(table 1). There was, however, a significant negative correlation between S-phase-fraction and pO_2.

Conclusions: Fast proliferating tumors have a lower pO_2 However, the initial pO_2 seems to be the strongest predictor for response to radiotherapy in cervical cancers.

443 POSTER

Functional and structural immunodefects after limited volume radiotherapy

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Purpose: The effect of limited volume irradation on the function of the human immunosystem has not been well documented. In a prospective study structural and functional aspects of the immunosystem were analyzed in 15 patients receiving a 26 Gy course of periaortal irradiation for stage I testicular seminoma

Methods: Immunophenotyping of penpheral lymphocytes (CD3, CD4, CD8; CD19, CD45RA, CD45RO, CD45RA, CD56, CD25, HLA-DR, CD34), lymphocyte transformation test (LTT) with mitogens (PHA, Con A, Okt3, Leu4, PWM) LTT with antigens (tuberculin, mumps, measles, rubella, varizella, HSV, influenza A, CMV, tetanus, candida, diphtheria) was performed at 0 Gy, 14 Gy and 26 Gy as well as 6 and 16 weeks after RT.

Results: All lymphocyte populations are reduced during and after radiotherapy. CD 19 pos. B-Lymphocytes and CD45RA positive naive cells are most sensitive. NK are more resistant. No significant alterations in lymphocyte reactivity towards mitogens and antigens was seen.

Conclusion: Although RT leads to an significant reduction in peripheral lymphocyte counts no functional impairments could be detected. Furthermore, most lymphocyte subsets recover to low normal levels 16 weeks after RT.

444 POSTER

Low dose irradiation for macular degeneration

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Aim: To determine the response of macular degeneration to low dose external beam irradiation and the acute and late morbidity on the eye.

Methods: Forty-seven patients (49 eyes) meeting stringent ophthalmological criteria underwent low dose irradiation delivered with a 6 MV linear accelerator to 1600 cGy in 8 equal fractions through an ipsilateral anterior oblique field angled 7°–10° posteriorly from June to December 1996. Ophthalmological evaluation was accomplished at 1, 3, 6, 9 and 12 months later.

Results: There was no acute or late toxicity. Visual acuity stabilized for most patients. Subjectively, 9 reported improvement and 4 slight worsening of vision but this did not always agree with objective acuity measurements. Edema and hemorrhage decreased or disappeared in the majority, with only 1 patient showing new areas of hemorrhage.

Conclusion: 1600 cGy causes regression of hemorrhage and edema, with stabilization of vision and without toxicity in the majority of patients. The results of a detailed ophthalmological review in progress will be presented.

445 POSTER

Current practice in early breast cancer post-operative irradiation: An Italian survey

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Purpose: To evaluate the present radiotherapy (XRT) management of early breast cancer (EBC), a questionnaire on adopted radiation parameters was sent to all XRT Departments of Northern Italy. This survey is also aimed at helping in the definition of national guidelines for the EBC post-operative XRT.

Methods: 50 XRT Departments received a questionnaire on specific aspects related to pre-treatment evaluation, treatment prescription, treatment preparation and execution for whole breast and tumor bed XRT, surgery-radiation-chemotherapy combination and follow-up. Analysis of variables and comparison with the European standards were performed.

Results: 37 out of 50 (74%) questionnaires, regarding ~5,500 patients treated per year, returned. A general agreement between Departments was found on main XRT aspects (total dose delivered to whole breast, basic XRT technique, beam modifiers, patient position, acute and late toxicity recording, etc.). Data dispersion was mainly noted on simulation and treatment planning procedures and quality of boost irradiation.

Conclusions: This survey evaluates the current practice of irradiation for EBC in Northern Italy. Results are generally in agreement with the European standard of reference (EORTC-EUSOMA Consensus document, 1991). However, several parameters need to be standardized and all these information represent the background to define national guidelines adapted to the Italian situation and resources.

The authors thank the radiation oncologist and medical physicists of the Depts participating in the survey. Without their cooperation this study could not have been performed.

446 POSTER

Locally advanced and metastatic thyroid cancer – 15-year results of adjuvant or palliative external beam radiotherapy

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Purpose: The role of postoperative external radiotherapy (RT) for thyroid cancer is still controversially discussed. We have analyzed long-term local control, systemic response and prognostic factors in patients with locally advanced, recurrent or metastatic disease.

