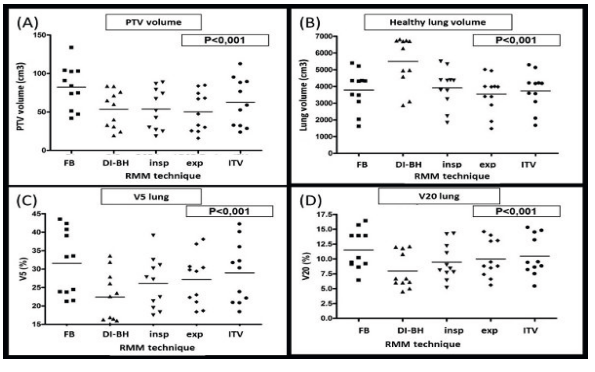
requirements. The aim of this study was to assess the dosimetric performance in clinical conditions of Acuros® XB in relation to AAA.
Materials and Methods: The clinical dosimetric planning of 60 patients who underwent treatment for RT, with Rapidarc™ technique and calculated with AAA where included in the study. The dosimetric plans werere calculated with the Acuros® XB, being compared and evaluated on dose-volume histograms (DVH) and radiobiological parameters. These 60 patients were divided into 3 groups of 20 patients each (head and neck, thorax and pelvis). For both plans the relative dose values at 5 points of the cumulative DHV for PTV were collected: minimum dose (Dmin), near-minimum dose (D98%), medium dose (Dmed), near-maximal dose (D2%) and maximal dose (Dmax).
Results: By comparing the data obtained in this study it was found that concerning the relative dose either in overall terms, or in terms of compartmental analysis of multiple groups of patients, the AAA overestimates the prediction of the dose for all evaluated DVH points except for Dmax. The comparison of the results of the averages calculated in the dosimetric plans for AAA and for the Acuros® XB suggest several scenarios: a reduction of the prescribed dose (Dmed) in 1.3%, a decrease also in the near-minimum dose (D98%), a decrease of 2.8% in Dmin and an increase in Dmax of 0.8%, which implies a decrease in the dose homogeneity inthe plan, and consequently the EUD is lower in all plans.
Conclusions: With the growing interest in RT techniques of volumetric modulated arc therapy (VMAT) for various clinical applications, Acuros®XB can provide both accuracy and speed of calculation in treatment planning.

PO-0816
What is the best dosimetric technique to deal with respiratory motion for lung cancer ?
A. Crespeau[1], S. Krhili[2], A. Paumier[2], M. Edouard[1], C. Di Bartolo[1], C. Legrand[1], J. Mesgouez[1], M. Georgin-Mege[2], D. Rousseau[2], D. Autret[1]
[1]*Integrated Center for Oncology, Medical Physics, Angers, France*
[2]*Integrated Center for Oncology, Radiotherapy, Angers, France*

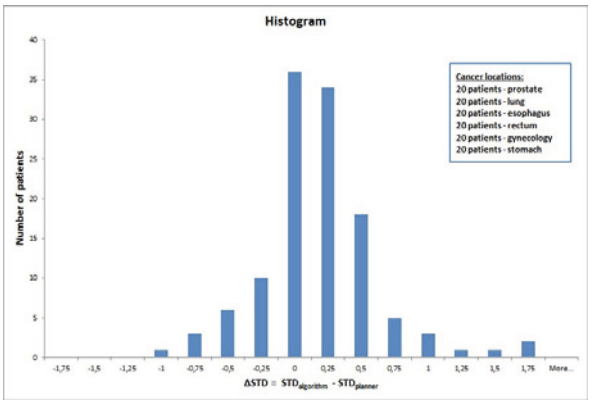
Purpose/Objective: To evaluate the dosimetric differences in term of target delineation, lung volume and dose delivered to the lungs between four respiratory movement management (RMM) techniques possibly used in lung tumours irradiation.
Materials and Methods: Seven patients with one or more primary or secondary lung lesions less than 5 cm (11 tumours in total) had four CT: free-breathing CT (FB), two deep-inspiration breath-hold (DI-BH) CT using a spirometer, and a 4DCT based on the acquisition of ten respiratory phases. From these four acquisitions, five treatments plans were performed: FB (reference method), DI-BH, and three from the 4DCT: two breathing synchronized treatments (inspiration (insp) and expiration (exp), both based on three phases) and one treatment taking into account all the tumours motions (based on ten phases, definition of the internal target volume (ITV)). Planning target volume (PTV) size and lungs size and dose delivered for the lungs were compared.
Results: Mean PTV for the FB modality was 83 ± 28 cm3, which was significantly greater than any of the other techniques (p<0.0001) (figure (A)). Compared to the FB PTV, PTV defined with the ITV was reduced by one quarter (63 ± 31 cm3). PTV with the DI-BH, breathing synchronized inspiration and breathing synchronized expiration techniques were reduced by one third (50 to 54, ± 24 to 26 cm3). DI led to significantly increase the healthy lung volume compared to other methods (mean volume of 5500 ± 1500 cm3 versus 3540 to 3920 cm3, respectively, p<0.0001) (figure (B)). The volume of healthy lungs receiving at least 5 and 20 Gy (V5 and V20) were significantly higher with the FB method than any of the other methods (p<0.0001) (figure (C) and figure (D)). The DI-BH modality led to the lowest lung V5 and V20.



