rotations positioning during the treatment of MCM using VMAT.

Materials and Methods: Eight treatments of MCM were randomly selected from the internal database. These were re-planned for single and multiple isocenters (S-iso; M-iso) VMAT. The prescription was set to 180Gy at 99% of target volume. Paddick conformity index (CI), V100%, V90% for target; V4.5Gy, V9Gy, V12Gy for body; beam-on and door-to-door times were analyzed. For each plan, three shifts (0.5°, 1°, 2°) were applied for pitch and roll for each isocenter, simulating incorrect patient repositioning (1°, 2°) and involuntary motion during the delivery (0.5°). The shifted plans were recalculated with the same monitor units and compared to the reference ones in terms of reduction in target volume receiving 90% and 100% of the prescription dose.

Results: A total of 43 metastases were evaluated. No significant differences were found in terms of CI between the two approaches. M-iso showed significant lower median V4.5Gy and V9Gy with respect to S-iso, while S-iso resulted in reduced beam on time (7.8±2.8 min vs. 10.4±3.2 min) and significant door-to-door time (16.3±2.7 min vs. 27.4±6.2 min). Concerning the rotated plans, there was a worsening with rotation increasing, with median V100% reduction for 2° rotations of 22.5% and 2.7% for, respectively, S-iso and M-iso.

Figure 1 reports the full data analysis on V90% and V100% in terms of volume loss.

Figure 1: Delta volume loss for target V90% and V100% in function of pitch and roll rotations.

Conclusions: Adjustments in all six dimensions, including unconventional pitch and roll rotations, are fundamental for MCM. S-iso reducing delivery time is the treatment of choice as the patient comfort is essential for so challenging patients. In case of S-iso, on-line patient monitoring during the delivery in 6D should be performed to avoid undesirable target underdosage.

PD-0470
Optimum immobilisation device for extremity soft tissue sarcoma radiotherapy
E. McCrickard¹, E. O'Shea¹, M. Dunne¹, S. Cosgrove¹, W. Garrett¹, C. Gillham¹
¹St Luke's Hospital, Academic Physics, Dublin, Ireland Republic of

Purpose/Objective: 60-80 patients with an extremity soft tissue sarcoma (ESTS) are diagnosed annually in Ireland. At least half will require radiotherapy pre or post-operatively. Accurate and reproducible patient immobilisation is essential for safe delivery of radiotherapy to these patients. However, the optimal technique remains to be determined.

Materials and Methods: Two lower limb immobilisation devices are compared in this prospective study. Arm A: is an in-house developed device, comprising of customized foot-orifices and footrests, fixed to the treatment couch. Arm B: is a similar device, but has the additional ability to elevate either limb independently.

Results: Preliminary results indicate Arm A is useful for proximal thigh/groin sites when limb separation is necessary and Arm B is advantageous when treating the distal/anterior thigh and calf.

Arm A: 268 ConeBeamCT (CBCT) scans were analysed on 20 patients to date. The resultant CTV-PTV margins required for setup uncertainty are 0.7, 0.5 and 0.6cm for X, Y, and Z directions respectively.

Arm B: 159 CBCT scans were analysed on 13 patients to date. The resultant CTV-PTV margins required for setup uncertainty are 0.6, 0.5 and 0.4cm for X, Y, and Z directions respectively.

The standard deviation of the systematic error (reproducibility of treatment position) was less for B than for A in all directions. Levene's test for equality/homogeneity of variances showed that the variances of the two groups were statistically significantly unequal in the z direction (p=.011).

Conclusions: This research is on-going. Both techniques satisfactorily immobilise the lower limb, however the results show a smaller CTV-PTV margin could be applied for those patients immobilised with the Arm B device. However, at present both devices are required. Final results of this research study will be available in April 2015; recommendations will be made regarding an optimal immobilisation device.

OC-0472
Whole breast radiotherapy does not affect growth of cancer foci in other quadrants: results from the TARGIT A trial
J. Vaidya¹, M. Bulsara², F. Wenz³, J.S. Tobias³, D.J. Joseph⁴, S. Massarat⁵, H. Flyger³, W. Eiermann⁶, C. Saunders⁷, M. Alvarado⁸, C. Brew-Graves⁹, I. Potyka¹⁰, N.R. Williams¹¹, M. Baum¹²
¹University College London, Division of Surgery and Interventional Science, London, United Kingdom
²University of Notre Dame, Statistics, Fremantle, Australia
³University of Mannheim, Radiotherapy, Mannheim, Germany
⁴University College London Hospital, Radiotherapy, London, United Kingdom
⁵Sir Charles Gairdner Hospital, Radiotherapy, Perth, Australia
⁶Centro di Riferimento Oncologia, Surgery, Aviano, Italy
⁷University of Copenhagen, Surgery, Copenhagen, Denmark
⁸Red Cross Hospital, Surgery, Munich, Germany
⁹University of Western Australia, Surgery, Perth, Australia
¹⁰UCSF, Surgery, San Francisco, USA
¹¹University College London, Surgery, London, United Kingdom

Purpose/Objective: In 1996 we reported that 63% of specimens of mastectomy performed for a unifocal cancer harbour other cancer foci; 80% of these foci are in other quadrants. In contrast, local recurrence after a lumpectomy occurs mainly at the site of the original tumour. Therefore, we hypothesized that cancer foci in other quadrants remain dormant even in the absence of radiation treatment to the whole breast [1]. This academic insight led us to develop the targeted intraoperative radiotherapy (TARGIT) technique using the IntraBeam device. In the TARGIT A randomized trial (n=3451) we compared risk adapted TARGIT vs. whole breast radiotherapy [2].

