer AK, Sjöström D, Ceberg C. Introducing multiple treatment plan-based comparison to investigate the performance of gantry angle optimisation (GAO) in IMRT for head and neck cancer. Acta Oncol. 51:743-51, 2012.
224. Tideman Arp D, Carl J. EXACTRAC x-ray and beam isocenters-What's the difference? Med Phys. 39:1418-23, 2012.
225. Toustrup K, Sørensen BS, Alsner J, Overgaard J. Hypoxia Gene expression Signatures as Prognostic and Predictive Markers in Head and Neck Radiotherapy. Semin Radiat Oncol. 22:119-27, 2012.
226. Toustrup K, Sørensen BS, Lassen P, Alsner J, Wiuf C, Overgaard J. Gene expression classifier predicts for hypoxic modification of radiotherapy with nimorazole in squamous cell carcinomas the head and neck. Radiother Oncol. 102: 122-9, 2012.
227. Vogelius IR, Bentzen SM. A literature-based meta-analysis of clinical risk factors for development of radiation induced pneumonitis. Acta Oncol. 51:975-83, 2012.
228. Wittenborn T, Nielsen T, Nygaard JV, Larsen EK, Thim T, Rydtoft LM, Vorup-Jensen T, Kjems J, Nielsen NC, Horsman MR, Falk E. Ultrahigh-field DCE-MRI of angiogenesis in a novel angiogenesis mouse model. J Magn Reson Imaging. 35: 703-10, 2012.
229. Wojdacz TK. Methylation Sensitive High Resolution Melting (MS-HRM) in the context of legislative requirements for validation of analytical procedures for diagnostic applications. Expert Rev Mol Diagn. 1: 39-47, 2012.
230. Wojdacz TK. Qualification and quantification of locus specific methylation – the basics. Front Genet. 3:21, 2012.
231. Worm ES, Høyer M, Fledelius W, Nielsen JE, Larsen LP, and Poulsen PR. On-line use of 3D marker trajectory estimation from cone-beam CT projections for precise setup in radiotherapy for targets with respiratory motion. Int J Radiat Oncol Biol Phys. 83:145-51, 2012.

2013

232. Andersen ES, Noe KO, Sørensen TS, Nielsen SK, Fokdal L, Paludan M, Lindegaard JC, Tanderup K. Simple DVH parameter addition as compared to deformable registration for bladder dose accumulation in cervix cancer brachytherapy. Radiother Oncol. 107:52-7, 2013.
233. Andreassen CN, Overgaard J, Alsner J. Independent prospective validation of a predictive test for risk of radiation induced fibrosis based on the gene expression pattern in fibroblasts irradiated in vitro. Radiother Oncol. 108:469-72, 2013.
234. Appelt AL, Pløen J, Vogelius IR, Bentzen SM, Jakobsen A. Radiation Dose-Response Model for Locally Advanced Rectal Cancer After Preoperative Chemoradiation Therapy. Int J Radiat Oncol Biol Phys. 85:74-80, 2013.
235. Appelt AL, Vogelius IR, Bentzen SM. Modern Hypofractionation Schedules for Tangential Whole Breast Irradiation Decrease the Fraction Size-corrected Dose to the Heart. Clin Oncol (R Coll Radiol). 25:147-52, 2013.
236. Aure MR, Leivonen SK, Fleischer T, Zhu Q, Overgaard J, Alsner J, Tramm T, Louhimo R, Alnæs GI, Perälä M, Busato F, Touleimat N, Tost J, Børresen-Dale AL, Hautaniemi S, Troyanskaya OG, Lingjærde OC, Sahlberg KK, Kristensen VN. Individual and combined effects of DNA methylation and copy number alterations on miRNA expression in breast tumors. Genome Biol. 14: 126, 2013.
237. Baumann M, Bodis S, Dikomey E, van der Kogel A, Overgaard J, Rodemann HP, Wouters B. Molecular radiation biology/oncology at its best: Cutting edge research presented at the 13th International Wolfsberg Meeting on Molecular Radiation Biology/Oncology. Radiother Oncol. 108:357-61, 2013.
238. Behrens CF, Andreasen TB, Lindberg H, Buhl SK, Vestergaard A, Elstrøm UV, Sjöström D. Quantitative image quality evaluation of pelvic computed tomography-based imaging systems: A novel concept in radiotherapy. Acta Oncol. 52:1579-82, 2013.
239. Bernchou U, Agergaard SN, Brink C. Radiopaque marker motion during pre-treatment CBCT as a predictor of intra-fractional prostate movement. Acta Oncol. 52:1168-74, 2013.
240. Bernchou U, Schytte T, Bertelsen A, Bentzen SM, Hansen O, Brink C. Time evolution of regional CT density changes in normal lung after IMRT for NSCLC. Radiother Oncol. 109:89-94, 2013.
241. Bjerre T, Crijns S, af Rosenschöld PM, Aznar M, Specht L, Larsen R, Keall P. Three-dimensional MRI-linac intra-fraction guidance using multiple orthogonal cine-MRI planes. Phys Med Biol. 58:4943-50, 2013.
242. Bøje CR, Dalton SO, Grønborg TK, Primdahl H, Kristensen CA, Andersen E, Johansen J, Andersen LJ, Overgaard J. The impact of comorbidity on outcome in 12 623 Danish Head and Neck Cancer Patients: A population based study from the DAHANCA database Acta Oncol. 52:285-93, 2013.
243. Brodin NP, Vogelius IR, Björk-Eriksson T, Munck af Rosenschöld P, Bentzen SM. Modeling freedom from progression for standard-risk medulloblastoma: a mathematical tumor control model with multiple modes of failure. Int J Radiat Oncol Biol Phys. 87:422-9, 2013.
244. Busk M, Horsman MR. Relevance of hypoxia in radiation oncology: pathophysiology, tumor biology and implications for treatment. Q J Nucl Med Mol Imaging. 57:219-34, 2013.

245. Busk M, Jakobsen S, Horsman MR, Mortensen LS, Iversen AB, Overgaard J, Nordsmark M, Ji X, Lee DY, Raleigh JR. PET imaging of tumor hypoxia using 18F-labeled pimonidazole. Acta Oncol. 52:1300-7, 2013.
246. Busk M, Mortensen LS, Nordsmark M, Overgaard J, Jakobsen S, Hansen KV, Theil J, Kallehauge JF, D'Andrea FP, Steiniche T, Horsman MR. PET hypoxia imaging with FAZA: reproducibility at baseline and during fractionated radiotherapy in tumour-bearing mice. Eur J Nucl Med Mol Imaging. 40:186-97, 2013.
247. Carus A, Gurney H, Gebski V, Harnett P, Hui R, Kefford R, Wilcken N, Ladekarl M, von der Maase H, Donskov F. Impact of baseline and nadir neutrophil index in non-small cell lung cancer and ovarian cancer patients: Assessment of chemotherapy for resolution of unfavourable neutrophilia. J Transl Med. 11:189, 2013.
248. Carus A, Ladekarl M, Hager H, Nedergaard BS, Donskov F. Tumour-associated CD66b(+) neutrophil count is an independent prognostic factor for recurrence in localised cervical cancer. Br J Cancer 108: 2116-22, 2013.
249. Carus A, Ladekarl M, Hager H, Pilegaard H, Nielsen PS, Donskov F. Tumor-associated neutrophils and macrophages in non-small cell lung cancer: No immediate impact on patient outcome. Lung Cancer. 81:130-137, 2013.
250. Christensen BO, Overgaard J, Kettner LO, Damsgaard TE. Long-term evaluation of postmastectomy breast reconstruction with the pedicled transverse rectus abdominis musculocutaneous flap. J Plast Surg Hand Surg. 47:374-8, 2013.
251. Christoffersen CP, Hansen D, Poulsen P, Sorensen TS. Registration-based reconstruction of four-dimensional cone beam computed tomography. IEEE Trans Med Imaging. 32:2064-77, 2013.
252. Dieperink KB, Johansen C, Hansen S, Wagner L, Andersen KK, Minet LR, Hansen O. The effects of multidisciplinary rehabilitation: RePCa-a randomised study among primary prostate cancer patients. Br J Cancer. 109:3005-13, 2013.
253. Dieperink KB, Wagner L, Hansen S, Hansen O. Embracing life after prostate cancer. A male perspective on treatment and rehabilitation. Eur J Cancer Care 22:549-58, 2013.
254. Edvardsen H, Landmark-Høyvik H, Reinertsen KV, Zhao X, Grenaker-Alnæs GI, Nebdal D, Syvänen AC, Rødningen O, Alsner J, Overgaard J, Borresen-Dale AL, Fosså SD, Kristensen VN. SNP in TXNRD2 associated with radiation-induced fibrosis: a study of genetic variation in reactive oxygen species metabolism and signaling Int J Radiat Oncol Biol Phys. 86:791-799, 2013.
255. Farr K, Khalil A, Knap M, Møller D, Grau C. Development of radiation pneumopathy and generalised radiological changes after radiotherapy are independent negative prognostic factors for survival in non-small cell lung cancer patients. Radiother Oncol. 107:382-388, 2013.
256. Grantzau T, Mellemkjær L, Overgaard J. Second primary cancers after adjuvant radiotherapy in early breast cancer patients: A national population based study under the Danish Breast Cancer Cooperative Group (DBCG). Radiother Oncol. 106:42-9, 2013.
257. Grau C, Borras JM, Malicki J, Slotman B, Dunscombe P, Coffey M, Hollywood D, Guedea F, Gasparotto C, Lievens Y. Radiotherapy capacity in European countries. Lancet Oncology 14: 196-198, 2013.

