estimated for the stomach and stomach wall with endpoints of ulceration and gastric bleeding respectively (6) & (7).

Results: The stomach wall model showed larger values of NTCP than the whole stomach. There was a mean increase of 5.93% (-0.42, 18.71%) in NTCP from the 50GyRA to the 60GyRA plans and a mean increase of 8.15% (-0.42, 19.79%) in NTCP from the 50GyRA to the 60GyRA plans. When the NTCP modelling is restricted to that outside PTV2, there was a mean decrease of 0.92% (-4.70, 1.00%) in NTCP from the 50GyRA to the 60GyRA plans and a mean increase of 2.25% (-0.42, 6.91%) in NTCP from the 50GyRA to the 60GyRA plans. There was a strong correlation between the NTCP value and the Stomach Wall/PTV1 overlap volume for all treatment plans (Pearson’s R=0.80, 0.77 and 0.77 for the 60GyRA, 50GyRA and 50Gy 3D plans respectively). There was also a strong correlation between the NTCP value and the Stomach Wall/PTV2 overlap volume for the 60GyRA plan (R= 0.82).

Conclusions: Radiobiological modelling suggests that increasing the prescribed dose to 60Gy may be associated with a significantly increased risk of toxicity to the stomach. The results of this study also suggest that the maximum prescribed dose safely achievable for each patient in the future may be dependent on the volume of the stomach within the treatment volume. It is recommended that stomach toxicity be closely monitored prospectively when treating patients with lower oesophageal tumours in the forthcoming SCOPE 2 trial.


EP-1471 Lung SABR: radiobiological multi planning comparison in a perspective of a multi-institutional study

F.R. Giglioli1, R. Ragona2, C. Fiandra3, G. Pastore4, V. Landoni2, G. Borzi1, E. Menghi5, E. Villaggi1, C. Carboni6, M. Zani7, E. Lorenzini8, M. Malisan1, I. Redaelli9, G. Loi10, V. Ravaglia11, D. Fedele12, R. Nigro13, B. Nardiello14, C. Frassanito15, M.D. Falco16, E. Cagni17, R. Ruggieri18, R. Consorti19, R. El Gawhary20, P. Mancosu21

1. A.O. U. Città della Salute e della Scienza di Torino, Radiotherapy, Torino, Italy
2. Università degli Studi di Torino, Radiotherapy, Torino, Italy
3. Ecomedica, Radiotherapy, Empoli, Italy
4. Istituto Regina Elena IPO, radiotherapy, Roma, Italy
5. REM, Radiotherapy, Catania, Italy
6. IRCCS di Meldola, Radiotherapy, Meldola, Italy
7. USL Piacenza, Radiotherapy, Piacenza, Italy
8. Niguarda Ca’ Granda, Radiotherapy, Milano, Italy
9. AOU Careggi, Radiotherapy, Firenze, Italy
10. U.S.L. 1, Radiotherapy, Massa Carrara, Italy
11. A.O.U di Udine, Radiotherapy, Udine, Italy
12. A.O. San Gerardo di Monza, Radiotherapy, Monza, Italy
13. A.O. Maggiore della Carità di Novara, Radiotherapy, Novara, Italy
14. USL 2 di Lucca, Radiotherapy, Lucca, Italy
15. Casa di cura San Rassore, Radiotherapy, Pisa, Italy
16. Ospedale di Rieti, Radiotherapy, Rieti, Italy
17. UPMC San Pietro, Radiotherapy, Roma, Italy
18. Casa di Cura Mater Dei, Radiotherapy, Bari, Italy
19. Policlinico tor Vergata, Radiotherapy, Roma, Italy
20. Arcispedale Santa Maria Nuova, Radiotherapy, Reggio Emilia, Italy
21. Ospedale Sacro Cuore don Calabria Negar, Radiotherapy, Negar, Italy
22. ACO San Filippo Neri, Radiotherapy, Roma, Italy
23. O. San Pietro Fatebenefratelli, Radiotherapy, Roma, Italy
24. IRCCS Istituto Clinico Humanitas, Radiotherapy, Milano, Italy

Purpose/Objective: The Italian Association of Medical Physics (AIFM) instituted in 2012 a working group dedicated to the Stereotactic ablative body radiotherapy (SABR). The aim of this work is to identify possible criticisms in approaching multicentric clinical trial for lung SABR, comparing, from a radiobiological and dosimetric point of view, the plans obtained with different treatment planning systems, techniques and planners.

Materials and Methods: Five CT series from a database of patients treated with RT on lung were sent to the participants. Dose prescription was 54 Gy in 3 fractions of 18 Gy each to planning target volume (PTV). Each participant was asked to prescribe dose in conformity to its experience (i.e. 100%, 30%, mean dose) to stress the individuality of every center. For all plans were calculated: the PTV gEUD (generalized equivalent uniform dose), MLD (mean lung dose) equivalent to 2 Gy for ipsilateral lung minus CTV and AOR (organ at risk) maximum dose. The dosimetric data and the parameters related to each center were analyzed including: expertise, equipment, size of leaves, TPS, radiation technique, and energy of radiation. Furthermore, a performance index was defined for each dosimetric parameter to compare plans with differences in terms of the PTV gEUD. For example the performance index regarding MLDeq2Gy is defined as PI = (MLDeq2Gy/gEUD)/Reference/(MLDeq2Gy/ gEUD)center. and the Reference value belongs to a center with mean performances.

