registration with the radiotherapy planning CT in the first patient, and with reference to bony anatomical landmarks in the second. A radiotherapy boost dose was then delivered to the sites of lymphatic involvement using an IMRT technique. Fig 1c shows the radiotherapy dose distribution for the first patient at the level of the involved lymph node in the left obturator region.

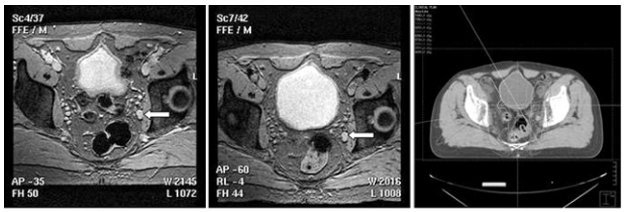

Fig 1a Fig 1b Fig 1c

Fig. 1

Discussion: MR scanning pre and post ferumoxtran at the time of the radiotherapy planning scan can provide clarification of pelvic lymph node status in patients with suspicious radiological findings at presentation. Such MRI images can be co-registered with the planning CT in order to achieve more precise target definition.

1382 POSTER

Validation of perfusion computed tomography (CT) parameters as surrogate markers of hypoxia in squamous cell carcinoma of the head and neck

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Background: Hypoxia is a determinant of radiation responsiveness and correlates with outcome in squamous cell carcinoma of the head and neck (HNSCC). A non-invasive method for identifying areas of reduced oxygenation within tumours may enable radiotherapy planning and delivery to be individually optimised.
Aim: To validate perfusion CT parameters as surrogate markers of hypoxia in HNSCC. These parameters were compared to pimonidazole hydrochloride, an extrinsic marker of hypoxia.
Methods: 48 measurements of perfusion CT parameters from 12 regions of interest (ROIs) were made in 5 patients with HNSCC prior to surgical resection. All scans were performed on a GE Lightspeed 16® scanner. The CT protocol includes a cine perfusion sequence with a rotation time of 1 sec, total acquisition time of 50 secs, using 80 kV and 100 mAs. Intravenous contrast agent, iohexol 300 was injected at a dose of 0.5 ml/kg at 4 ml/sec. Perfusion CT parameters are analyzed using GE CT Perfusion 3® software which yields parameter maps of tissue blood volume, BV(ml/100 g); blood flow, BF (ml.100 $g^{-1}min^{-1}$); mean transit time, MTT(s) and microvascular permeability surface area product, PS (ml.100 $g^{-1}min^{-1}$). 0.5 g/m^2 pimonidazole hydrochloride was administered intravenously 16–20 hours before surgery. At resection the tumour was orientated such that the pathological specimen was sectioned in the image plane. The pimonidazole uptake was identified by immunohistochemistry. A histological section within the tumour was matched to the corresponding image slice and corresponding ROIs drawn on both the image slice and the section. The percentage of pimonidazole staining within the ROIs defined the hypoxic fraction. Correlations between the perfusion CT parameters and the hypoxic fraction were assessed using the Spearman rank correlation coefficient (Rs).
Results: see table 1

	BF		BV		MTT		PS	
Min	Mean	Min	Mean	Max	Mean	Max	Mean	
Rs	0.726	0.389	0.583	0.483	−0.431	−0.431	−0.536	0.35
95%CI	0.242 to 0.92	−0.256 to 0.794	−0.005 to 0.872	−0.144 to 0.834	−0.812 to 0.209	−0.812 to 0.209	−0.854 to 0.075	−0.298 to 0.777
P	**0.01**	0.23	**0.05**	0.12	0.18	0.18	0.08	0.29

Conclusion: These preliminary results suggest that selective parameters derived from perfusion CT may be of use as surrogate markers of hypoxia in HNSCC. Such a non-invasive, spatial mapping of intratumoural hypoxia may enable targeted radiation dose escalation to radioresistant clonogens with the potential for improved local control and survival in this group of patients.