258. Grau C, Høyer M, Alber M, Overgaard J, Lindegaard JC, Muren LP. Biology-guided adaptive radiotherapy (BiGART) - more than a vision? Acta Oncol. 52:1243-7, 2013.
259. Grau C. The model-based approach to clinical studies in particle radiotherapy - a new concept in evidence based radiation oncology? Radiother Oncol. 107:265-6, 2013.
260. Havelund BM, Holdgaard PC, Rafaelsen SR, Mortensen LS, Theil J, Bender D, Pløen J, Spindler KL, Jakobsen A. Tumour hypoxia imaging with 18F-fluoroazomycinarabinofuranoside PET/CT in patients with locally advanced rectal cancer. Nucl Med Commun. 34:155-61, 2013.
261. Havelund BM, Olsen DA, Andersen RF, Spindler KL, Brandslund I, Jakobsen A, Soerensen FB. The Influence of Tissue Ischemia on Biomarker Expression in Colorectal Cancer. Appl Immunohistochem Mol Morphol. 21:298-307, 2013.
262. Iversen AB, Busk M, Horsman MR. Induction of hypoxia by vascular disrupting agents and the significance for their combination with radiation therapy. Acta Oncol. 52:1320-6, 2013.
263. Jeppesen SS, Schytte T, Jensen HR, Brink C, Hansen O. Stereotactic body radiation therapy versus conventional radiation therapy in patients with early stage non-small cell lung cancer: an updated retrospective study on local failure and survival rates. Acta Oncol. 52:1552-8, 2013.
264. Kallehauge J, Nielsen T, Haack S, Peters DA, Mohamed S, Fokdal L, Lindegaard JC, Hansen DC, Rasmussen F, Tanderup K, Pedersen EM. Voxelwise comparison of perfusion parameters estimated using dynamic contrast enhanced (DCE) computed tomography and DCE-magnetic resonance imaging in locally advanced cervical cancer. Acta Oncol. 52:1360-8, 2013.
265. Korsager AS, Carl J, Ostergaard LR. MR-CT registration using a Ni-Ti prostate stent in image-guided radiotherapy of prostate cancer. Med Phys. 40: , 2013.
266. Korsager AS, Stephansen UL, Carl J, Ostergaard LR. The use of an active appearance model for automated prostate segmentation in magnetic resonance. Acta Oncol. 52:1374-7, 2013.
267. Lassen P, Overgaard J, Eriksen JG. Expression of EGFR and HPV-associated p16 in oropharyngeal carcinoma: Correlation and influence on prognosis after radiotherapy in the randomized DAHANCA 5 and 7 trials. Radiother Oncol. 108:489-94, 2013.
268. Lindegaard JC, Fokdal LU, Nielsen SK, Juul-Christensen J, Tanderup K. MRI-guided adaptive radiotherapy in locally advanced cervical cancer from a Nordic perspective. Acta Oncol. 52:1510-9, 2013.
269. Lønbro S, Dalgas U, Primdahl H, Johansen J, Nielsen JL, Aagaard P, Hermann AP, Overgaard J, Overgaard K. Progressive resistance training rebuilds lean body mass in head and neck cancer patients after radiotherapy - Results from the randomized DAHANCA 25B trial. Radiother Oncol. 108:314-9, 2013.
270. Lønbro S, Dalgas U, Primdahl H, Johansen J, Nielsen JL, Overgaard J, Overgaard K. Lean body mass and muscle function in head and neck cancer patients and healthy individuals - results from the DAHANCA 25 study. Acta Oncol. 52:1543-51, 2013.
271. Lønbro S, Dalgas U, Primdahl H, Overgaard J, Overgaard K. Feasibility and efficacy of progressive resistance training and dietary supplements in radiotherapy treated head and neck cancer patients - the DAHANCA 25A study. Acta Oncol. 52:310–18, 2013.

272. Lund JL, Frøslev T, Deleuran T, Erichsen R, Nilsson T, Pedersen AN, Høyer M. Validity of the Danish National Registry of Patients for chemotherapy reporting among colorectal cancer patients is high. Clin Epidemiol. 5:327-34, 2013.
273. Lyhne NM, Christensen A, Alanin MC, Bruun MT, Jung TH, Bruhn MA, Jespersen JB, Kristensen CA, Andersen E, Godballe C, Buchwald C, Bundgaard T, Johansen J, Lambertsen K, Primdahl H, Toustrup K, Sørensen JA, Overgaard J, Grau C. Waiting times for diagnosis and treatment of head and neck cancer in Denmark in 2010 compared to 1992 and 2002. Eur J Cancer. 49:1627-33, 2013.
274. Lyngholm CD, Christiansen PM, Damsgaard TE, Overgaard J. Long-term follow-up of late morbidity, cosmetic outcome and body image after breast conserving therapy. A study from the Danish Breast Cancer Cooperative Group (DBCG). Acta Oncol. 52:259–269, 2013.
275. Maraldo MV, Aznar MC, Vogelius IR, Petersen PM, Specht L. Involved node radiation therapy: an effective alternative in early-stage hodgkin lymphoma. Int J Radiat Oncol Biol Phys. 85:1057-65, 2013.
276. Maraldo MV, Brodin NP, Aznar MC, Vogelius IR, Munck Af Rosenschöld P, Petersen PM, Specht L. Estimated risk of cardiovascular disease and secondary cancers with modern highly conformal radiotherapy for early-stage mediastinal Hodgkin lymphoma. Ann Oncol. 24:2113-8, 2013.
277. Maraldo MV, Brodin P, Aznar MC, Vogelius IR, Munck af Rosenschöld P, Petersen PM, Specht L. Doses to carotid arteries after modern radiation therapy for Hodgkin lymphoma: is stroke still a late effect of treatment? Int J Radiat Oncol Biol Phys. 87:297-303, 2013.
278. Mohamed S, Nielsen SK, Fokdal LU, Pedersen EM, Lindegaard JC, Tanderup K. Feasibility of applying a single treatment plan for both fractions in PDR image guided brachytherapy in cervix cancer Radiother Oncol. 107:32-8, 2013.
279. Mortensen HR, Jensen K, Aksglæde, K., Behrens M, Grau C. Late dysphagia after IMRT for head and neck cancer and correlation with dose-volume parameters. Radiother Oncol. 107:288-294, 2013.
280. Mortensen HR, Jensen K, Grau C. Aspiration pneumonia in patients treated with radiotherapy for head and neck cancer. Acta Oncol. 52:270–76, 2013.
281. Mortensen HR, Overgaard J, Jensen K, Specht L, Overgaard M, Johansen J, Evensen JF, Andersen E, Andersen LJ, Hansen HS, Grau C; DAHANCA Group. Factors associated with acute and late dysphagia in the DAHANCA 6 & 7 randomized trial with accelerated radiotherapy for head and neck cancer. Acta Oncol. 52:1535-42, 2013.
282. Muren LP, Rossi C, Hug E, Lee A, Glimelius B. Establishing and expanding the indications for proton and particle therapy. Acta Oncol. 52:459-62, 2013.
283. Muren LP, Thwaites DI. The on-going quest for treatment precision and conformality in radiotherapy. Radiother Oncol. 109:337-41, 2013.
284. Myhre S, Lingjærde OC, Hennessy BT, Aure MR, Carey MS, Alsner J, Tramm T, Overgaard J, Mills GB, Børresen-Dale AL, Sørlie T. Influence of DNA copy number and mRNA levels on the expression of breast cancer related proteins. Mol Oncol. 7:704-18, 2013.

285. Nawroth I, Alsner J, Deleuran BW, Dagnaes-Hansen F, Yang C, Horsman MR, Overgaard J, Howard KA, Kjems J, Gao S. Peritoneal macrophages mediated delivery of chitosan/siRNA nanoparticle to the lesion site in a murine radiation-induced fibrosis model. Acta Oncol. 52:1730-8, 2013.
286. Nesvacil N, Tanderup K, Hellebust TP, De Leeuw A, Lang S, Mohamed S, Jamema SV, Anderson C, Pötter R, Kirisits C. A multicentre comparison of the dosimetric impact of inter- and intra-fractional anatomical variations in fractionated cervix cancer brachytherapy. Radiother Oncol. 107:20-5, 2013.
287. Nielsen MS, Nyström MW, Carl J. Potential position errors using fiducial markers for gated image guided radiotherapy. Acta Oncol. 52:1472-6, 2013.
288. Nielsen T, Nielsen NC, Holm TH, Ostergaard L, Horsman MR, Busk M. Ultra-high field 1H magnetic resonance imaging approaches for acute hypoxia. Acta Oncol. 52:1287-92, 2013.
289. Nissen HD, Appelt AL. Improved heart, lung and target dose with deep inspiration breath hold in a large clinical series of breast cancer patients. Radiother Oncol. 106:28-32, 2013.
290. Nygaard DE, Persson GF, Brink C, Specht L, Korreman SS. Evaluation of methods for selecting the midventilation bin in 4DCT scans of lung cancer patients. Acta Oncol. 52:1715-22, 2013.
291. Offersen BV, Nielsen HM, Overgaard M, Overgaard J. Is regional nodes radiotherapy an alternative to surgery? Breast. 22:S118-28, 2013.
292. Østergaard L, Tietze A, Nielsen T, Drasbek KR, Mouridsen K, Jespersen SN, Horsman MR. The Relationship between Tumor Blood Flow, Angiogenesis, Tumor Hypoxia, and Aerobic Glycolysis. Cancer Res 73: 5618-24, 2013.
293. Overgaard J. The heat is (still) on--the past and future of hyperthermic radiation oncology. Radiother Oncol. 109:185-7, 2013.
294. Pagh A, Vedtofte T, Lynggaard CD, Rubek N, Lonka M, Johansen J, Andersen E, Kristensen CA, von Buchwald C, Andersen M, Godballe C, Overgaard J, Grau C. The value of routine follow-up after treatment for head and neck cancer. A National Survey from DAHANCA. Acta Oncol. 52:277-84, 2013.
295. Ravkilde T, Keall PJ, Grau C, Høyer M, Poulsen PR. Time-resolved dose reconstruction by motion encoding of volumetric modulated arc therapy fields delivered with and without dynamic multileaf collimator tracking. Acta Oncol. 52:1497-503, 2013.
296. Ravkilde T, Keall PJ, Grau C, Høyer M, Poulsen PR. Time-resolved dose distributions to moving targets during volumetric modulated arc therapy with and without dynamic MLC tracking. Med Phys. 40:111723, 2013.
297. Ravn S, Holmberg M, Sørensen P, Frøkjær JB, Carl J. Differences in supratentorial white matter diffusion after radiotherapy - new biomarker of normal brain tissue damage? Acta Oncol. 52:1314-9, 2013.
298. Rønjom MF, Brink C, Bentzen SM, Hegedüs L, Overgaard J, Johansen J. Hypothyroidism after primary radiotherapy for head and neck squamous cell carcinoma: normal tissue complication probability modeling with latent time correction. Radiother Oncol. 109:317-22, 2013.

299. Sapru S, Mohamed S, Fokdal L, Nkiwane K, Swamidas J, Mahantshetty U, Kirisits C, Pötter R, Christian Lindegaard J, Tanderup K. Dose to the non-involved uterine corpus with MRI guided brachytherapy in locally advanced cervical cancer. Radiother Oncol. 107:93-8, 2013.
300. Schmidt ML, Hoffmann L, Kandi M, Møller DS, Poulsen PR. Dosimetric impact of respiratory motion, interfraction baseline shifts, and anatomical changes in radiotherapy of non-small cell lung cancer. Acta Oncol. 52:1490-6, 2013.
301. Skyt PS, Petersen JB, Yates ES, Poulsen PR, Ravkilde TL, Balling P, Muren LP. Dosimetric verification of complex radiotherapy with a 3D optically based dosimetry system: Dose painting and target tracking. Acta Oncol. 52:1445-50, 2013.
302. Søes S, Sørensen BS, Alsner J, Overgaard J, Hager H, Hansen LL, Kristensen LS. Identification of accurate reference genes for RT-qPCR analysis of formalin-fixed paraffin-embedded tissue from primary Non-Small Cell Lung Cancers and brain and lymph node metastases. Lung Cancer. 81:180-6, 2013.
303. Sørensen BS, Busk M, Olthof N, Speel EJ, Horsman MR, Alsner J, Overgaard J. Radiosensitivity and effect of hypoxia in HPV positive head and neck cancer cells. Radiother Oncol. 108:500-5, 2013.
304. Sørensen BS, Overgaard J, Bassler N. In response to the commentary 'Particle species dependence of cell survival relative biological effectiveness: Evident and not negligible' by Thomas Friedrich, Marco Durante & Michael Scholz. Acta Oncol. 52:591, 2013.
305. Tanderup K, Beddar S, Andersen CE, Kertzscher G, Cygler JE. In vivo dosimetry in brachytherapy. Med Phys. 40: , 2013.
306. Tanderup K, Nesvacil N, Pötter R, Kirisits C. Uncertainties in image guided adaptive cervix cancer brachytherapy: Impact on planning and prescription. Radiother Oncol. 107:1-5, 2013.
307. Tehrani JN, O'Brien RT, Poulsen PR, Keall P. Real-time estimation of prostate tumor rotation and translation with a kV imaging system based on an iterative closest point algorithm. Phys Med Biol. 58:8517-33, 2013.
308. Thing RS, Bernchou U, Mainegra-Hing E, Brink C. Patient-specific scatter correction in clinical cone beam computed tomography imaging made possible by the combination of Monte Carlo simulations and a ray tracing algorithm. Acta Oncol. 52:1477-83, 2013.
309. Thor M, Apte A, Deasy JO, Karlsdóttir À, Moiseenko V, Liu M, Muren LP. Dose/volume-response relations for rectal morbidity using planned and simulated motion-inclusive dose distributions. Radiother Oncol. 109:388-93, 2013.
310. Thor M, Apte A, Deasy JO, Muren LP. Statistical simulations to estimate motion-inclusive dose-volume histograms for prediction of rectal morbidity following radiotherapy. Acta Oncol. 52:666-75, 2013.
311. Thor M, Bentzen L, Hysing LB, Ekanger C, Helle SI, Karlsdóttir A, Muren LP. Prediction of rectum and bladder morbidity following radiotherapy of prostate cancer based on motion-inclusive dose distributions. Radiother Oncol. 107:147-52, 2013.
312. Thörnqvist S, Hysing LB, Zolnay AG, Söhn M, Hoogeman MS, Muren LP, Heijmen BJ. Adaptive radiotherapy in locally advanced prostate cancer using a statistical deformable motion model. Acta Oncol. 52:1423-9, 2013.

