a second operation. TIC, in our experience, is a simple, cost-effective and rapid intra-operative assessment tool to allow a single stage approach to axillary node status. We are now routinely acting on the basis of the TIC result.

5124 POSTER

Left anterior descending coronary artery (LAD) doses from breast radiotherapy: is prone treatment positioning beneficial?

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Introduction: Breast radiotherapy increases risks of late cardiovascular mortality/morbidity. LAD irradiation is implicated in pathogenesis but the effects of prone positioning on its dosimetry are unknown. We compare LAD and heart doses from whole (WBI) and partial (PBI) breast radiotherapy planned prone and supine.
Methods & materials: Twenty-two patients with left breast cancer had titanium clips placed in excision cavity walls at breast conservation surgery. Each underwent standard supine CT-scanning before being repositioned & re-imaged prone on an in-house platform with an aperture through which index breast falls. Partial-breast CTV was defined as tumour bed (clips/tissue distortion) +15 mm margin. WB clinical target volume (CTV) was defined using radio-opaque wire marking clinically palpable breast tissue. Heart & LAD were outlined. Tangential-field PBI & WBI plans were generated for each position (total: 88 plans). Mean normal tissue doses (NTD_{mean}) for heart/LAD, & maximum LAD (LAD_{max}) doses were compared for prone vs supine positions (paired t-test) and by individual patient (IP).
Results: Population data are summarized in the table.

	Mean doses (standard deviation)					
	WBI			PBI		
	Supine	Prone	p	Supine	Prone	p
Heart NTD_{mean} (Gy_3)	1.1 (0.4)	1.0 (0.6)	0.9	0.3 (0.2)	0.5 (0.3)	0.05
LAD NTD_{mean} (Gy_3)	11.1 (7.2)	10.0 (6.7)	0.7	2.0 (1.6)	3.5 (2.9)	0.05
LAD_{max} (Gy)	48.1 (4.6)	46.1 (4.4)	0.1	27.0 (18.0)	32.3 (17.3)	0.4

Reviewing IP data for WBI, prone positioning improved heart/LAD doses in 13/22 cases (mean improvement in LAD NTD_{mean} = 8.1 Gy) but worsened doses in 9/22 cases (mean increase in LAD NTD_{mean} = 9.8 Gy). A supine LAD NTD_{mean} of $\geqslant$12 Gy correlated with a benefit from prone treatment on LAD NTD_{mean} ($p < 0.001$) & LAD_{max} ($p = 0.02$). In the context of PBI, prone positioning improved cardiac doses in only 6/22 cases (mean LAD_{max} improvement = 19.0 Gy) but worsened doses in 16/22 cases (mean LAD_{max} increase = 19.7 Gy). For both WBI & PBI, breast volume >1000 cm^3 correlated with a benefit from prone treatment ($p = 0.003$).
Conclusions: Mean LAD doses from both prone & supine tangential-field WBI are significant. Prone positioning is likely to improve LAD dosimetry only in women with breast volumes >1000 cm^3 ($\geqslant$D cup (UK)) and/or supine LAD NTD_{mean} doses of $\geqslant$12 Gy, and should be used with caution in smaller-breasted women in whom the position is likely to be detrimental. LAD doses from PBI are overall lower than from WBI but prone positioning is again likely to be detrimental in women with breast volumes $\leqslant$1000 cm^3.

5125 POSTER

Verifying CTV-PTV margins for isocentric breast cancer radiotherapy, using an off-line correction protocol and fixed couch height

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Background: To investigate patient setup (SU) variability, and thus PTV margins, when implementing a new, fully conformal, isocentric irradiation technique with standardised immobilisation material and fixed couch height (FCH).
Materials and Methods: From 03/02/09 to 23/03/09, 530 portal images (PI's) were analysed from 65 consecutive patients, 44 with tangential (TG) fields and 21 with TG fields plus nodal irradiation (TG + N). Patients were simulated on a conventional simulator to mark the isocenter. Patients were immobilised using a breastboard. A CT scan was taken in the same position. For all patients treated with TG + N fields, 2 SU fields and all treatment fields were checked on the simulator before start, verifying patient positioning, couch parameters, position of the leafs, source-skin distances, correct shielding of contralateral breast, chin and larynx and verifying the correspondence with the Digitally Reconstructed Radiographs. During treatment, patients were positioned according to fuchsine lines, but with FCH determined on the simulator and a tolerance of 5 mm in lateral (Lat) and cranial-caudal (CC) direction. PI's of all treatment fields were taken on day 1 and halfway. For patients treated with TG + N fields, PI's of 2 SU fields were taken on day 1, 2 and 3 (D1−3) of the course and further on weekly. D1−3: online adjustment if mismatch >5 mm. Mean mismatch (MM) was calculated after 3 days, using values of PI's taken before any online correction. When MM was larger than 3 mm, adjustments were applied for the rest of the course.
Results: Systematic SU errors were 1.9 mm in anterior-posterior (AP), 2.0 mm in Lat and 2.3 mm in CC direction. Mean of systematic errors was 0. Random SU errors were 1.3 mm in AP, 1.6 mm in Lat and 1.3 mm in CC direction. Per patient and in every direction, MM of D1−3 very well predicted the eventual systematic error over the whole course, indicating the usefulness of the correction protocol. Using the formula of Van Herk et al., margins should be 6 mm in AP and Lat and 7 mm in CC direction.
Conclusions: Analysing match results, our centre specific SU accuracy for breast cancer treatment is comparable but slightly better then expected compared to literature and former own work. In our opinion, this is due to strict patient positioning with FCH and a tolerance of 5 mm in lateral (Lat) and cranial-caudal (CC) direction and to the use of a correction protocol. Calculated CTV-PTV margins were introduced in our centre, allowing a better sparing of the organs at risk.