Conclusions: First of all, the contouring strategy was different with the 4DCT and DI-BH techniques compared to the FB technique. In the two first cases, automatic margins were only used to create the PTV and only concerned the patient setup accuracy but not the tumour displacement, although with the FB technique non personalized and automatic margins were applied to create ITV and PTV. Secondly, DI-BH technique provides the most significant dosimetric advantages: small PTV and large lung volume. However, patients must be able to hold 20 seconds of apnea, which moreover prevent to perfom CBCT images to setup the patient (duration about 45s). Respiratory gating (insp and exp) also reduces the PTV, but its application often requires the implantation of fiducial which limits its use and the treatment time is also important. Finally, an ITV technique allows for a personalized and reduced PTV compared to FB technique, and allows using CBCT to setup the patient without the implantation of fiducial.

PO-0817
Dose gradient based algorithm for beam weights selection in 3D-CRT plans.
M. Gizynska[1], P. Kukolowicz[1]
[1]*The Maria Sklodowska-Curie Memorial Cancer Center, Medical Physics, Warsaw, Poland*

Purpose/Objective: The 3D-CRT planning is usually done with trial method which is quite time consuming. In this work we tested the usage of dose gradient based algorithm for selection of beam weights in 3D-CRT plans. Our algorithm is easy to implement for three fields technique with wedges defined by planner.
Materials and Methods: We assume that most homogenous dose distribution in target volume, for given set of beam angles and beam modifiers, is achieved when the dose gradient at ICRU Reference Point (chosen as isocenter point) is equal zero. Therefore calculation of beam weights is done in 2D by solving set of equations:
$\sum w_i \cdot D_i(ICRU) = D_p(ICRU)$;
$\sum w_i \cdot grad\, D_i(ICRU) = 0$
(D_i is dose from i^{th} beam normalized to isocenter, D_p is prescribed dose, w_i –weight of i^{th} beam defined at the ICRU Reference Point). First equation guarantees that prescribed dose in isocenter should be equal D_p. Second equation sets dose gradient (here in 2D plane) to zero. Method was tested for 120 patients, treated in our clinic in 2011-2012, with different cancer locations (prostate, lung, esophagus, rectum, gynecology, stomach). For each patient three fields conformal plan (6MV and 15 MV x-ray) with the same geometry as proposed by experienced planners were prepared. Beam weights were calculated with formulas given above. We compared dose distributions achieved with the proposed method and those prepared by experienced planners. All other modifications (wedges, MLC, jaws) were the same. Both plans were created with the Eclipse Treatment Planning System. The homogeneity of dose distributions of mathematically optimized and prepared by planners plans were compared. The homogeneity was expressed in terms of standard deviation and near minimum and maximum doses in the Planning Target Volume. All mathematical calculations were performed with the help of free Python language.
Results: Mean difference of standard deviation obtained by the proposed algorithm and by planners (with trial-and-error forward planning process) was 0.1% (see histogram plot for details): 0.1% for prostate cancer, 0.3% for lung cancer, -0.1% for esophagus cancer, 0.1% for rectum cancer, -0.1% for gynecology cancer, -0.1% for stomach cancer. Mean D98% difference was: -0.2% for prostate cancer, -0.4% for lung cancer, 0.2% for esophagus cancer, -0.1%for rectum cancer, 0.1% for gynecology cancer, 0.2% for stomach cancer. Mean D2% difference was: 0.3% for prostate cancer, 0.9% for lung cancer, -0.1% for esophagus cancer, 0.3% for rectum cancer, 0.3% for gynecology cancer, 0.2% for stomach cancer.