313. Thörnqvist S, Hysing LB, Zolnay AG, Söhn M, Hoogeman MS, Muren LP, Bentzen L, Heijmen BJ. Treatment simulations with a statistical deformable motion model to evaluate margins for multiple targets in radiotherapy for high-risk prostate cancer. Radiother Oncol. 109:344-9, 2013.
314. Thörnqvist S, Muren LP, Bentzen L, Hysing LB, Høyer M, Grau C, Petersen JB. Degradation of target coverage due to inter-fraction motion during intensity-modulated proton therapy of prostate and elective targets. Acta Oncol. 52:521-7, 2013.
315. Thorsen LB, Thomsen MS, Overgaard M, Overgaard J, Offersen BV; on behalf of the Danish Breast Cancer Cooperative Group Radiotherapy Committee. Quality assurance of conventional non-CT-based internal mammary lymph node irradiation in a prospective Danish Breast Cancer Cooperative Group trial: The DBCG-IMN study. Acta Oncol. 52:1526-34, 2013.
316. Tramm T, Hennig G, Kyndi M, Alsner J, Sørensen FB, Myhre S, Sørlie T, Overgaard J. Reliable PCR quantitation of estrogen, progesterone and ERBB2 receptor mRNA from formalin-fixed, paraffin-embedded tissue is independent of prior macro-dissection. Virchows Arch. 463:775-86, 2013.
317. Tramm T, Sørensen BS, Overgaard J, Alsner J. Optimal Reference Genes for Normalization of qRT-PCR Data from Archival Formalin-fixed, Paraffin-embedded Breast Tumors Controlling for Tumor Cell Content and Decay of mRNA. Diagn Mol Pathol. 22:181-7, 2013.
318. Vestergaard A, Muren LP, Søndergaard J, Elstrøm UV, Høyer M, Petersen JB. Adaptive plan selection vs. re-optimisation in radiotherapy for bladder cancer: adose accumulation comparison. Radiother Oncol. 109:457-62, 2013.
319. Vogelius IR, Bentzen SM. Meta-analysis of the Alpha/Beta Ratio for Prostate Cancer in the Presence of an Overall Time Factor: Bad News, Good News, or No News? Int J Radiat Oncol Biol Phys. 85:89-94, 2013.
320. Vogelius IR, Håkansson K, Due AK, Aznar MC, Berthelsen AK, Kristensen CA, Rasmussen J, Specht L, Bentzen SM. Failure-probability driven dose painting. Med Phys. 40:081717, 2013.
321. Wiechec E, Overgaard J, Kjeldsen E, Hansen LL. Chromosome 1q25.3 copy number alterations in primary breast cancers detected by multiplex ligation-dependent probe amplification and allelic imbalance assays and its comparison with fluorescent in situ hybridization assays. Cell Oncol 36:113-20, 2013.
322. Winther M, Alsner J, Tramm T, Nordsmark M. Hypoxia-regulated gene expression and prognosis in loco-regional gastroesophageal cancer. Acta Oncol. 52:1327-35, 2013.
323. Worm ES, Høyer M, Fledelius W, Hansen AT, Poulsen PR. Variations in magnitude and directionality of respiratory target motion throughout full treatment courses of stereotactic body radiotherapy for tumors in the liver. Acta Oncol. 52:1437-44, 2013.
324. Worm ES, Høyer M, Fledelius W, Poulsen PR. Three-dimensional, Time-Resolved, Intrafraction Motion Monitoring Throughout Stereotactic Liver Radiation Therapy on a Conventional Linear Accelerator. Int J Radiat Oncol Biol Phys. 86:190-7, 2013.

2014

325. Aggerholm-Pedersen N, Safwat A, Bærentzen S, Nordsmark M, Nielsen OS, Alsner J, Sørensen BS. The importance of reference gene analysis of formalin-fixed, paraffin-embedded samples from sarcoma patients - an often underestimated problem. Transl Oncol. 7:687-93, 2014.
326. Appelt AL, Bentzen SM, Jakobsen A, Vogelius IR. Dose-response of acute urinary toxicity of long-course preoperative chemoradiotherapy for rectal cancer. Acta Oncol. 30:1-8, 2014.
327. Appelt AL, Vogelius IR, Farr KP, Khalil AA, Bentzen SM. Towards individualized dose constraints: Adjusting the QUANTEC radiation pneumonitis model for clinical risk factors. Acta Oncol. 53:605-12, 2014.
328. Appelt AL, Vogelius IR, Pløen J, Rafaelsen SR, Lindebjerg J, Havelund BM, Bentzen SM, Jakobsen A. Long-term results of a randomized trial in locally advanced rectal cancer: no benefit from adding a brachytherapy boost. Int J Radiat Oncol Biol Phys. 90:110-8, 2014.
329. Assenholt MS, Vestergaard A, Kallehauge JF, Mohamed S, Nielsen SK, PetersenJB, Fokdal L, Lindegaard JC, Tanderup K. Proof of principle: Applicator-guidedstereotactic IMRT boost in combination with 3D MRI-based brachytherapy in locally advanced cervical cancer. Brachytherapy. 14:50-56, 2014.
330. Aznar MC, Persson GF, Kofoed IM, Nygaard DE, Korreman SS. Irregular breathing during 4DCT scanning of lung cancer patients: is the midventilation approach robust? Phys Med. 30:69-75, 2014.
331. Bassler N, Hansen DC, Lühr A, Thomsen B, Petersen JBB, Sobolevsky N. SHIELD-HIT12A - a Monte Carlo particle transport program for ion therapy research. Journal of Physics: Conference Series (in press).
332. Bassler N, Toftegaard J, Lühr A, Sørensen BS, Scifoni E, Krämer M, Jäkel O,Mortensen LS, Overgaard J, Petersen JB. LET-painting increases tumour control probability in hypoxic tumours. Acta Oncol. 53: 25-32, 2014.
333. Baumann M, Overgaard J. What next? Radiother Oncol. 110: 1-2, 2014.
334. Brink C, Bernchou U, Bertelsen A, Hansen O, Schytte T, Bentzen SM. Locoregional Control of Non-Small Cell Lung Cancer in Relation to Automated Early Assessment of Tumor Regression on Cone Beam Computed Tomography. Int J Radiat Oncol Biol Phys. 14:395-402, 2014.
335. Brix L, Ringgaard S, Sørensen TS, Poulsen PR. Three-dimensional liver motion tracking using real-time two-dimensional MRI. Med Phys. 41:042302, 2014.
336. Brodin NP, Maraldo MV, Aznar MC, Vogelius IR, Petersen PM, Bentzen SM, Specht L. Interactive decision-support tool for risk-based radiation therapy plan comparison for Hodgkin lymphoma. Int J Radiat Oncol Biol Phys. 88:433-45, 2014.
337. Brodin NP, Munck af Rosenschöld P, Blomstrand M, Kiil-Berthlesen A, Hollensen C, Vogelius IR, Lannering B, Bentzen SM, Björk-Eriksson T. Hippocampal sparing radiotherapy for pediatric medulloblastoma: impact of treatment margins and treatment technique. Neuro Oncol. 16:594-602, 2014.

338. Brodin NP, Vogelius IR, Björk-Eriksson T, Munck Af Rosenschöld P, Maraldo MV, Aznar MC, Specht L, Bentzen SM. Optimizing the radiation therapy dose prescription for pediatric medulloblastoma: minimizing the life years lost attributable to failure to control the disease and late complication risk. Acta Oncol. 53:462-70, 2014.
339. Bøje CR, Dalton SO, Primdahl H, Kristensen CA, Andersen E, Johansen J, Andersen LJ, Overgaard J. Evaluation of comorbidity in 9388 head and neck cancer patients: a national cohort study from the DAHANCA database. Radiother Oncol. 110:91-97, 2014.
340. Bøje CR. Impact of comorbidity on treatment outcome in head and neck squamous cell carcinoma - A systematic review. Radiother Oncol. 110:81-90, 2014.
341. Carl J, Sander L. Five-year follow-up using a prostate stent as fiducial in image-guided radiotherapy of prostate cancer. Acta Oncol. Dec 24:1-6, 2014.
342. Casares-Magaz O, Toftegaard J, Muren LP, Kallehauge JF, Bassler N, Poulsen PR, Petersen JB. A method for selection of beam angles robust to intra-fractional motion in proton therapy of lung cancer. Acta Oncol. 53:1058-63, 2014.
343. Deasy JO, Muren LP. Advancing our quantitative understanding of radiotherapy normal tissue morbidity. Acta Oncol. 53:577-9, 2014.
344. Due AK, Vogelius IR, Aznar MC, Bentzen SM, Berthelsen AK, Korreman SS, Loft A, Kristensen CA, Specht L. Recurrences after intensity modulated radiotherapy for head and neck squamous cell carcinoma more likely to originate from regions with high baseline [18F]-FDG uptake. Radiother Oncol. 111:360-5, 2014.
345. Dunscombe P, Grau C, Defourny N, Malicki J, Borras JM, Coffey M, Bogusz M, Gasparotto C, Slotman B, Lievens Y; HERO consortium; HERO consortium. Guidelines for equipment and staffing of radiotherapy facilities in the European countries: Final results of the ESTRO-HERO survey. Radiother Oncol. 112:165-77, 2014.
346. Elstrøm UV, Olsen SR, Muren LP, Petersen JB, Grau C. The impact of CBCT reconstruction and calibration for radiotherapy planning in the head and neck region - a phantom study. Acta Oncol. 53:1114-24, 2014.
347. Eriksen JG, Salembier C, Rivera S, De Bari B, Berger D, Mantello G, Müller AC, Martin AN, Pasini D, Tanderup K, Palmu M, Verfaillie C, Pötter R, Valentini V; ESTRO. Four years with FALCON - an ESTRO educational project: achievements and perspectives. Radiother Oncol. 112:145-9, 2014.
348. Falk M, Pommer T, Keall P, Korreman S, Persson G, Poulsen P, Munck af Rosenschöld P. Motion management during IMAT treatment of mobile lung tumors—a comparison of MLC tracking and gated delivery. Med Phys. 41:101707, 2014.
349. Fledelius W, Worm E, Høyer M, Grau C, Poulsen PR. Real-time segmentation of multiple implanted cylindrical liver markers in kilovoltage and megavoltage x-ray images. Phys Med Biol. 11:2787-800, 2014.
350. Fokdal L, Ortoft G, Hansen ES, Røhl L, Pedersen EM, Tanderup K, Lindegaard JC. Toward four-dimensional image-guided adaptive brachytherapy in locally recurrent endometrial cancer. Brachytherapy. 13:554-61, 2014.