5126 POSTER

Ipsilateral breast tumour relapse: local recurrence versus new primary and the effect of whole breast radiotherapy on the rate of new primaries

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Background: The justification for partial breast radiotherapy (PBRT) after breast conservation surgery for early breast cancer includes an assumption that ipsilateral breast tumour relapses (IBTR) presenting outside the index quadrant are mostly new primary tumours (NP) that develop whether or not radiotherapy is given. We aim to test the hypothesis that whole breast radiotherapy (WBRT) is ineffective in preventing NP by comparing rates in irradiated and contralateral breasts after tumour excision and WBRT.
Materials and Methods: A retrospective review was undertaken of 1410 women with breast cancer entered into a prospective randomized trial of radiotherapy fractionation involving annual clinical assessment to identify IBTR and contralateral breast cancer (CLBC). IBTR was classified into local recurrence (LR) or NP based on location and histology, and subdivided as definite or likely depending on the completeness of clinical data. Rates of ipsilateral NP and CLBC were compared over a 15-year period of follow-up. Due to the non-independence of the endpoints, complex statistical methods are required for formal comparison of event rates.
Results: At a median follow-up of 10 years, there were 150 documented cases of IBTR: 118 (79%) were definite or likely LR; 27 (18%) were definite or likely NP; and 5 (3%) could not be classified. There were 71 cases of CLBC. Results of an analysis which allows for the reporting of multiple events within an individual will be reported to formally compare event rates.
Conclusions: Despite uncertainty in some cases in classifying IBTR as LR or NP on clinical criteria, the absolute numbers of each event type appear to suggest that WBRT reduces the rate of ipsilateral NP tumours.

5127 POSTER

Hypofractionation versus conventional fractionation radiotherapy (RT) after breast conservative treatment of breast cancer: radiation induced pneumonitis

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Background: Hypofractionated RT for breast cancer has beneficial aspect on patients and health care systems due to reduction of treatment time and cost, but the incidence of potencial adverse effects on underlying normal lung tissue should be further investigated.

Materials and Methods: Between 2008 and early 2009, 34 patients with T1−2N0M0 breast cancer were randomised into two groups. Group A (n = 17) received standard radiotherapy with 50 Gy/25f/5w plus boost 10 Gy/5f/1w to tumor bed and Group B (n = 17) 43.2 Gy/16f/22 d plus boost 8.1 Gy/3f/3 d. All patients were tested using spirometry and gas diffusion tests on D0 (before RT), during RT (on D7 and D21) and after completion of RT at 3, 6, 9, 12 months. High resolution CT scans were performed at 6, 9, 12 months after completion of RT. Respiratory symptoms were recorded.
Results: Preliminary results are shown in the table.

Follow-up time (at present)	Treatment group	Uncomplicated	Complicated	Total
6 months	Group-A	7	1	8
	Group-B	2	4	6
	Total	9	5	14
9 months	Group-A	3	1	4
	Group-B	3	1	4
	Total	6	2	8
12 months	Group-A	2	0	2
	Group-B	1	0	1
	Total	3	0	3

The percentance of incidence of radiation-induced pneumonitis for the two treatment groups, is directly derived from the data of the table: **i) Group-A:** 12.5% (6-month follow up) and 25% (9-month follow up), and **ii) Group-B:** 66.7% (6-month follow-up) and 25% (9-month follow-up).
Conclusions: The preliminary results indicate an increase in the incidence of radiation-induced pneumonitis for the patients of group-B (hypofractionated RT regimen) over that for the patients of group-A (conventional fractionation). However, this is an ongoing study and for statistically confident conclusions an investigation of late effects on a larger number of patients is necessary.

5128 POSTER

Optimal radiation field in pathological N0-N1 patients treated with neoadjuvant chemotherapy followed by surgery for locally-advanced breast cancer