Methods: Between 1976–1992, 121 out of 483 consecutive patients (46 m., 75 f.) with histologically proven thyroid carcinoma (papillary, n = 31; follicular = 40; medullary = 21; undifferentiated/anaplastic = 24; and other tumors = 5) received RT and were followed for a median of 7.5 years. Prior therapy was surgery (92) and radio-iodine therapy (63). The RT was indicated for advanced papillary/follicular T4/N+ tumors, macroscopic tumor burden after resection and unfavourable histologies. All cases were stratified into 3 groups according to tumor burden prior to RT: R1 resection of primary tumor (n = 33); R2 resection or locally recurrent tumor (46), or metastatic tumor burden (42). RT was applied to tumor and lymphatics or metastatic site with 2 Gy single dose up to 40–60 Gy total dose.

Results: Complete (CR) and overall response (CR/PR) was 100% and 100% respectively in group 1, 61%/55% in group 2, 33%/17% in group 3. In the latter groups, relief of tumor-associated symptoms was achieved in 68% (group 2) and 58% (group 3). Treatment toxicity WHO 2°/3° occurred in 5%. In long-term analysis, loco-regional progression or relapse occurred in 18% (group 1), 46% (group 2) and 83% (group 3) ($p < 0.001$). The 5- and 10-year disease-free-survival rates were 83% and 78% respectively for group 1, 48% and 42% (group 2) and 24% and 15% (group 3) ($p < 0.05$). In univariate analysis, tumor burden, initial CR, histology (papillary and follicular) and gender were positively correlated with long-term relapse- and disease-free survival. Even patients with metastatic disease achieved long-term survival when initially presenting with a single metastatic site.

Conclusion: Postoperative RT is effective in managing locally advanced thyroid cancer.

447 POSTER

Radiotherapy with carbogen breathing and nicotinamide in locally advanced non-small cell lung cancer (NSCLC)

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Purpose: Combining radiotherapy (XRT) with carbogen (C) and nicotinamide (NAM) has been proposed as a strategy to overcome acute and chronic hypoxia. The feasibility, toxicity and influence on local control of this treatment was tested in locally advanced, non-small cell lung cancer patients (pts).

Methods: Between January 1996–June 1996, 38 pts were randomised: 21 pts to radiotherapy alone (XRT) and 17 pts to radiotherapy + carbogen + nicotinamide arm (XRT + C-NAM). All patients received XRT with fractionation scheme in daily fractions of 3.2 Gy, five days/week up to 14 fraction in XRT arm and 12 fraction in XRT + C-NAM arm. Thus, Biological Equivalent Doses (BED) were reduced by %9 for normal lung tissue and %23 for medulla spinalis in XRT + C-NAM arm.

Results: In general, C-NAM was well tolerated. There was no difference between two arms regarding grade III–IV acute toxicities ($p = 0.475$). In

the XRT + C-NAM arm, nausea and vomiting were the most frequent side effects reported by rates of %50 and %24, respectively. Six weeks following completion of treatment, the improvements of performance status and pulmonary symptoms were significantly higher in XRT + C-NAM arm (p = 0.001 and p = 0.019)., There was no difference in late toxicities between two arms in a median following time of 7.8 month (p = 0.606). Loco-regional control rate was significantly higher in XRT + C-NAM arm (p = 0.003).

Conclusion: Using carbogen and nicotinamide as a radiosensitizer in locally advanced NSCLC seems to be safe treatment with manageable toxicities. Preliminary tumour control rates are encouraging and clinical testing will be continued.

448 POSTER

Total body irradiation in the treatment of myeloma by autologous bone marrow transplantation (ABMT)

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To evaluate the toxicity and the contribution of TBI and high dose Melphalan as conditioning treatment for ABMT.

Methods: Twenty nine patients, mean age 55 years (41–65) with stage II (4 patients) or stage III (25 patients) multiple myeloma were treated after conventional chemotherapy with TBI followed 24 h later by melphalan (140 mg/m2). Before transplantation, 10% of the patients were in complete remission (RC), 34% in partial response (PR), 20% non responders. The prescribed dose of TBI (8 to 12 Gy, 2 fractions of 2 Gy per day at 9.8 cGy/mn dose rate), the dose to the lung (4 to 10 Gy) were adapted to the age.

Results: Median follow-up was 38 months. After transplantation, the overall response rate was 79% with 31% of CR and 45% of PR. Three toxic deaths occurred. Acute lung toxicities occurred in 30%, not correlated to dose. Late toxicity was noted in 6/26 patients (23%). Three-year actuarial survival was 72%, correlated with response to initial chemotherapy (100% in RC versus 56% in PR), response after BMT (81% in RC versus 50% in RP, p = 0.0049) and to delay between the diagnosis and BMT higher than 8 months (70% versus 0%, p = 0.0093).