351. Glimelius B, Johansen C, Muren LP, Nilbert M. Acta Oncologica and a new generation of scientists in oncology. Acta Oncol. 53:849-51, 2014.
352. Grantzau T, Overgaard J. Risk of second non-breast cancer after radiotherapy for breast cancer: A systematic review and meta-analysis of 762,468 patients. Radiother Oncol. 2014 Nov 7.
353. Grantzau T, Thomsen MS, Væth M, Overgaard J. Risk of second primary lung cancer in women after radiotherapy for breast cancer. Radiother Oncol. 111:366-73, 2014.
354. Grau C, Defourny N, Malicki J, Dunscombe P, Borras JM, Coffey M, Slotman B, Bogusz M, Gasparotto C, Lievens Y; HERO consortium; HERO consortium. Radiotherapy equipment and departments in the European countries: Final results from the ESTRO-HERO survey. Radiother Oncol. 112:155-64, 2014.
355. Grégoire V, Ang K, Budach W, Grau C, Hamoir M, Langendijk JA, Lee A, Le QT, Maingon P, Nutting C, O'Sullivan B, Porceddu SV, Lengele B. Delineation of the neck node levels for head and neck tumors: a 2013 update. DAHANCA, EORTC, HKNPCSG, NCIC CTG, NCRI, RTOG, TROG consensus guidelines. Radiother Oncol. 110:172-81, 2014.
356. Hansen CR, Bertelsen A, Riis HL, Christiansen RL, Hansen O, Sykes JB, Thwaites DI, Brink C. Plan quality and delivery accuracy of flattening filter free beam for SBRT lung treatments. Acta Oncol. Sep 19:1-6, 2014.
357. Hansen CR, Christiansen RL, Nielsen TB, Bertelsen AS, Johansen J, Brink C. Comparison of three immobilisation systems for radiation therapy in head and neck cancer. Acta Oncol. 53:423-7, 2014.
358. Hansen DC, Bassler N, Sørensen TS, Seco J. The image quality of ion computed tomography at clinical imaging dose levels. Med Phys. 41:111908, 2014.
359. Hansen DC, Petersen JB, Bassler N, Sørensen TS. Improved proton computed tomography by dual modality image reconstruction. Med Phys. 41:031904, 2014.
360. Hansen O, Schytte T, Nielsen M, Brink C. Age dependent prognosis in concurrent chemo-radiation of locally advanced NSCLC. Acta Oncol. Oct 7:1-7, 2014.
361. Haack S, Kallehauge JF, Jespersen SN, Lindegaard JC, Tanderup K, Pedersen EM. Correction of diffusion-weighted magnetic resonance imaging for brachytherapy of locally advanced cervical cancer. Acta Oncol. 53:1073-8, 2014.
362. Håkansson K, Specht L, Aznar MC, Rasmussen JH, Bentzen SM, Vogelius IR. Prescribing and evaluating target dose in dose-painting treatment plans. Acta Oncol. 53:1251-6, 2014.
363. Kaidar-Person O, Poortmans P, Klimberg S, Haviland J, Offersen B, Audisio R, Yarnold J. Haste makes waste: are the data regarding TARGIT-A IORT ready for prime time? Breast Cancer Res Treat. 147:221-2, 2014.
364. Kaidar-Person O, Yarnold J, Offersen BV, Poortmans P. Is current evidence about intraoperative partial breast irradiation sufficient for broad implementation in clinical practice? Eur J Surg Oncol. 40:791-3, 2014.
365. Kallehauge JF, Tanderup K, Duan C, Haack S, Pedersen EM, Lindegaard JC, Fokdal LU, Mohamed SM, Nielsen T. Tracer kinetic model selection for dynamic contrast-enhanced magnetic resonance imaging of locally advanced cervical cancer. Acta Oncol. 53:1064-72, 2014.

366. Kertzscher G, Andersen CE, Tanderup K. Adaptive error detection for HDR/PDR brachytherapy: guidance for decision making during real-time in vivo point dosimetry. Med Phys. 41:052102, 2014.
367. Kertzscher G, Rosenfeld A, Beddar S, Tanderup K, Cygler JE. In vivo dosimetry: trends and prospects for brachytherapy. Br J Radiol. 87:20140206, 2014.
368. Kirchheiner K, Nout RA, Tanderup K, Lindegaard JC, Westerveld H, Haie-Meder C, Petrič P, Mahantshetty U, Dörr W, Pötter R. Manifestation pattern of early-late vaginal morbidity after definitive radiation (chemo)therapy and image-guided adaptive brachytherapy for locally advanced cervical cancer: an analysis from the EMBRACE study. Int J Radiat Oncol Biol Phys. 89:88-95, 2014.
369. Kirisits C, Rivard MJ, Baltas D, Ballester F, De Brabandere M, van der Laarse R, Niatsetski Y, Papagiannis P, Hellebust TP, Perez-Calatayud J, Tanderup K,Venselaar JL, Siebert FA. Review of clinical brachytherapy uncertainties:analysis guidelines of GEC-ESTRO and the AAPM. Radiother Oncol. 110:199-212, 2014.
370. Lassen P, Primdahl H, Johansen J, Kristensen CA, Andersen E, Andersen LJ, Evensen JF, Eriksen JG, Overgaard J; Danish Head and Neck Cancer Group (DAHANCA). Impact of HPV-associated p16-expression on radiotherapy outcome in advanced oropharynx and non-oropharynx cancer. Radiother Oncol. 2014 113:310-6, 2014.
371. Lievens Y, Defourny N, Coffey M, Borras JM, Dunscombe P, Slotman B, Malicki J, Bogusz M, Gasparotto C, Grau C; HERO consortium; HERO consortium. Radiotherapy staffing in the European countries: Final results from the ESTRO-HERO survey. Radiother Oncol. 112:178-86, 2014.
372. Lievens Y, Dunscombe P, Defourny N, Gasparotto C, Borras JM, Grau C. HERO (Health Economics in Radiation Oncology): A Pan-European Project on Radiotherapy Resources and Needs. Clin Oncol (R Coll Radiol). 2014 Nov 20.
373. Lorenzen EL, Ewertz M, Brink C. Automatic segmentation of the heart in radiotherapy for breast cancer. Acta Oncol. 53:1366-72, 2014.
374. Lühr A, Priegnitz M, Fiedler F, Sobolevsky N, Bassler N. Dependence of simulated positron emitter yields in ion beam cancer therapy on modeling nuclear fragmentation. Appl Radiat Isot. 83:165-170, 2014.
375. Lønbro S. The effect of progressive resistance training on lean body mass in post-treatment cancer patients - A systematic review. Radiother Oncol. 110:71-80, 2014.
376. Malinen E, Muren LP. Image guided therapy - do we get the picture? Acta Oncol. 53:3-5, 2014.
377. Maraldo MV, Brodin NP, Aznar MC, Vogelius IR, Munck Af Rosenschöld P, Petersen PM, Specht L. Doses to head and neck normal tissues for early stage Hodgkin lymphoma after involved node radiotherapy. Radiother Oncol. 110:441-7, 2014.
378. Maraldo MV, Jørgensen M, Brodin NP, Aznar MC, Vogelius IR, Petersen PM, Berthelsen AK, Christensen CB, Hjalgrim LL, Specht L. The impact of involved node, involved field and mantle field radiotherapy on estimated radiation doses and risk of late effects for pediatric patients with Hodgkin lymphoma. Pediatr Blood Cancer. 61:717-22, 2014.

379. Metwally MA, Frederiksen KD, Overgaard J. Compliance and toxicity of the hypoxic radiosensitizer nimorazole in the treatment of patients with head and neck squamous cell carcinoma (HNSCC). Acta Oncol. 53:654-61, 2014.
380. Metwally MA, Jansen JA, Overgaard J. Study of the Population Pharmacokinetic Characteristics of Nimorazole in Head and Neck Cancer Patients Treated in the DAHANCA-5 Trial. Clin Oncol (R Coll Radiol). 2014 Dec 16.
381. Muren LP, Teräs M, Knuuti J. NACP 2014 and the Turku PET symposium: the interaction between therapy and imaging. Acta Oncol. 53:993-6, 2014.
382. Nielsen TB, Hansen O, Schytte T, Brink C. Four-dimensional dose evaluation of inhomogeneous dose distributions planned for non-small cell lung cancer patients with lymph node involvement. Acta Oncol. 53:707-12, 2014.
383. Nielsen TB, Hansen O, Schytte T, Brink C. Inhomogeneous dose escalation increases expected local control for NSCLC patients with lymph node involvement without increased mean lung dose. Acta Oncol. 53:119-25, 2014.
384. Nygren MK, Tekle C, Ingebrigtsen VA, Mäkelä R, Krohn M, Aure MR, Nunes-Xavier CE, Perälä M, Tramm T, Alsner J, Overgaard J, Nesland JM, Borgen E, Børresen-Dale AL, Fodstad Ø, Sahlberg KK, Leivonen SK. Identifying microRNAs regulating B7-H3 in breast cancer: the clinical impact of microRNA-29c. Br J Cancer. 110:2072-80, 2014.
385. Overgaard J. Radiotherapy: Gazing at the crystal ball of European radiotherapy. Nat Rev Clin Oncol. 2015 Jan;12(1):5-6. doi:10.1038/nrclinonc.2014.205. Epub 2014 Nov 25. PubMed PMID: 25421280.
386. Petersen SE, Bentzen L, Emmertsen KJ, Laurberg S, Lundby L, Høyer M. Development and validation of a scoring system for late anorectal side-effects in patients treated with radiotherapy for prostate cancer. Radiother Oncol. 111:94-9, 2014.
387. Petersen SE, Bregendahl S, Langschwager M, Laurberg S, Brock C, Drewes AM, Krogh K, Høyer M, Lundby L. Pathophysiology of late anorectal dysfunction following external beam radiotherapy for prostate cancer. Acta Oncol. 53:1398-404, 2014.
388. Pettersen EO, Ebbesen P, Gieling RG, Williams KJ, Dubois L, Lambin P, Ward C, Meehan J, Kunkler IH, Langdon SP, Ree AH, Flatmark K, Lyng H, Calzada MJ, Peso LD, Landazuri MO, Görlach A, Flamm H, Kieninger J, Urban G, Weltin A, Singleton DC, Haider S, Buffa FM, Harris AL, Scozzafava A, Supuran CT, Moser I, Jobst G, Busk M, Toustrup K, Overgaard J, Alsner J, Pouyssegur J, Chiche J, Mazure N, Marchiq I, Parks S, Ahmed A, Ashcroft M, Pastorekova S, Cao Y, Rouschop KM, Wouters BG, Koritzinsky M, Mujcic H, Cojocari D. Targeting tumour hypoxia to prevent cancer metastasis. From biology, biosensing and technology to drug development: the METOXIA consortium. J Enzyme Inhib Med Chem. Oct 27:1-33, 2014.
389. Poulsen PR, Worm ES, Petersen JB, Grau C, Fledelius W, Høyer M. Kilovoltage intrafraction motion monitoring and target dose reconstruction for stereotactic volumetric modulated arc therapy of tumors in the liver. Radiother Oncol. 111:424-30, 2014.