1383 POSTER

Dosimetric parameters on the development of radiation pneumonitis – the significance of topographic dose distribution

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Background: A variety of different dose-volume histogram (DVH) parameters have been reported to be correlated to the incidence of radiation pneumonitis (RP). But these DVH parameters do not take topographic dose distribution of lung into account. We tried to reveal the correlation of incidence of RP and the topographic dose distribution of lung including other known several DVH and clinical parameters.
Material and methods: From July 2000 to October 2004, of patients irradiated for small and non-small cell lung cancer, 63 patients who received more than 50 Gy and were followed-up for more than 6 months were analyzed for RP according to National Cancer Institute Common Toxicity Criteria. There were 46 males and 17 females and median age was 70 years (35~91 years). ECOG performance score was PS 0–1 in 29 and 2 or more in 34 patients. Most patients were stage III (I-II 4, IIIa 13 and IIIb 46). Prior to radiation therapy, five patiens received open thoracotomy without lung resection and 25 patients received induction chemotherapy. Concurrent chemotherapy was given to 23 patients during the radiation therapy. After acquisition of planning CT, 3D planning and dosimetric calculations were done with Pinnacle[3]® (Philips, USA). Total dose ranged from 50.0–70.2 Gy (median 63.0) with conventional fraction size (1.8–2.0 Gy). Analyzed parameters included clinical (age, gender, performance status, Stage, FEV1, open thoracotomy and induction or concurrent chemotherapy) and DVH (mean lung dose (MLD), V20 and V30) parameters. After dividing the normal lung volume into total (TL), involved lateral (IL), upper (UL) and lower (LL) (with equal volume), topographic distribution of DVH parameters were also analyzed.
Result: Median follow-up period was 13 months (6–52 months). Grade 2 or higher RP developed in 17 patients (27%). Median time to development of Grade 2 or higher RP was 3 months (2~14 months). Induction chemotherapy reduced the incidence of RP ($p = 0.0258$). Other clinical parameters did not influence on the incidence of RP. Total prescribed dose did not influence on the RP incidence ($p = 0.3852$). DVH parameters of upper half lung (MLD_UL, V20_UL and V30_UL) were not significant. On the other hand, although the mean value of MLD_LL was lower than that of MLD_UL (7.3 Gy vs 21.1 Gy, $p = 0.000$), parameters of lower half lung were all significant ($p = 0.0166$ for MLD_LL, 0.0027 for V20_LL and 0.0164 for V30_LL). MLD_TL also showed statistical significance ($p = 0.0206$), but other parameters of involved lateral and both lung did not show consistency.
Conclusions: Lower half lung seemed to be more sensitive to radiation pneumonitis. This topographic difference of the vulnerability to radiation pnuemonitis should be taken into account at the time of radiation therapy planning and biological response modeling.

1384 POSTER

Interclinican variability in delineation of tumour volumes for glioblastomas with the assistance of MRI fusion

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Background: The aim of this study is to assess the intra- and interclinician variability in contouring target volumes of glioblastomas in the post-operative setting with and without the assistance of pre-operative MRI fusion.
Methods and materials: 8 clinicians participated in the study (including a radiologist) and were asked to contour tumour volumes on 2 randomly selected patients with typical glioblastomas. Both patients underwent pre-operative imaging with an MRI, followed by debulking surgery. Planning CTs were then performed post-operatively. Clinicians were asked to contour gross tumour volumes (GTVs) on the planning CT (GTV-CT), using the pre-operative MRI films as a guide to the tumour bed. This process was then repeated with on a fused CT-MRI image. Clinicians expanded the fused GTV (GTV-MRI) a planning target volume (PTV) using the EORTC guidelines (2–3cm margin). Variability was analysed in terms of total volume and position (by comparing the centre of the volumes (COV) in the x, y and z planes and by the amount of non-overlap (residual volumes) between the volumes).
Results: There was a significantly lower inter-clinician variability in the GTV-MRI volumes compared with the GTV-CT in cubic centimetres (standard deviation of 35 and 14 respectively, $p = 0.002$). Expansion to a PTV from the GTV-MRI resulted in an increase in the variability of the volumes (standard deviation = 22). The location of the COV of the GTV-MRI was less variable than the COV of the GTV-CT in 3 planes. The average spread of the COV in the x-, y-, and z-planes for both patients in cm was 0.93, 1, and 1.2 for the GTV-CT and 0.36, 0.25 and 0.6 for the GTV-MRI. The residual volumes in comparing the GTV-CT and GTV-MRI expressed