Conclusions: Marrow transplantation conditioned by TBI and melphalan is: 1) a promising approach in patients under 65 years, 2) indicated early in the strategy of treatment, 3) needs to be adapted to age to minimize acute and late toxicity.

449 POSTER

Precision of fractionated stereotactic conformation radiotherapy of brain tumours

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Purpose: To assess the geometric accuracy of field alignment in stereotactic conformation radiotherapy of brain tumours.

Methods: In 20 pat. the transfer of the computer assisted 3-D treatment plan to the patient was evaluated by repeated computerscans. The precision during treatment delivery was quantitatively assessed using sequential verification films. Linear discrepancies were measured between treatment plan and repeated CT scans (reproducibility of the isocentre during treatment set-up) and between 20 consecutive verification films per patient (reproducibility during treatment deliv.).

Results: For the total group of patients, the distribution of all deviations showed mean values between 0.5 mm and 1.6 mm ± 0.7 mm–1.3 mm during treatment set-up and between 1.1 mm and 2.0 mm ± 0.6 mm–2.0 mm during treatment delivery, resp. For all patients, deviations for the transition to the treatment machine were similar to deviations during subsequent treatment delivery, with 95% of all absolute deviations less than 4.0 mm.

Conclusions: Random fluctuations of field displacements up to 4.0 mm during treatment set-up and delivery prevail. They must be considered when prescribing the safety margins of the planned target volume and should help to determine "cut-off points" for corrective actions in stereotactic conformation radiotherapy of brain tumours.

450 POSTER

Quantitative assessment of early and late postradiation skin reactions in breast cancer patients

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Purpose: In dermatology high-resolution ultrasonic systems are valuable to follow up inflammatory dermatoses. 20 MHz ultrasonic imaging is investigated for quantitative assessment of early and late postradiation skin reactions.

Methods: Between April and November 1996, 96 high resolution ultrasound examinations of the skin in 29 patients treated for breast cancer were analysed. Total doses were between 46 and 60 Gy. The time interval between completion of radiotherapy and ultrasonic examination was up to 135 months. Irradiated and non-irradiated skin were compared.

Results: Changes of thickness and texture of dermis and subcutis were found. There were significant differences between irradiated and non-irradiated skin in early (p < 0.001) and late (p = 0.0018) reactions. The most pronounced dermal thickening occurred in early skin reactions. During radiation therapy corium thickness correlated with administered dose. Echogenicity of upper and lower corium decreased. In upper corium the greatest reduction of signal intensity occurred in early reactions. Early reactions of lower corium differed significantly from late reactions (p = 0.001). Discrepancies between visible skin reactions described by examining physicians, and ultrasonic proved changes were obvious.

Conclusion: There are specific textures of early and late postradiation skin reactions in comparison to non-irradiated skin. In contrast to physical examination, high-resolution 20 MHz ultrasound is a non-invasive and quantitative, easy reproducible method for assessing and documentation of early and late skin reaction during and after radiotherapy.

451 POSTER

Clinical experience with cross section imaging based conformal treatment planning procedures at 486 interstitial brachytherapy applications

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Purpose: Quality of a brachytherapy application depends on the choice of the target volume, on the dose distribution homogeneity and radiation injury on critical tissues.

Methods: Basic imaging method for conformal treatment planning is the cross-sectional imaging. The clinical applicability of a new type 3D planning system using CT and/or MRT-simulation or US-simulation for planning purposes was studied. The planning system developed at Kiel University differs from usual brachytherapy planning systems because of the obligatory use of cross-sectional imaging as basic imaging method for reconstruction of structures of interest. Dose distribution and normal anatomy can be visualized on each CT/MRT/US slice and on coronal-sagittal-axial- and oblique reconstructions (3D), as well as dose-volume histogram curves and special colour-coded visualization of dose homogeneity in the target can be analyzed.

Results: We observed on the base of planning procedures on 364 transrectal ultrasound (TRUS) guided prostate implants, 28 TRUS guided perineal implants with the RASHA applicator, 2 implants using surface templates as well as 92 free-hand plastic tube implants a significant input of quality in terms of the better interpretation of target delineation, delineation of critical structures as well as dose distribution.

Conclusion: Conformal brachytherapy treatment planning for interstitial brachytherapy means significant advantages for the clinical routine compared to 2D or semi-3D methods and offers new possible indications for implants.

452 POSTER

Hemoglobin levels predict local regional control after postoperative radiotherapy for advanced head and neck cancer

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Purpose: Low hemoglobin (Hb) levels are associated with poor response to primary radiotherapy. This has been established especially for squamous cell carcinomas (SCC) of the head and neck (H&N). The present study