390. Quigley DA, Fiorito E, Nord S, Van Loo P, Alnæs GG, Fleischer T, Tost J, Moen Vollan HK, Tramm T, Overgaard J, Bukholm IR, Hurtado A, Balmain A, Børresen-Dale AL, Kristensen V. The 5p12 breast cancer susceptibility locus affects MRPS30 expression in estrogen-receptor positive tumors. Mol Oncol. 8:273-84, 2014.
391. Ravkilde T, Keall PJ, Grau C, Høyer M, Poulsen PR. Fast motion-including dose error reconstruction for VMAT with and without MLC tracking. Phys Med Biol. 59:7279-96, 2014.
392. Ravn S, Holmberg M, Sørensen P, Frokjaer JB, Carl J. Presurgical functional magnetic resonance imaging in patients with brain tumors. Acta Radiol. 2014 Dec 18.
393. Ringbæk TP, Weber U, Petersen JB, Thomsen B, Bassler N. Monte Carlosimulations of new 2D ripple filters for particle therapy facilities. Acta Oncol. 53:40-9, 2014.
394. Rosenstein BS, West CM, Bentzen SM, Alsner J, Andreassen CN, Azria D, Barnett GC, Baumann M, Burnet N, Chang-Claude J, Chuang EY, Coles CE, Dekker A, De Ruyck K, De Ruysscher D, Drumea K, Dunning AM, Easton D, Eeles R, Fachal L,Gutiérrez-Enríquez S, Haustermans K, Henríquez-Hernández LA, Imai T, Jones GD, Kerns SL, Liao Z, Onel K, Ostrer H, Parliament M, Pharoah PD, Rebbeck TR, Talbot CJ, Thierens H, Vega A, Witte JS, Wong P, Zenhausern F; Radiogenomics Consortium.Radiogenomics: radiobiology enters the era of big data and team science. Int J Radiat Oncol Biol Phys. 89:709-13, 2014.
395. Sander L, Langkilde NC, Holmberg M, Carl J. MRI target delineation may reduce long-term toxicity after prostate radiotherapy. Acta Oncol. 53:809-14, 2014.
396. Schmidt ML, Poulsen PR, Toftegaard J, Hoffmann L, Hansen D, Sørensen TS. Clinical use of iterative 4D-cone beam computed tomography reconstructions to investigate respiratory tumor motion in lung cancer patients. 53:1107-13, 2014.
397. Schytte T, Nielsen TB, Brink C, Hansen O. Pattern of loco-regional failure: after definitive radiotherapy for non-small cell lung cancer. Acta Oncol. 53:336-41, 2014.
398. Serup-Hansen E, Linnemann D, Skovrider-Ruminski W, Høgdall E, Geertsen PF, Havsteen H. Human Papillomavirus Genotyping and p16 Expression As Prognostic Factors for Patients With American Joint Committee on Cancer Stages I to III Carcinoma of the Anal Canal. J Clin Oncol. 32:1812-17, 2014.
399. Skripcak T, Belka C, Bosch W, Brink C, Brunner T, Budach V, Büttner D, Debus J, Dekker A, Grau C, Gulliford S, Hurkmans C, Just U, Krause M, Lambin P, Langendijk JA, Lewensohn R, Lühr A, Maingon P, Masucci M, Niyazi M, Poortmans P, Simon M, Schmidberger H, Spezi E, Stuschke M, Valentini V, Verheij M, Whitfield G, Zackrisson B, Zips D, Baumann M. Creating a data exchange strategy for radiotherapy research: Towards federated databases and anonymised public datasets. Radiother Oncol. 113:303-309, 2014.
400. Stokkevåg CH, Engeseth GM, Ytre-Hauge KS, Röhrich D, Odland OH, Muren LP, Brydøy M, Hysing LB, Szostak A, Palmer MB, Petersen JB. Estimated risk of radiation-induced cancer following paediatric cranio-spinal irradiation with electron, photon and proton therapy. Acta Oncol. 53:1048-57, 2014.

401. Søndergaard J, Holmberg M, Jakobsen AR, Agerbæk M, Muren LP, Høyer M. A comparison of morbidity following conformal versus intensity-modulated radiotherapy for urinary bladder cancer. Acta Oncol. 53:1321-8, 2014.
402. Sørensen BS, Busk M, Horsman MR, Alsner J, Overgaard J, Kyle AH, Minchinton AI. Effect of radiation on cell proliferation and tumor hypoxia in HPV-positive head and neck cancer in vivo models. Anticancer Res. 34:6297-304,, 2014.
403. Tanderup K, Eifel PJ, Yashar CM, Pötter R, Grigsby PW. Curative radiationtherapy for locally advanced cervical cancer: brachytherapy is NOT optional. Int J Radiat Oncol Biol Phys. 88:537-9, 2014.
404. Tanderup K, Viswanathan AN, Kirisits C, Frank SJ. Magnetic Resonance Image Guided Brachytherapy. Semin Radiat Oncol. 24:181-191, 2014.
405. Thomsen JB, Beierholm AR, Boye K, Carl J. Comment on The Radiological Physics Center's standard dataset for small field size output factors (J Appl Clin Med Phys. 2012;13(5):282-89). J Appl Clin Med Phys. 15:4784, 2014.
406. Thomsen MS, Harrov U, Fledelius W, Poulsen PR. Inter- and intra-fraction geometric errors in daily image-guided radiotherapy of free-breathing breast cancer patients measured with continuous portal imaging. Acta Oncol. 53:802-8, 2014.
407. Thor M, Andersen ES, Petersen JB, Sørensen TS, Noe KØ, Tanderup K, Bentzen L, Elstrøm UV, Høyer M, Muren LP. Evaluation of an application for intensity-based deformable image registration and dose accumulation in radiotherapy. Acta Oncol. 53:1329-36, 2014.
408. Thorsen LB, Thomsen MS, Berg M, Jensen I, Josipovic M, Overgaard M, Overgaard J, Skogholt P, Offersen BV; Danish Breast Cancer Cooperative Group Radiotherapy committee. CT-planned internal mammary node radiotherapy in the DBCG-IMN study: benefit versus potentially harmful effects. Acta Oncol. 53:1027-34, 2014.
409. Toftegaard J, Fledelius W, Seghers D, Huber M, Brehm M, Worm ES, Elstrøm UV, Poulsen PR. Moving metal artifact reduction in cone-beam CT scans with implanted cylindrical gold markers. Med Phys. 41:121710, 2014.
410. Tramm T, Kyndi M, Myhre S, Nord S, Alsner J, Sørensen FB, Sørlie T, Overgaard J. Relationship between the prognostic and predictive value of the intrinsic subtypes and a validated gene profile predictive of loco-regional control and benefit from post-mastectomy radiotherapy in patients with high-risk breast cancer. Acta Oncol. 53:1337-46, 2014.
411. Tramm T, Mohammed H, Myhre S, Kyndi M, Alsner J, Børresen-Dale AL, Sørlie T, Frigessi A, Overgaard J. Development and validation of a gene profile predicting benefit of postmastectomy radiotherapy in patients with high-risk breast cancer: a study of gene expression in the DBCG82bc cohort. Clin Cancer Res. 20:5272-80, 2014.
412. Valentini V, Boldrini L, Damiani A, Muren LP. Recommendations on how to establish evidence from auto-segmentation software in radiotherapy. Radiother Oncol. 112:317-20, 2014.
413. Vestergaard A, Kallehauge JF, Petersen JB, Høyer M, Søndergaard J, Muren LP. An adaptive radiotherapy planning strategy for bladder cancer using deformation vector fields. Radiother Oncol. 112:371-5, 2014.

414. Vestergaard A, Muren LP, Lindberg H, Jakobsen KL, Petersen JB, Elstrøm UV, Agerbæk M, Høyer M. Normal tissue sparing in a phase II trial on daily adaptive plan selection in radiotherapy for urinary bladder cancer. Acta Oncol. 53:997-1004, 2014.
415. Vogelius IR, Bentzen SM. Hypofractionated radiation therapy for prostate cancer: more food for thought from recent trial. J Clin Oncol. 32:1852-3, 2014.
416. Wittenborn TR, Larsen EK, Nielsen T, Rydtoft LM, Hansen L, Nygaard JV, Vorup-Jensen T, Kjems J, Horsman MR, Nielsen NC. Accumulation of nano-sized particles in a murine model of angiogenesis. Biochem Biophys Res Commun. 443:470-6, 2014.
417. Wojdacz TK, Windeløv JA, Thestrup BB, Damsgaard TE, Overgaard J, Hansen L. Identification and characterization of locus-specific methylation patterns within novel loci undergoing hypermethylation during breast cancer pathogenesis. Breast Cancer Res. 16:R17, 2014.
418. Yarnold J, Offersen BV, Olivotto I, Poortmans P, Sarin R. Radiotherapy for breast cancer, the TARGIT-A trial. Lancet. 383:1717-8, 2014.

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419. Leth T, von Oettingen G, Lassen-Ramshad YA, Lukacova S, Høyer M. Survival and prognostic factors in patients treated with stereotactic radiotherapy for brain metastases. Acta Oncol. 54:107-14, 2015.
420. Mohamed S, Kallehauge J, Fokdal L, Lindegaard JC, Tanderup K. Parametrial boosting in locally advanced cervical cancer: Combined intracavitary/interstitial brachytherapy vs. intracavitary brachytherapy plus external beam radiotherapy. Brachytherapy. 14:23-8, 2015.
421. Mohamed SM, Aagaard T, Fokdal LU, Pedersen EM, Lindegaard JC, Tanderup K. Assessment of radiation doses to the para-aortic, pelvic, and inguinal lymph nodes delivered by image-guided adaptive brachytherapy in locally advanced cervical cancer. Brachytherapy. 2015 14:56-61, 2015.