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Background: To investigate the treatment results and evaluate the necessity to irradiate the supraclavicular lymph node region (SCN) in pathological N0-N1 patients treated with neoadjuvant chemotherapy followed by surgery and radiotherapy (RT) for locally advanced breast cancer.
Material and Methods: Between 1996 and 2006, 115 patients with initial tumor size >5 cm or clinically positive lymph nodes were treated with neoadjuvant chemotherapy followed by surgery and radiotherapy. Among these patients, we retrospectively reviewed 57 patients with pathological N0 or N1. All patients received anthracycline based neoadjuvant chemotherapy. Thirty patients were treated with modified radical mastectomy and 27 patients with breast conserving surgery. The pathological tumor stage was T0 or Tis in 21%; T1 in 33%: T2 in 28%: T3 in 16% and T4 in 2% of patients. The pathological lymph node stage was N0 in 47% and N1 in 53%. Adjuvant RT was given to all patients; 37 patients to chest wall or breast and supraclavicular area (SCNRT+ group) and 20 patients only to chest wall or breast (SCNRT− group).
Results: Locoregional failure free survival (LRFFS), distant metastasis free survival (DMFS), disease free survival (DFS) and overall survival (OS) at 5 years were 92%, 83.2%, 81.4% and 87.7%, respectively. Pathological tumor stage and hormone treatment were statistically significant factors for DMFS, DFS and OS on multivariate analysis ($p < 0.05$). Radiation field to include supraclavicular area or not did not seem to be any relationship with LRFFS, DMFS, DFS and OS. In pN0 and pN1 patients, 5-year DFS was 86.6% and 68.8% in SCNRT+ group, compared with 80.8% and 100% in SCNRT− group, respectively ($p = 0.9794$, $p = 0.0713$).
Conclusions: In patients with pathological N0 or N1 after neoadjuvant chemotherapy followed by surgery, we might dispense radiotherapy to SCN and give only to chest wall or breast in selected patients according to pathological tumor stage.

5129 POSTER

Surfactant protein D as a serological marker of lung inflammation in breast cancer patients under radiation treatment

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Background: Surfactant protein D (SP-D), a potential specific marker of lung disease, and C-reactive protein (CRP), an established inflammatory marker, are evaluated to assess radiation-induced lung inflammation in breast cancer patients.
Material and Methods: SP-D and CRP levels were measured prospectively by ELISA in 40 patients with primary breast cancer, aged 29−71 years, and 20 healthy controls. Serum samples were collected prior to initiation, during, and at completion of radiation therapy and throughout a follow-up period of 7 months (90, 140 and 240 days after the initiation).
Results: According to their median SP-D and CRP serum levels, patients were categorized into three groups. Regarding SP-D, patients of the first group exhibited levels within normal range compared to healthy controls (<110 ng/ml) at all time points. Patients within the second group exhibited increased levels at the end of radiation therapy and during follow-up (At the end: 123.57 ng/ml, Follow-up: 90th day: 113.86 ng/ml, 140th day: 116.22 ng/ml), whereas patients of the third group expressed highest levels, above normal range, at all time points. Considering CRP, serum levels were within normal range at all time points for patients of the first and second group compared to healthy controls (114.2–3832.6 ng/ml) whereas increased levels (4946.2 ng/ml) were observed only prior to radiation therapy for the patients of the third group. No disease progression was observed according to clinical evaluation and tumor marker measurements (CEA and CA 15−3).
Conclusions: Increased levels of SP-D and CRP prior to radiotherapy, in the patients of the third group, indicate the presence of an inflammatory condition not associated with radiation treatment. The sustained elevated SP-D expression at all time points suggests that this molecule may be a more sensitive marker of lung inflammation than CRP. Regarding patients of the second group, the increased SP-D serum expression at the end of radiotherapy and during follow-up may be suggestive of radiation-induced lung inflammation. However, CRP does not appear to reflect these effects since no corresponding increase was detected. Concluding SP-D seems to be indicative of lung inflammation in breast cancer patients under radiation therapy, serving as a specific noninvasive serological marker.

5130 POSTER

Short-term outcome of prospective trial for Japanese breast cancer patients treated with accelerated partial breast irradiation using 3D Conformal Radiotherapy

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Purpose: We present our clinical trial utilizing 3D-conformal radiation therapy (3D-CRT) to deliver accelerated partial breast irradiation (APBI) in patients with early-stage breast cancer treated with breast conserving therapy.
Methods and Materials: Between Janualy 2008 and March 2009, 51 patients with Stage 0−2 breast cancer were enrolled at National Cancer Center Hospital, Japan, institutional review board-approved. Eligibility criteria included pathological tumor size <3 cm, invasive ductal and lobular histologies as well as ductal carcinoma in situ, lumpectomy with negative surgical margins, $\leqslant$3 positive axillary nodes, unifocal lesion, and written patients consent. Patients receiving chemotherapy before operation were excluded. The clinical target volume consisted of the lumpectomy cavity with surgical clips plus a 10 mm margin; the planning target volume (PTV) was calculated from the CTV using uniform 3-D expansions. The prescribed dose was 38.5 Gy in 10 fractions given over 2 weeks. All patients were treated once a day.
Results: The median follow-up after radiotherapy was 248 days (range, 35–456). The clinical stage distribution was as follows: 0 in 7 patients, 1 in 33, and 2 in 20. The median tumor size was 16 mm (range, 5−30 mm). The median age was 58 year (range, 32−79). 15 patients underwent chemotherapy before entering trial. Adverse event information according to CTCAE V3.0 is presented in table. No local or distant recurrences developed.
Conclusion: 3D-CRT for APBI is feasible for Japanese breast cancer patients in short follow up. Additional follow-up will be needed to assess the long-term feaibility and efficacy of APBI using 3D-CRT.