Materials and Methods: Randomisation occurred either before surgery (Prepathology stratum: TARGIT given during lumpectomy) or after surgery (TARGIT given as a delayed procedure); the main analysis found that using TARGIT during...
initial lumpectomy is the preferred option rather than delayed administration by reopening the wound. We therefore estimated the number of cancer foci in quadrants other than the original tumour and compared the incidence of recurrence in such quadrants as per treatment received (TARGIT vs. EBRT).

Results: 793 patients in the prepathology stratum randomized to TARGIT had only TARGIT as their radiotherapy and had. 2098 women years of follow up. The 5 year local recurrence rate in those who received TARGIT alone was 2.7% (95% CI 1.35.5), which was not different from the whole prepathology cohort randomized to TARGIT: 2.1% (1.14.2). In these 793 patients, one would expect 63% (i.e., 500) of patients to have additional foci of cancer in their breasts and 80% of these (i.e., 400) should be in quadrants other than the index quadrant. In reality, after 2098 women years of follow up, 7 patients had recurrence in the scar, 6 had new contralateral cancers and 2 had cancers growing in other quadrants implying that the remaining 398 foci had remained dormant. Amongst 935 patients who received whole breast radiotherapy the same number of cancers (n=2) grew in other quadrants implying that the remaining 398 foci had remained dormant. Of note, 94.4% of cases in the TARGIT A trial did not have a preoperative MRI, so patients who may have had multicentric cancer foci detectable by MRI would have not been excluded from the trial.

Conclusions: Cancer foci in breast that are away from the site of the primary tumour remain dormant and behave no differently from those in the contralateral breast. They also appear to be unaffected by whole breast radiotherapy or are treated sufficiently by systemic therapies. This analysis from the randomized TARGIT A trial provides further proof supporting partial breast irradiation.

References:

OC-0473
Intraoperative radiotherapy (IORT) in breast cancer: analysis of 6,816 cases from ISIORT database
1University of Piemonte Orientale, Radiotherapy, Novara, Italy
2University Hospital, Radiotherapy, Salzburg, Austria
3University Hospital Gregorio Maranon, Radiotherapy, Madrid, Spain
4University Medical Center, Radiotherapy, Mannheim, Germany
5Hospital, Radiotherapy, Città di Castello, Italy
6University Hospital, Radiotherapy, Verona, Italy
7University Hospital, Radiotherapy, Genova, Italy
8Greater Poland Cancer Center, Radiotherapy, Poznan, Poland
9Hospital, Radiotherapy, Cuneo, Italy
10Hospital, Radiotherapy, Foligno, Italy
11University Hospital Sant’Andrea, Radiotherapy, Roma, Italy
12Hospital, Radiotherapy, Trento, Italy
13Instituto Madrileño de Oncología, Radiotherapy, Madrid, Spain
14Hospital San Filippo Neri, Radiotherapy, Roma, Italy
15Hospital, Radiotherapy, Lublin, Poland
16Hospital, Radiotherapy, Catania, Italy
17Hospital, Radiotherapy, Treviso, Italy
18Hospital, Radiotherapy, Haifa, Israel
19Hospital, Radiotherapy, Reggio Emilia, Italy
20Hospital, Radiotherapy, Montpellier, France
21Hospital, Radiotherapy, Castellanza, Italy
22Hospital, Radiotherapy, Bergamo, Italy
23Hospital, Radiotherapy, Koln, Germany
24Hospital, Radiotherapy, Wilrijk, Belgium

Purpose/Objective: A joint analysis of clinical and technical data from 34 centres within the International Society of Intraoperative Radiation Therapy (ISIORT) was undertaken in order to identify the range of intraoperative radiotherapy (IORT) indications and techniques for various tumour sites. In this survey we analysed breast treatments.

Materials and Methods: Since 2007, we collected demographic, clinical and technical data related to IORT procedures in a common database. Prospective and retrospective data entry was possible. The current study analysed 6,816 breast tumours.

Results: Breast tumours represent 80.3% of all data of the ISIORT survey that encompassed 8,493 IORT procedures performed from 1992 to 2014. Median age of breast patients was 61.1 years (range 16-90). Gender was female in 99.7% and male in 0.3% of cases. In 6,702 cases (98.3%), IORT was a component of radical treatment for primary, newly diagnosed disease and in 114 cases (1.7%), it was an attempt to rescue localized recurrent breast cancer.

IORT was performed as a boost before or after EBRT in 3,258 cases (47.8%) with doses of 8-12 Gy. In 3,558 cases (52.6%), IORT was used as single radiation treatment modality with doses of 18 Gy, 20 Gy or 21 Gy. The patients enrolled in study protocols represented 33% of those treated by a single dose and 6.3% of those treated by a boost dose. IORT was delivered after and before tumour removal in 39% and 61% of cases, respectively.

In 6,406 cases (94%), IORT was performed using electrons of 4-12 MeV energy. The most used applicators (77% of cases) were 5 or 6 cm in diameter and bevel angle was 0° in the majority of cases (88%). Four hundred and ten cases (6% of patients) were treated with a 50-kV x-ray source in a single centre. X-rays treatments were delivered by a spherical applicator inserted into the surgical cavity after tumour removal.

Conclusions: At present, the ISIORT database represents the largest clinical and technical IORT data collection. Breast cancer is the most frequent IORT treatment performed in the 34 participating centres. From this analysis, it emerged that in most cases IORT was used as single shoot of 18-21 Gy, the most employed treatment modality was electron beam and the procedure was most frequently performed after tumour removal. Only a minority of patients was included in clinical trials.

Further data analyses could enhance multi-institutional performance and serve as a basis for designing clinical trials in an effort to define the role of IORT in tailored multimodality therapeutic approaches.