Appendix 2: CIRRO affiliated PhD projects and students

List of ph.d.-projects in CIRRO. Projects in bold indicates completed projects (n=52)

1. **Appelt, Ane: Evaluation of dose plan quality with focus on prediction of side-effects following radiotherapy of lung and rectum. University of Southern Denmark, project completed 2014.**
2. **Bertelsen, Anders: Volumetric Modulated Arc Therapy (VMAT®) - advantages and disadvantages. University of Southern Denmark, project completed 2012.**
3. **Bjerre, Troels: Automated Image-Based Procedures for Adaptive Radiotherapy. Danish Technical University, project completed 2013.**
4. Brøndum, Line: Predictive and prognostic markers in head and neck cancer patients. Aarhus University (enrolled 2012).
5. **Bøje, Charlotte: The importance of comorbidity for the outcome of radiotherapy for head and neck cancer. Aarhus University, project completed 2013.**
6. **Christensen, Bekka A.O.: Postmastectomy breast reconstruction. Evaluation of factors influencing early and long-term outcome. Aarhus University, project completed 2011.**
7. Christoffersen, Christian: Motion compensated image reconstruction. Aarhus University (enrolled 2010).
8. **D'Andrea, Filippo: Genetic or microenvironmental origin of radioresistance in sarcoma) Studies in mesenchymal cancer stem cells derived soft tissue sarcoma model. Aarhus University, project completed 2011.**
9. **Dieperink, Karin: A new everyday life – rehabilitation and mastering late effects of radiotherapy for prostate cancer. University of Southern Denmark, project completed 2013.**
10. **Due, Anne Kirkebjerg: Imaging and tumour definition in IMRT of head and neck cancer. Copenhagen University, project completed 2012.**
11. **Elstrøm, Ulrik Vindelev: Image-guided adaptive radiotherapy of head and neck cancer. Aarhus University, project completed 2011.**
12. **Emmertsen, Katrine: Influence of neoadjuvant radiotherapy on bowel, urinary and sexual function after treatment for rectal cancer. Aarhus University, project completed 2013.**
13. Farr, Katherina P.: Individualised aproach in radical radiotherapy of stage III lung cancer incorporating functional imaging in the treatment planning. Aarhus University (enrolled 2011).
14. Fode, Mette Marie: Towards biology adapted stereotactic body radiation therapy of liver metastases. Aarhus University (enrolled 2013).
15. **Gottlieb, Karina Lindberg: Investigation of respiration induced intra- and inter-fractional tumour motion using a standard Cone Beam CT. University of Southern Denmark, project completed 2012.**
16. **Grantzau, Trine: Risk of second primary cancer among Danish women with breast cancer treated with postoperative radiotherapy. Aarhus University, project completed 2014.**
17. **Haack, Søren: Diffusion Weighted MRI for Radiotherapy Planning. Aarhus University, project completed 2015.**
18. **Hansen, Anders Elias: Characterization, regulation and the role ofhypoxia and markers of hypoxia to radiotherapy of canine soft tissue sarcomas a spontaneous model of human disease. Copenhagen University, project completed 2011.**
19. **Hansen, David C: Improving Ion Computed Tomography. Aarhus University, project completed 2014.**

20. Hassan, Mohammed: Preliminary Results, Quality Assurance and Biological Studies of Head and Neck Cancer patients undergoing accelerated radiotherapy with or without Nimorazole in a randomized multicenter trial. Aarhus University (enrolled 2010).
21. **Havelund, Birgitte Mayland: Clinical aspects of hypoxia-inducible factors in colorectal cancer. University of Southern Denmark, project completed 2012.**
22. **Herrmann, Rochus: Investigation of dosimetric and radiobiological models for particle therapy. Aarhus University, project completed 2012.**
23. **Hoff, Camilla: Importance of Hemoglobin Concentration and its Modification for the Outcome of Head and Neck Cancer Patients treated with Radiotherapy. Aarhus University, project completed 2012.**
24. **Kaiser, Franz-Joachim: Novel Dosimetry Methods in Heavy Charged Particle Beams. Aarhus University, project completed 2013.**
25. **Kallehauge, Jesper: Functional Imaging for Individualized Adaptive Radiotherapy in Locally Advanced Cervical Cancer. Aarhus University, project completed 2013.**
26. **Kertzscher, Gustavo: Real-time radiation dosimetry for improved patient safety in brachy therapy. Danish Technical University, project completed 2013.**
27. **Korsager, Anne Sofie: Evaluation of autosegmentation strategies in hybrid medical imaging. Aalborg University, project completed 2014.**
28. **Lassen, Pernille. The role of Human papillomavirus in head and neck cancer and the impact on radiotherapy outcome. Aarhus University, project completed 2010.**
29. Laurberg, Tinne: A study on age-dependent tumorbiological characteristics among low-risk breast cancer patients. Aarhus University (enrolled 2011).
30. Laustsen, Søren R.: Functional magnetic resonance scans in patients with brain tumors. Aarhus University (enrolled 2011).
31. **Lønbro, Simon: Resistance training and dietary supplements as intervention for regaining muscle mass following radiotherapy in head and neck cancer patients. Aarhus University, project completed 2013.**
32. **Lorenzen, Ebbe: Risk of heart disease in modern breat cancer radiotherapy. University of Southern Denmark (enrolled 2010).**
33. Lyngholm, Christina: Breast Conserving Therapy (BCT) Cosmetic outcome and longterm adverse reactions in the DBCG 89-protocol. Aarhus University (enrolled 2009).
34. **Mohamed, Sandy: Image guided radiotherapy in cervical cancer. Aarhus University, project completed 2014.**
35. **Møller, Søren: Clinical applications of O-(2-[18F]fluoroethyl)-L-tyrosine (FET) PET in patients with gliomas. Copenhagen University, project completed 2014.**
36. **Mortensen, Hanna Rahbek: Reduction of dysphagia-related morbidity in head and neck radiotherapy. Aarhus University, project completed 2013.**
37. **Mortensen, Lise Saksø: 4D biological imaging of hypoxia in human tumours. Aarhus University, project completed 2012.**
38. **Nawroth, Isabel: Intervention studies for Radiation-induced fibrosis (RIF) using RNA interference. Aarhus University, project completed 2011.**
39. Nielsen, Martin Skovmos: Precision and accuracy in Image Guided RT. Impact of NiTi stent for lung cancer patients. Aalborg University (enrolled 2010).
40. **Nielsen, Mette Bak: Role of extensive surgery with or without interstitial brachytherapy in advanced primary or locally recurrent rectal cancer. Aarhus University, project completed 2012.**

41. **Nielsen, Tine Bjørn: Organ motion - 4D imaging and treatment. University of Southern Denmark, project completed 2012.**
42. **Noe, KØ. Deformable Image Registration for Use in Radiotherapy. Aarhus University, project completed 2009.**
43. Nygaard, Ditte Eklund: Modelling of positional tumour variations in 4D [Modellering af positionelle tumor variationer i 4D] Copenhagen University (enrolled 2009).
44. **Ottosson, Rickard: Monte Carlo based treatment plans for radiotherapy: Evaluation and optimization of modern treatment planning and treatment techniques. Danish Technical University, project completed 2012.**
45. Pagh, Anja: Importance of follow up after treatment for head and neck cancer. Aarhus University (enrolled 2010).
46. **Petersen, Stine Elleberg: Morbidity in patients with prostate cancer treated with radiation therapy. Aarhus University, project completed 2014.**
47. **Ravkilde, Thomas: Dose delivery for moving targets with and without tracking. Aarhus University, project completed 2014.**
48. **Rønjom, Marianne F.: Radiation-induced hypothyrodism in head and neck cancer. University of Southern Denmark, project completed 2015.**
49. Sander, Lotte: Side effects following use of a Ni Ti stent as a marker in radiotherapy of prostate cancer [Bivirkninger efter brug af Nikkel Titanium stent som markør ved intenderet kurativ strålebehandling for prostatacancer]. Aalborg University (enrolled 2010).
50. Schmidt, Mai Lykkegaard: Characterization and management of target motion during radiotherapy of lung cancer. Aarhus University (enrolled 2013).
51. **Schytte, Tine: Clinical advantages and disadvantages of optimized radiation therapy and planning as a respiratory guided planning and rotation IMRT in conjunction with altered radiation dose and the addition of radiation potentiating drugs. University of Southern Denmark, project completed 2013.**
52. **Serup-Hansen, Eva: Tumour markers and the predictive value of MRI and PET-CT scans in concomitant chemoradiotherapy of anal cancer. Copenhagen University, project completed 2014.**
53. **Skyt, Peter Sandegaard: Three-dimensional dosimetry in radiotherapy using new polymer materials and optical tomography. Aarhus University, project completed 2013.**
54. **Sveistrup, Joen: Radiotherapy treatment of prostate cancer - Effect, side effects, and ability to function. Copenhagen University, project completed 2013.**
55. **Søndergaard, Jimmi: Image guided tumour boost of localized unifocal c. vesica urinaria [Billedvejledt tumorboost af lokaliseret unifokal c. vesica urinaria: Et fase I/II project]. Aarhus University, project completed 2010.**
56. **Sørensen, Brita Singers: Influence of tumour microenvironmental factors on endogenous markers of hypoxia. Aarhus University, project completed 2009.**
57. Thing, Rune Slot: Dose calculation based on Cone Beam CT images. University of Southern Denmark (enrolled 2013).
58. **Thor, Maria: Prediction of adverse effects in pelvic radiotherapy incorporating normal tissue position and biology patterns. Aarhus University, project completed 2013.**
59. **Thörnqvist, Sara: Robust treatment planning to account for variations in target position and function for RT of locally advanced prostate cancer. Aarhus University, project completed 2013.**
60. **Thorsen, Lise: Impact of adjuvant radiotherapy to the internal mammary lymph nodes in the treatment of early lymph node metastasizing breast cancer. Aarhus University, project completed 2015.**

61. **Toustrup, Kasper: Tumour Microenvironment, Hypoxia and Gene Expression Signatures in Squamous Cell Carcinomas of the Head and Neck. Aarhus University, project completed 2011.**
62. **Tramm, Trine: Gene expression analysis on RNA extracted from archival paraffin-embedded tissue from a cohort of breast cancers. Aarhus University, project completed 2013.**
63. Vestergaard, Anne. On-line adaptive radiotherapy to account for anatomical changes. Aarhus University (enrolled 2012).
64. **Wiechec, E. Characterization of new breast cancer susceptibility genes with impact on prognosis and design of novel anticancer therapies. Aarhus University, project completed 2010.**
65. Winther, Mette: Analysis of the clinical impact of a novel chemo- and irradiation sensitivity predictor in gastroesophageal cancer. Aarhus University (enrolled 2011).
66. **Wojdacz, Tomasz: Methylation Sensitive High Resolution Melting (MS-HRM) - development and application in cancer research and diagnostics. Aarhus University, project completed 2010.**
67. **Worm, Esben: Liver tumour motion during radiotherapy. Aarhus University, project completed 2013.**
68. **Wright, Pauliina: Development and modelling of image-guided adaptive radiotherapy strategies for bladder cancer. Aarhus University, project completed 2010.**