Conclusions: Proposed algorithm gives dose distribution comparable with those achieved by planners and therefore can serve as a support in creating 3D-CRT plans. It is also simple in use and can speed up the treatment planning process.

PO-0818

Magnetic field effects on the skin dose in MRI-guided breast radiotherapy

T.C.F. van Heijst[1], M.D. den Hartogh[1], G.H. Bol[1], B.W. Raaymakers[1], J.J.W. Lagendijk[1], H.G.J.D. van den Bongard[1], B. van Asselen[1]
[1]UMC Utrecht, Radiotherapy, Utrecht, The Netherlands

Purpose/Objective: The UMC Utrecht design of a 1.5T MR scanner integrated with a 6MV linear accelerator – or MRL – will have the ability of providing fast image-guidance with a high soft-tissue contrast, directly during irradiation (RT) with the patient on the MRL. MRI-guided treatment opens possibilities for developing new RT techniques. In addition, it is necessary to study the effects of the magnetic field itself on the dose distribution. Due to the electron return effect, the skin dose can be increased, depending on the magnetic field strength and the beam/skin inclination angle. Since generally large volumes of skin are included in the treatment fields in breast cancer patients, the objective of this treatment planning study is to investigate the effects on the skin dose in presence of a magnetic field, for whole-breast irradiation (WBI) and accelerated partial-breast irradiation (APBI).

Materials and Methods: In 11 patients with early-stage breast cancer, target volumes and organs at risk (OARs) were delineated on CT scans registered with MRI after breast-conserving surgery. Two intensity-modulated radiotherapy (IMRT) techniques were considered: tangential WBI and seven-field APBI. Beam geometries with individually optimized beam angles were used for all patients. For WBI, dose prescription was 42.56Gy (16x2.66 Gy), while for APBI the prescription was 38.5Gy (10x3.85Gy). The OARs - heart, lungs, contralateral breast, body, skin (the first 5 mm of ipsilateral breast tissue) - were subject to clinical constraints. To include the magnetic field in the dose calculations, in-house developed treatment planning software was used, based on GPU-based MonteCarlo calculations, and Fast Inverse Dose Optimization. IMRT plans were made for magnetic field strengths of 0T, 0.35T, and 1.5T. All plans were generated using a template of cost functions. Optimization was fluence-based only.

Results

Dose parameters Mean (SD)		PTV D95 (%)	PTV D107 (%)	Ips. Mean lung dose (Gy)	Heart V10Gy (%)	Skin Mean dose (Gy)	Skin V35Gy (%)
WBI	0T	94.6 (0.5)	0	5.5 (2.0)	1.7 (2.2)	29.9 (1.9)	50.6 (6.0)
	0.35T	96.6 (0.7)	0	5.6 (2.0)	2.2 (2.7)	32.7 (2.1)	68.2 (6.0)
	1.5T	96.5 (0.7)	0	5.7 (2.0)	2.2 (2.7)	34.5 (2.2)	73.9 (5.2)
APBI	0T	96.8 (0.8)	0	3.9 (1.7)	0.7 (1.6)	5.2 (2.0)	2.5 (2.7)
	0.35T	96.8 (1.0)	0	3.6 (1.6)	0.1 (0.1)	5.6 (2.4)	2.7 (2.3)
	1.5T	96.8 (0.7)	0	1.4 (1.4)	0.3 (0.8)	5.8 (2.4)	3.0 (2.3)

For all plans the clinical dose constraints could be met using a template of cost functions (table 1). The skin dose was increased at non-zero field strengths for WBI (figure 1), while equal PTV coverage was achieved, with a small compromise on lung and heart dose. The average V35Gy for the skin was 50.6%, 68.2% and 73.9% for WBI at 0T, 0.35T and 1.5T, respectively. For APBI, only minor effects were observed in the skin area: V35Gy was respectively 2.5%, 2.7% and 3.0%.