Results: Twenty-six centers with 3D-Conformal RT, IMRT, VMAT (Linac 88%), CyberKnife (4%) and Tomotherapy (8%)
joined this inter-comparison. Almost every region of Italy was represented. In figure 1, the distribution of the PTV gEUD and of the MLDeq2Gy PI are shown. The dot line is the minimum PI required value; the spread of the data intra-institution and inter-institution is visible. The PI related to the rib max dose shows a significant correlation (p=0.01) with the use of CyberKnife versus Linac or Tomo. Almost all centers have values above the minimum required index but all of them, except for CyberKnife, show performances below the reference one, indicating a weak consideration of this constraint. Otherwise, for the PI of spinal cord max dose, all center are above the dot line. Any correlation was found between performances and the participants expertise or for other technical parameters.

Figure 1: distribution of gEUD among the centres and of MLDeq2Gy performance index. The dot line is the minimum required value.

Conclusions: A notable inter-institutional difference in terms of gEUD and general planning strategies was found. For a multi-institutional study perspective, detailed dose specification and planning strategies based on collaboration and discussion are mandatory.

EP-1472
Do 4DCT and CBCT imaging doses need to be included in the planning of radiotherapy treatments?

L. Rogers1, N. Suchowerska1, A. Ralston1, A. Napper1, D.R. McKenzie2
1Chris O’Brien Lifehouse, Radiation Oncology, Camperdown Sydney, Australia
2University of Sydney, School of Physics, Camperdown Sydney, Australia

Purpose/Objective: 4DCT and CBCT imaging in radiotherapy delivers a small priming dose, which is ignored in treatment planning, despite evidence that the size and sequence of partial fractions affects cell survival1,2. The delay between imaging and treatment may be minutes or days for CBCT and 4DCT respectively. There is a trend towards increasing use of these imaging modalities as they enable more accurate delivery of therapeutic dose. The biological effect of an imaging partial fraction in addition to the therapeutic dose on cell survival is uncertain. We report here on the effect of an imaging dose prior to a therapeutic dose on cell survival in two human cancer cell lines and one normal human cell line. The effects are examined for current typical imaging dose levels and a projection is made of the effects on cell survival of an increase in the imaging dose.

Materials and Methods: In-vitro clonogenic assays were used to obtain experimental data for non-small cell lung cancer

(NCI-H460), melanoma (MM576) and a normal (HUVEC) cell lines. The 4DCT was performed on a Toshiba Aquilion CT with a Varian RPM motion management system and the CBCT on a 6MV proton beam from a Varian Novalis linac with a kV-cone beam system. The therapeutic dose D1 was delivered after time t using the Varian Novalis. An expression for cell survival S was derived using the Lea-Catcheside formalism, with and without the imaging dose D. The effect on cell survival of increasing the imaging dose to a projected 10, 20 and 50 cGy was modelled.

Results: For the two human cancer cell lines considered in this study, D1 (measured to be 0, 0.60cGy [CBCT] or 14.0 cGy [4DCT]) given prior to a D1 (0, 2 or 4 Gy), has no measurable effect on cell survival, irrespective of the time delay. The theoretical analysis confirmed the experimental findings for these imaging doses, that an additional partial fraction dose from CBCT or 4DCT is not likely to affect tumour control significantly as the cell survival was predicted to decrease by 2-3% for 4DCT. However, if the imaging dose is increased to 20 and 50 cGy, it is predicted the clonogenic survival would decrease by 6 and 15% respectively for the cancer cell lines. This decrease was predicted to be smaller for the normal cell line (4 and 6% for 20 and 50 cGy respectively).

Conclusions: This study indicates that, at the current dose levels, it is not necessary to consider the imaging dose from 4DCT or CBCT in the planning of radiotherapy treatment. However, if the imaging dose is increased then imaging dose may need to be included in treatment planning.

References

EP-1473
Modelling the impact of oxygenation, accelerated repopulation and heterogeneous fractionation on SBRT outcome

E. Lindblom1, A. Dasu2, I. Toma-Dasu3
1Stockholm University, Medical Radiation Physics, Stockholm, Sweden
2Linköping University, Department of Radiation Physics and Department of Medical and Health Sciences, Linköping, Sweden
3Stockholm University and Karolinska Institutet, Medical Radiation Physics Department of Physics (SU) and Department of Oncology and Pathology (KI), Stockholm, Sweden

Purpose/Objective: While conventionally fractionated radiotherapy (CFRT) has proven ineffective in curing non-small-cell lung cancer (NSCLC), promising results have been obtained with stereotactic body radiotherapy (SBRT) employing few high-dose fractions. Extreme hypofractionation might however compromise the treatment outcome in hypoxic tumours given the reduced possibility for reoxygenation between fractions. An alternative approach