Appendix 3: Dissertations by CIRRO affiliated students

PhD degree

1. Noe, KØ. Deformable Image Registration for Use in Radiotherapy. PhD Thesis, Faculty of Science, Aarhus University. Defended October 1, 2009.
2. Sørensen, BS. Influence of tumour microenvironmental factors on endogenous markers of hypoxia. PhD Thesis, Faculty of Health Sciences, Aarhus University. Defended November 6, 2009.
3. Søndergaard, J. Intensity-modulated image guided radiotherapy of bladder cancer: Clinical implementation and early outcome. PhD Thesis, Faculty of Health Sciences, Aarhus University. Defended April 1, 2011.
4. Nawroth, I. Intervention of radiation-induced skin fibrosis by RNA interference. PhD Thesis, Faculty of Science, Aarhus University. Defended May 19, 2011.
5. Wiechec, E. Characterization of new breast cancer susceptibility genes with impact on prognosis and design of novel anticancer therapies. PhD Thesis, Faculty of Health Sciences, Aarhus University. Defended May 28, 2010.
6. Wojdacz, TK. Methylation Sensitive High Resolution Melting (MS-HRM) - development and application in cancer research and diagnostics. PhD Thesis, Faculty of Health Sciences, Aarhus University. Defended June 4, 2010.
7. Lassen, P. The role of Human papillomavirus in head and neck cancer and the impact on radiotherapy outcome. PhD Thesis, Faculty of Health Sciences, Aarhus University. Defended June 18 2010.
8. Wright, P. Development and modelling of image-guided adaptive radiotherapy strategies for bladder cancer. PhD Thesis, Faculty of Health Sciences, Aarhus University. Defended October 26, 2010.
9. Christensen, B. Postmastectomy breast reconstruction. Evaluation of factors influencing early and long-term outcome. PhD Thesis, Faculty of Health Sciences, Aarhus University. Defended June 14, 2011.
10. Elstrøm, UV. Image-guided adaptive radiotherapy of head and neck cancer. PhD Thesis, Faculty of Health Sciences, Aarhus University. Defended June 17, 2011.
11. Toustrup, K. Development of a hypoxia targeted gene expression classifier in squamous cell carcinomas of the head and neck. PhD Thesis, Faculty of Health Sciences, Aarhus University. Defended August 18, 2011.
12. Hansen, AE. Molecular Imaging Using Cu-ATSM and FDG in Solid Canine Tumors - Evaluation of Tumor Hypoxia. PhD Thesis, Faculty of Life Sciences, Copenhagen University. Defended August 29, 2011.
13. D'Andrea, F. Intrinsic radiation resistance of mesenchymal cancer stem cells and implications for treatment response in a murine sarcoma model. PhD Thesis, Faculty of Health Sciences, Aarhus University. Defended December 13, 2011.
14. Hoff, CM. Importance of hemoglobin concentration and its modification for the outcome of head and neck cancer patients treated with radiotherapy. Defended April 16, 2012.
15. Bertelsen, A. Volumetric Modulated Arc Therapy (VMAT®) - advantages and disadvantages. PhD Thesis, University of Southern Denmark. Defended June 1, 2012.
16. Nielsen, MB. Role of extensive surgery with or without interstitial brachytherapy in advanced primary or locally recurrent rectal cancer. PhD Thesis, Faculty of Health Sciences, Aarhus University. Defended June 15 2012.
17. Herrmann, R. Investigation of dosimetric and radiobiological models for particle therapy. PhD Thesis, Faculty of Health Sciences, Aarhus University. Defended July 2, 2012.

18. Mortensen, LS. 4D biological imaging of hypoxia in human tumours. PhD Thesis, Faculty of Health Sciences, Aarhus University. Defended November 8, 2012.
19. Nielsen, TB. Organ Motion – 4D imaging and treatment. PhD Thesis. University of Southern Denmark. Defended December 21, 2012.
20. Gottlieb, KL. Investigation of respiration induced intra- and inter-fractional tumour motion using a standard Cone Beam CT. PhD Thesis. University of Southern Denmark. 2012.
21. Due, AK. Recurrence location after definitive (chemo)radiation therapy for head and neck squamos cell carcinoma in relation to clinical target volumes and (18F)-FDG uptake. PhD Thesis. Copenhagen University. Defended 2012.
22. Havelund, BM. Hypoxia and hypoxia-related biomarkers in rectal cancer. PhD Thesis, University of Southern Denmark, 2012.
23. Ottosson, R. Monte Carlo based treatment plans for radiotherapy: Evaluation and optimization of modern treatment planning and treatment techniques. PhD Thesis, Danish Technical University. Defended 2012.
24. Skyt, PS. Three-dimensional optical bases dosimetry: Characterization and application. PhD Thesis. Health, Aarhus University. Defended March 6, 2013.
25. Thor, M. Prediction of adverse effects in pelvic radiotherapy incorporating normal tissue position and biology patterns. PhD Thesis. Health, Aarhus University. Defended May 15, 2013.
26. Thörnqvist, S. Robust treatment planning to account for variations in target position and function for RT of locally advanced prostate cancer. PhD Thesis. Health, Aarhus University. Defended May 16, 2013.
27. Lønbro, S. Resistance training and dietary supplements as intervention for regaining muscle mass following radiotherapy in head and neck cancer patients. PhD Thesis. Health, Aarhus University. Defended August 15, 2013.
28. Kaiser F-J. Novel dosimetry methods in heavy charged particle beams. PhD Thesis. Health, Aarhus University. Defended August 20, 2013.
29. Bøje, CR. The importance of comorbidity for the outcome of radiotherapy for head and neck cancer. PhD Thesis, Health, Aarhus University. Defended August 22, 2013
30. Dieperink, K. Rehabilitation in Prostate Cancer Care. PhD Thesis. University of Southern Denmark. Defended August 27, 2013.
31. Emmertsen, K. Influence of neoadjuvant radiotherapy on bowel, urinary, and sexual function after treatment for rectal cancer. PhD Thesis. Health, Aarhus University. Defended September 6, 2013.
32. Bjerre, T. Automated Image-Based Procedures for Adaptive Radiotherapy. PhD Thesis. Department of Applied Mathematics and Computer Science. Technical University of Denmark.
33. Kallehauge, J. Functional Imaging for Individualized Adaptive Radiotherapy in Locally Ad-vanced Cervical Cancer. PhD Thesis. Health, Aarhus University. Defended October 18, 2013.
34. Mortensen, HR. Reduction of dysphagia-related morbidity in head and neck radiotherapy. PhD Thesis. Health, Aarhus University. Defended November 19, 2013.
35. Worm, E. Image based motion monitoring during stereotactic body radiotherapy at a conventional linear accelerator. PhD Thesis. Health, Aarhus University. Defended February 27, 2014.
36. Tramm, T. Gene expression analysis on RNA extracted from archival paraffin-embedded tissue from a cohort of breast cancers. PhD Thesis. Health, Aarhus University. Defended July .. 2014.
37. Kertzscher, G. Real-time radiation dosimetry for improved patient safety in brachy therapy. PhD Thesis. DTU Nutech, Technical University of Denmark. 2013.
38. Schytte, T. Local control and toxicity in NSCLC patients treated with definitive radiotherapy. PhD Thesis. University of Southern Denmark. Defended December 13, 2013.

39. Sveistrup, J: Toxicity and quality of life after IG-IMRT for prostate cancer. PhD Thesis. Copenhagen University. Defended 2013.
40. Serup-Hansen, E. Tumourmarkers and the predictive value of MRI and PET-CT scans in con-comitant chemoradiotherapy of anal cancer. PhD Thesis. University of Copenhagen. Defended March 7, 2014.
41. Appelt, A. Bioeffect modelling of clinical outcomes after radiation therapy for individualization of treatment effect estimation and risk prediction. University of Southern Denmark. Defended March 19, 2014.
42. Mohammed, S. Image guided radiotherapy in cervical cancer. Defended June 13, 2014.
43. Lorenzen, E. Risk of heart disease from modern radiotherapy. PhD Thesis. University of Southern Denmark. Defended March 21, 2014.
44. Korsager, AS. Image registration and image segmentation for image-guided radiotherapy of prostate cancer. PhD Thesis. Aalborg University, Denmark. Defended June 25, 2014.
45. Petersen, SE. Morbidity in patients with prostate cancer treated with radiation therapy. PhD Thesis. Aarhus University. Defended August 21, 2014.
46. Ravkilde, T. Dynamic multileaf collimator tracking and dose delivery for moving targets in radiotherapy. PhD Thesis. Aarhus University. Defended October 10, 2014.
47. Møller, S. Advanced PET- and MR-imaging in re-irradiation of high-grade glioma. PhD Thesis. University of Copenhaven. Defended October 28, 2014.
48. Grantzau, T. Second primary cancers after adjuvant radiotherapy in early breast cancer patients. PhD Thesis. Aarhus University. Defended October 30, 2014.
49. Hansen, DC. Improving Ion Computed Tomography. PhD Thesis. Aarhus University. Defended November 27, 2014.
50. Rønjom, M. Radiation-induced hypothyrodism in head and neck cancer. PhD Thesis. University of Southern Denmark. To be defended.
51. Thorsen, LBJ. Impact of adjuvant radiotherapy to the internal mammary lymph nodes in the treatment of early lymph node metastasizing breast cancer. PhD Thesis. Aarhus University. To be defended.
52. Haack, S. Diffusion weighted MRI for radiotherapy planning. PhD Thesis. Aarhus University. To be defended.

Masters degree

1. Kofoed, T. Image quality of 4DCT scans. Master's Thesis, Niels Bohr Institute, University of Copenhagen. May 2009.
2. Østergaard, MA. Non-invasive imaging of tumour microenvironment using co-registred MRI and PET imaging in tumour models. Master's Thesis. Biomedical Engineering, University of Aarhus, October 2011.
3. Petersen, KM. Field Map Guided Registration for Diffusion-Weighted Magnetic Resonance Imaging. Master's Thesis, Department of Computer Science, Aarhus University, May 2012.

Appendix 4: CIRRO affiliated senior scientists

1. Alsner, Jan. Associate professor, AUH. WP01 leader. WP coordinator.
2. Andersen Claus. Associate professor, Risø-DTU. WP08 leader.
3. Andreassen, Nicolaj. MD PhD, AUH.
4. Bangsgaard, Jens-Peter. Medical physicist, RH. CAK.
5. Bassler, Niels. Associate professor, AU.
6. Behrens, Claus. Physicist PhD, Herlev.
7. Bentzen, Lise. MD PhD, AUH.
8. Brink, Carsten. Associate professor, OUH. WP05 leader.
9. Busk, Morten. Senior scientist PhD, AUH
10. Carl, Jesper. Chief physicist, Aalborg. WP07 leader, CAK
11. Engelholm, Svend Aage. Professor MD, RH. IP11 coordinator.
12. Eriksen, Jesper Grau. MD PhD, OUH
13. Fledelius, Walther. Postdoc, AUH
14. Grau, Cai. Professor MD, AUH. Scientific coordinator. CAK
15. Hansen, Olfred. MD PhD, OUH. IP02 coordinator. CAK
16. Havsteen, Hanne. MD PhD, Herlev. IP13 coordinator
17. Helt-Hansen, Jakob. Senior scientist, Risø-DTU
18. Horsman, Mike. Associate Professor, AUH.
19. Høyer, Morten. Associate professor MD, AUH. IP06 and IP08 coordinator.
20. Jakobsen, Anders. Professor MD, Vejle. IP09 coordinator. CAK
21. Johansen, Jørgen. MD PhD, OUH
22. Korreman, Stine. Director of Physics Research, RH. WP06 leader. CAK.
23. Kristensen, Brian. Chief physicist, Herlev. CAK
24. Larsen, Rasmus. Professor, DTU.
25. Lauritzen, Bent. Head of programme, Risø-DTU. CAK
26. Laursen, Louise Vagner. Academic coordinator, postdoc. AUH
27. Lindegaard, Jacob. Associate professor MD, AUH. IP10 and IP 12 coordinator.
28. Lühr, Armin. Postdoc, AU.
29. Muren, Ludvig. Associate professor, AUH
30. Nielsen, Thomas. Postdoc, AUH
31. Nordsmark, Marianne. MD PhD, AUH. WP02 leader and IP05 coordinator.
32. Nørrevang, Ole. Chief physicist, AUH
33. Offersen, Birgitte. MD PhD, AUH. IP03 coordinator.
34. Østergaard, Leif. Professor, AUH. WP04 leader.
35. Overgaard, Jens. Professor MD, AUH. Director. IP01 coordinator
36. Overgaard, Marie. MD, AUH. IP03 coordinator.
37. Pedersen, Erik Morre. MD PhD, AUH
38. Petersen, Jørgen. Senior scientist PhD, AUH.
39. Petersen, Peter Meidahl. MD PhD, RH. IP08 leader.
40. Poulsen, Per Rugaard. Associate Professor, AUH.
41. Skogholt, Peter. Medical physicist, Vejle Sygehus.
42. Sørensen, Brita Singers. Postdoc, AUH.
43. Sørensen, Thomas Sangild. Associate professor, AU. WP03 leader.
44. Specht, Lena. Professor MD, RH. IP04 coordinator.
45. Tanderup, Kari. Associate Professor, AUH. WP coordinator.
46. Vogelius, Ivan. Postdoc, RH. WP09 leader.
47. Wojdacz, Tomasz. Postdoc, AU.