as a percentage of the mean ranged from 43 to 67 for patient 1 and 45 to 89 for patient 2.
Conclusions: The inter-clinician variability in delineating a GTV of a post-operative glioblastoma was significantly less when using a fused CT-MRI image ($p = 0.002$). There was also less variability in the position of the volume in 3-dimensions (x-, y- and z-planes). This consistency did not hold when clinicians expanded to a PTV. This may be due to the clinicians' interpretation of the EORTC guidelines.

1385 POSTER

Role of endorectal magnetic resonance in staging patients candidate to radical conformal radiotherapy

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Background/Purpose: Magnetic Resonance (MR) is an imaging method that allows a good anatomical representation of the prostate and is becoming the imaging method of choice for staging prostate carcinoma before radical treatment. The purpose of this study is to evaluate endorectal MR (ERMR) powerfull in modifying clinical stage in patients with adenocarcinoma of the prostate and study MR stage correlation with serum PSA and Gleason score.
Material and methods: Between january 2002 and december 2004, 97 patients (pts) with biopsy proven prostatic adenocarcinoma referred to the Radiation Therapy department and candidate for esclusive conformal radiotherapy were included in the study. Of all the patients clinical stage, pre-treatment PSA value, Gleason score, ultrasound imaging have been available. Staging has been recorded according to the UICC 2002. MR scan was conducted in the Diagnostic Radiology department by using an endorectal and a surface spool (phased array) and through the acquisition of multiplanar sequences FSE (T1 and weighed T2). Probability of extracapsular extension or seminal vesicle invasion was also calculated according to the Roach formula.
Results: Clinical stage of the 97 pts, according to the UICC TNM 2002, pre-MR imaging was as follows: Stage I: 9 pts, Stage II: 79 pts and Stage III: 9 pts. ERMR confirmed clinical stage in 39 pts (40.2%), but in 58 pts (59.8%) MR stage was different. In 9 pts (9.3%) we observed a TNM reduction; with a stage reduction in 6 cases (6.2%). In 49 pts (50.5%) we observed a TNM increase; with a stage increase in 23 cases (23.7%). After MR imaging staging was as follows: Stage I: 3 pts, Stage II: 74 pts, Stage III: 18 pts and Stage IV: 2 pts. Stage modification was particularly observed in Stage I and Stage III and 2 Stage IV were detected (table 1)

Table 1: MR imaging stage modification

Stage	I	II	III	IV	Total
Pre MR	9	79	9	0	97
After MR	3	74	18	2	97
Modification	−6	−5	9	2	
Percentage (%)	66.7	6.3	100	200	

Conclusions: RM imaging is confirmed to be a good diagnostic tool in staging prostate cancer. Stage modification was observed in 58 pat. (59.8%). A more advanced stage may cause a more aggressive approach and let to select patients for a dose-escalation protocol. Statistical analysis and correlation between prognostic factors and Roach formula will be discussed.

1386 POSTER

Radiotherapy in trimodality treatment for pleural mesothelioma: is IMRT better?