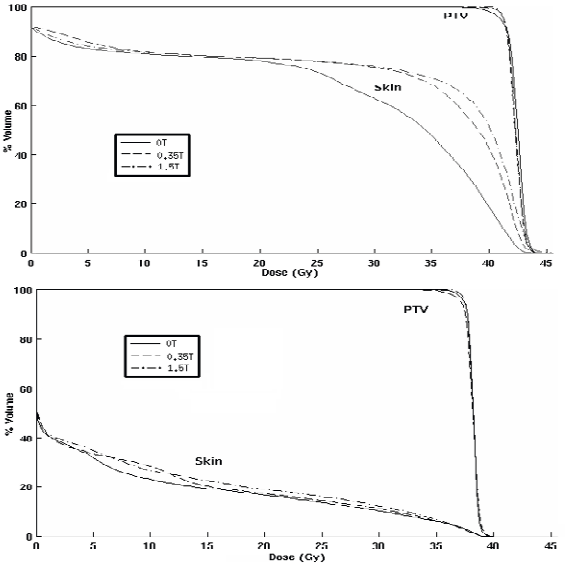


Figure 1: DVH for WBI (above) and APBI (below). Skin and PTV are depicted at 0T, 0.35T and 1.5T.

Conclusions: With the use of our planning system, acceptable IMRT plans for WBI and APBI in an MRL were generated employing a class solution. For WBI, the presence of a magnetic field resulted in an increased skin dose, which is a drawback if WBI treatments are to be performed on the MRL. For APBI however, the induced effects on the skin dose due to the magnetic field were small. This opens the possibilities for developing MR-guided treatments for APBI in the MRL.

PO-0819

Comparison of IMRT plans for prostate cancer patients between VERO, TomoTherapy, and conventional linac.

K. Nihei[1], S. Kitou[1], T. Furuya[1], S. Hashimoto[1], S. Kageyama[1], T. Shimizuguchi[1], H. Tanaka[1], Y. Machitori[1], T. Chang[1], K. Karasawa[1]
[1]Tokyo Metropolitan Komagome Hosp., Department of Radiation Oncology, Tokyo, Japan

Purpose/Objective: The aim of this study is to compare the dose distributions of intensity-modulated radiation therapy (IMRT) plans for patients with prostate cancer between MHI TM-2000 (VERO), TomoTherapy HiArt System (TomoTherapy), and conventional linac (Clinac 21EX), all of which are installed in our institution.

Materials and Methods: Ten patients with localized prostate cancer treated by IMRT at our institution were included in this planning study. The clinical target volume (CTV) was defined as the prostate with or without the proximal seminal vesicles according to risk groups. The planning target volume (PTV) was defined as the CTV + three-dimentional margins of 8 mm (5 mm on the rectal side). The rectum from the sigmoid flexure to the anal verge and the bladder were also delineated as solid organs. For each patient, IMRT planning was implemented for 3 different treatment machines, including VERO, TomoTherapy, and Clinac 21EX, so as to achieve the similar optimal dose delivery to the target volumes with the same dose constraints for normal tissues. IMRT schedule consisted of 76Gy in 38fr. As the method of IMRT, segmental multi-leaf collimator (MLC) IMRT with 7 static ports, helical IMRT, and dynamic MLC IMRT with 7 static ports, were adopted for VERO, TomoTherapy, and Clinic 21EX, respectively. As planning software, iPlan ver.4.5.1, TomoTherapy Planning Station 4.1.2, and Eclipse ver.10.0 were used for VERO, TomoTherapy, and Clinac 21EX, respectively.

The dose-volume parameters described below were calculated in each treatment machine: D50 and D95 of the PTV and CTV; V40, V50, V60, V70 and V75 of the rectum; V65, V70 and V75 of the bladder. The mean values and standard deviations (SD) of each parameter among 10 patients were calculated in each treatment machine, and compared between 3 treatment plans.

Results: The dose-volume parameters calculated in each treatment machine are shown in the following Table.