Appendix 5: Status for Intervention Protocols

The detailed status of the 27 clinical Intervention Protocols is listed below:

- **CIRRO-IP010209 – Prognostic value of ^{18}F-FAZA PET scans following primary radiotherapy in patients with head and neck carcinoma** [Den prognostiske værdi af 18F-FAZA Positron Emissions Tomografi hos patienter med hoved-hals karcinom efter primær strålebehandling (DAHANCA 24)] PI: Lise Saksø Mortensen, AUH. Status: Protocol closed. 40 patients accrued. Participating departments: Aarhus, Odense.
- **CIRRO-IP010309 – Resistance training and dietary supplements as intervention for regaining muscle mass following radiotherapy in head and neck cancer patients** [Styrketræning kombineret med kosttilskud som intervention til genopbygning af muskelmasse efter strålebehandling for hoved-hals cancer (DAHANCA 25A and 25B)]
  PI: Simon Lønbro, AU. Status: DAHANCA 25A and 25B, protocol closed. 71 patients accrued. Participating departments: Aarhus, Odense, Herlev.
- **CIRRO - IP010112 – Phase I/II study of accelerated hyperfractionated radiotherapy, concomitant cisplatin and nimorazole to patients with stage III-IV p16 negative squamous carcinoma in larynx, pharynx and cavum oris** [Fase I/II studie af accelereret hyperfraktioneret strålebehandling, konkomitant cisplatin og nimorazol til patienter med stadie III-IV p16 negativt planocellulært carcinom i larynx, pharynx og cavum oris (DAHANCA 28A)]
  PI: DAHANCA. Status: Protocol active. 17 patients accrued. Participating departments: Aarhus, Aalborg, Odense
- **CIRRO-IP020109** - **NARLAL - Navelbine And Radiotherapy in Locally Advanced Lung cancer**
  PI: Olfred Hansen, OUH. Status: Protocol closed. 121 patients accrued. Participating departments: Odense, Aarhus, Aalborg, Vejle, Herlev, Rigshospitalet.
- **CIRRO-IP020209** - **TARLAL - Tarceva And Radiotherapy in Locally Advanced Lung cancer**
  PI: Olfred Hansen, OUH. Status: Protocol active. 12 patients accrued. Participating departments: Odense, Aarhus, Vejle.
- **CIRRO-IP030109 – A randomized trial of Partial Breast Irradiation (PBI) in node-negative early breast cancer.**
  PI: Birgitte Offersen, AUH. Status: Protocol active. 731 patients accrued. Participating departments: Aarhus, Aalborg, Vejle, Odense, Rigshospitalet, Herlev.
- **CIRRO-IP030209** - **Hypofractionated adjuvant radiotherapy in node-negative early breast cancer**
  PI: Marie Overgaard, AUH. Status: Protocol closed. 1883 patients accrued. Participating departments: Aarhus, Aalborg, Vejle, Odense. International participants: Dresden, Kristiansand and Stavanger.
- **CIRRO-IP030113** - **DBCG SIB (simultaneous integrated boost)**
  PI: Birgitte Offersen, AUH. Status: Activation expected spring 2015. Participating departments: Aarhus, Aalborg, Vejle, Odense, RH, Herlev.

- **CIRRO-IP040110** - **Reduction of risk of long-term complications of radiotherapy for lymphomas.** PI: Lena Specht, RH. Status: Protocol closed. 70 patients accrued. Participating departments: Rigshospitalet
- **CIRRO-IP050109** - **CRITICS-study: ChemoRadiotherapy after Induction chemoTherapy In Cancer of the Stomach.**
  PI: Marianne Nordsmark, AUH. Status: Protocol active. 16 patients accrued in Aarhus. Participating departments: AUH. 690 patients accrued internationally.
- **CIRRO-IP060109** - **RAS-trial: Radiofrequency ablation versus stereotactic body radiation therapy for colorectal liver metastases: A randomized trial.**
  PI: Morten Høyer, AUH. Status: Protocol closed. 4 patients accrued in Denmark. Participating departments: Aarhus, Odense.
- **CIRRO-IP070109 – Image guided tumour boost of localized unifocal c. vesica urinaria** [Billedvejledt tumorboost af lokaliseret unifokal c. vesica urinaria: Et fase I/II project].
  PI: Jimmi Søndergaard, AUH. Status: Protocol active. 12 patients accrued. Participating departments: Aarhus, Herlev.
- **CIRRO-IP070112 – Daily adapted radiotherapy of bladder cancer: A phase II study** [Dagligt tilpasset strålebehandling af blærekræft: Et fase II studie].
  PI: Anne Vestergaard, AUH. Status: Protocol closed. 65 patients accrued. Participating departments: Aarhus, Odense, Herlev.
- **CIRRO-IP080109 - Hypo-RT-PC: Study on hypofractionated radiotherapy in intermediary risk prostate cancer patients** [Fase III studie om hypofraktioneret stråleterapi til patienter med prostatacancer i intermediær risikogruppe].
  PI: Morten Høyer, AUH. Status: Protocol active. 22 patients accrued in Aarhus (1043 internationally). Participating departments in Denmark: Aarhus.
- **CIRRO-IP080209 - PROPEL A+B Pelvine lymph node irradiation with concomitant boost to the prostate in high risk prostate cancer patients** [Pelvin lymfeknudebestråling med samtidigt boost til prostata for prostatakræftpatienter i høj-risikogruppe: Et fase I/II studium].
  PI: Lise Bentzen, AUH. Status: Protocol closed. 87 patients accrued. Participating departments: Aarhus, Aalborg, Herlev, RH and Odense.
- **CIRRO-IP080110 – A new everyday life – Rehabilitation and mastering late effects of radiotherapy for prostate cancer** [En ny hverdag - Rehabilitering og mestring af senfølger efter kurativ strålebehandling for prostatacancer].
  PI: Karin Dieperink, OUH. Status: Protocol closed. 162 patients accrued. Participating departments: Odense
- **CIRRO-IP080210 – RADICALS - Radiotherapy and Androgen Deprivation in Combination after Local Surgery** [Radioterapi og androgen deprivation i kombination efter prostatektomi]
  PI: Peter Meidahl Petersen, RH. Status: Protocol active. 9 patients accrued at RH. Participating departments: RH and Herlev. OUH and Aarhus expected to follow soon.

- **CIRRO-IP090109 - Watchful Waiting in rectal cancer: A prospective observational study of rectal cancer patients after concomitant chemoradiotherapy** [Watchful waiting: Et prospektivt observationsstudie af patienter med cancer recti efter concomitant strålebehandling og kemoterapi].
  PI: Anders Jakobsen, Vejle. Status: Protocol closed. 52 patients accrued. Participating departments: Vejle (treating patients from other departments also)
- **CIRRO-IP090209 – Contrast enhanced transrectal ultrasound scanning of rectal cancer patients** [Kontrast forstærket transrektal ultralydskanning af patienter med rektal cancer].
  PI: Anders Jakobsen, Vejle. Status: Protocol active. 40 patients accrued. Participating departments: Vejle (treating patients from other departments also)
- **CIRRO-IP090309 – Consecutive rectoscopies in connection with pre-operative chemo-radiotherapy of rectal tumours** [Konsekutive rektoskopier foretaget i forbindelse med præ-operativ kemostrå-leterapi af rektum tumorer på Vejle Sygehus].
  PI: Anders Jakobsen, Vejle. Status: Protocol closed. 100 patients accrued. Participating departments: Vejle (treating patients from other departments also)
- **CIRRO-IP090110 – Predictive value of 18F-FAZA-PET/CT in neoadjuvant radiotherapy of patients with locally advanced cancer recti [Den prædiktive værdi af 18F-FAZA-PET/CT ved neoadjuverende strålebehandling til patienter med lokal avanceret c. recti].**
  PI: Birgitte Mayland Havelund, Vejle. Status: Protocol closed. 14 patients accrued. Participating departments: Vejle.
- **CIRRO-IP100110 – Observational study on contact X-ray and transanal endoscopic microsurgery in curative treatment of rectal cancer (CONTEM).**
  PI: Anni Ravnsbæk, AUH. Status: Activation expected 2015.
- **CIRRO-IP120109 - EMBRACE: An International Study on MRI-guided Brachytherapy in Locally Advanced Cervical Cancer.**
  PI: Jacob Lindegaard, AUH. Status: Protocol active. 67 patients accrued in Aarhus (1050 in total). Participating departments in Denmark: Aarhus.
- **CIRRO-IP120111 – IMAP: Repetitive Functional Imaging & Mapping Biopsies in Locally Advanced Cervical Cancer.**
  PI: Jacob Lindegaard, AUH. Status: Protocol active. 31 patients accrued. Participating departments: Aarhus (others are expected to follow).
- **CIRRO-IP130109 – IMANAL: PET-CT scans and MRI in anal cancer patients** [PET-CT skanning og MR ved analcancer].
  PI: Hanne Havsteen, Herlev. Status: Protocol closed. 22 patients accrued. Participating departments: Herlev.
- **CIRRO-IP130111 - ^{18}F-FMISO-PET, ^{18}F-FDG-PET/CT, DWI-MR, and DCE-MR scans as predictor of response on chemo-radiotherapy of patients with anal cancer** [^{18}F-FMISO-PET, ^{18}F-FDG-PET/CT, DWI-MR og DCE-MR scanninger som prædiktorer for respons på kemoterapi/radioterapi af patienter med analcancer].
  PI: Eva Serup-Hansen, Herlev. Status: Protocol closed. 50 patients accrued. Participating departments: Herlev.

- **CIRRO-IP140111 – Image-guided re-irradiation of high-grade glioma – a clinical phase I/II trial** [Billedvejledt rebestråling af højgradsgliom - et klinisk fase I/II forsøg].
  PI: Søren Møller, RH. Status: Protocol active. 32 patients accrued. Participating departments: RH.