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Purpose: To evaluate different radiotherapy techniques in mesothelioma patients irradiated after chemotherapy and radical surgery.
Materials and methods: Between 3−2003 and 11–2004, 10 patients with pleural mesothelioma were found eligible for multi-modality treatment, consisting of 3 cycles of chemotherapy (CDDP-Pemetrexed), extrapleural pneumonectomy and radiotherapy. Radiotherapy was targeted to the entire pleural cavity, encompassing the Goretex-patch reconstruction of the diaphragm and pathologically proven sites of nodal invasion. Irradiation aimed at a dose of 54 Gy/1.8 Gy on this entire volume, a boost of 10 Gy/2 Gy was foreseen in case of microscopically incomplete resection. A standard 3D conformal set-up, using oblique fields with table rotation, was compared with an irradiation with IMRT (intensity modulated radiotherapy).
Results: 1 patient was found irresectable during operation and was referred for further palliative chemotherapy. All other 9 patients underwent a macroscopically complete resection. One of these suffered from serious post-operative complications. The remaining 8 were referred for adjuvant radiotherapy (4 left-sided, 4 right-sided). For comparison purposes, all patients were planned with the standard 3D-technique as well as with IMRT. The respective doses and volumes (IMRT data between brackets) to the clinical target volume (CTV) and the organs at risk (OAR, heterolateral lung, liver, heart and spinal cord) are shown in the table.

Patient side*	CTV dose (Gy)		Lung	Liver	Heart	Spinal cord
	mean dose (Gy)	max dose (Gy)	V20 (%)	V30 (%)	V50 (%)	max dose (Gy)
Left	55.9 (54.4)	61.8 (57.5)	0.6 (19.1)	4.5 (8)	47.6 (40.6)	49.9 (47.4)
Right	55.3 (54.4)	59.9 (57.9)	4.1 (19)	68.2 (54)	42.2 (40.6)	50.3 (47.9)
All	55.2 (54.4)	60.9 (57.7)	2.3 (19)	39.4 (31)	44.9 (40.6)	50.1 (47.6)

*Averages.

Conclusions: 3D conformal radiotherapy yields an acceptable target volume coverage with sufficient sparing of the critical organs for left-sided tumours (be it with larger dose inhomogeneity). For right-sided tumours, on the contrary, at least part of the irradiation has to be delivered with IMRT in order to keep the liver dose within acceptable limits, which again is at the expense of the dose delivered to the remaining heterolateral lung.

1387 POSTER

Treatment of bone metastasis in French speaking Europe: the radiation oncologists' options: a GEMO survey

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The GEMO launched in June 2004 a large survey addressed to 4706 physicians taking care of cancer to better apprehend the diagnostic and therapeutic approaches in patients with bone metastasis (BM). TNS sofres Healthcare contacted physicians by mail. 740 send back their questionnaire. 180 of them were interest in radiation therapy. We report only physicians'responses for which oncology represented 100% of their activity. To evaluate the characteristics of the modalities of treatment two clinical cases were proposed. We report the answers for one of them: ie painful BM of T6-T8 in a woman with a long history of breast cancer without spinal compression.
Results: 30Gy/10F protocol was used by 69.4%. 78.3% used 2 opposite beams and 15.7% only one posterior beam. The energy is adapted to the localisation for 39.1% and not in 58.3% (41.7% used 15MV photons, 10.4% 10 MV, 7% 5−6 MV). A dosimetry is realized always or often in 71.3% of the cases. For 71.3% one vertebra is added at each extremity to define the treated target volume and for 21.7% 2 vertebras are added. Hypofractionnated protocol (8 Gy/1 F) is sometime used by 53.9% of responders. The reasons given are the results of the trials, patients in bad condition (72.6%), or very painful (43.5%) or because the department is very busy (25.8%). 44.3% did not used 8 Gy/1 F because they were afraid of the secondary effects (52.9%), the lower efficacy (43.1%), good patient's condition (64.7%) and they are not convinced by the results of trials (23.5%). The criteria used to determine the protocol of irradiation are: Performance status (69.4%), emergency (64.5%), intensity of the pain (43.8%), general prognosis (36.4%).
Conclusion: This survey should be compared with modalities of irradiation used in other countries. High quality irradiation techniques are used in French speaking Europe but hypofractionnated protocolof 8 Gy/1 F is not commonly used.