groups. The logrank test showed a significant difference between ages ($\chi^2 = 21.023$, 6 df, $P = 0.002$) but the logrank test for linear trend was not significant ($\chi^2 = 0.242$, 1 df, $P = 0.62$). In conclusion, it is clear that in this study late toxicity occurrence was not relied to age.

176 POSTER

QUALITY ASSURANCE USING PORTAL IMAGING: THE ACCURACY OF PATIENT POSITIONING IN IRRADIATION OF BREAST CANCER

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Purpose: To study the accuracy of patient positioning in irradiation of breast cancer.

Methods and Materials: In 31 women with breast cancer portal images were obtained using a fast electronic megavoltage radiotherapy imaging system. Quantitative analysis of 508 megavolt portal images and comparison with 31 digitized simulation films were performed.

Results: Concerning patient positioning in the field, mean standard deviations of the difference between simulation and treatment images were in mm 3.03 for the central lung distance, 3.09 at + 4 cm, 3.29 for the central irradiated width, 3.05 for the central beam edge to skin distance, 4.11 for the craniocaudal distance. Maximal variations of standard deviations were respectively 1.72–5.97; 1.92–4.78; 1.20–5.99; 1.06–5.11; 0.98–6.09.

Conclusion: The tangential breast treatment set-up is very stable and reproducible. The Electronic Portal Imaging Device appears to be an adequate tool to study the accuracy of treatment set-ups with this method.

177 POSTER

THE ACCURACY OF PATIENT POSITIONING IN IRRADIATION OF RECTUM CANCER

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Purpose: Evaluation of correct positioning using an ionisation chamber on-line portal imaging system in routine clinical radiotherapy of rectum cancer.

Methods and Materials: In 13 patients with pelvic irradiation, portal images were obtained using a fast electronic megavoltage radiotherapy imaging system. A total of 208 portal images and 13 simulator films were used to determine the values of setup deviations in the X-Y-directions and the rotation of fields in a fixed coordinate system, and the accuracy of the manually positioned blocks.

Results: Mean standard deviations of the difference between simulation and treatment images were in mm: 7.33 and 7.13 for X and Y, 3.55 for the rotation fault, and 4.55 for the position of blocks. Maximal variations of standard deviations were respectively 2.29–11.91; 2.39–7.83; 1.84–7.07; 1.17–10.09.

Conclusion: The errors of field positions summed up to a mean of up to 11.91 mm in one patient. Maximal errors counted in single fields up to 30 mm. The mean error of manual block positioning was not acceptable. Thus, mechanically fixed blocks are now used after obtaining the results of this study. A daily control should be considered for difficult patients.

178 POSTER

CONCURRENT RADIATION THERAPY AND CHEMOTHERAPY (CARBOPLATIN/5-FLUOROURACIL) IN ADVANCED CANCER OF THE UTERINE CERVIX

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Aim: Combining RT and CT aiming at a better local control and disease free survival.

Materials and Methods: From April 1989 till January 1994, 74 patients (pts), with bulky stage IB and/or IIA (12), IIA/B (44) and IIIA/B (18) cervical cancer were treated with external radiation therapy (45 Gy in 1.8 Gy fractions) followed by 2 × 17.5 Gy brachytherapy or 25 Gy external boost. This was combined with 3 cycles of Carboplatin 300 mg/m^2 i.v. day 1 and 5-FU 600 mg/m^2 over 24 hrs day 2–5, q 28 days. Six weeks after treatment additional hysterectomy was performed when feasible, otherwise multiple biopsies were taken. Histology: 60 pts squamous, 3 adenosquamous, 5 small-cell squamous, 2 small-cell neuroendocrine and 4 adenocarcinoma.

Results: The median follow-up is 48 months (range 16–67 months). Seventy-three pts are evaluable. In 43 pts a hysterectomy was feasible: 28 showed pCR and 25/28 are NED; 1 died of complications and 2 pts of metastasis. In 15/43 pts tumor cells were found: 4 died of metastasis and 11 are NED. In 29 pts only biopsies were taken: 6 showed tumor cells and 5/6 died; in 23/29 there was pCR with 14 pts NED, 5 pts died of local ± distant disease and 4 pts of distant disease. In 1 patient no histology is available: she died of distant disease. Twenty-two out of 73 pts relapsed: 11 locally (3 distant also) and 11 distant only. So the local control is 85%. All local relapses occurred <1 yr. The overall survival at 4 yrs is 68% (st IB-IIA 75%; st IIB 75%; st III 47%). All 74 pts completed therapy. Leucopenia gr.I (WHO) occurred in 18, gr.II in 34, gr.III in 20 and gr.IV in 2 pts. Thrombocytopenia gr.I occurred in 58, gr.II in 12, gr.III in 1 and gr.IV in 2 pts. No bleeding or leucopenic fever occurred. G.I. toxicity was mild. Severe late toxicity is similar as with radiation therapy alone. These good results on local control and survival are now the basis for a randomized study we started.

179 POSTER

PREVENTION OF ORAL MUCOSITIS IN HEAD AND NECK RADIATION THERAPY

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The purpose is to evaluate the effectiveness of a protocol to prevent oral mucositis, an usual complication of head and neck radiotherapy. This protocol consists of a previous oral cavity examination, mouth hygienization, infectious focuses remotion and administration of chlorhexidine, sucralfate and benzydamine mouthwashes. A retrospective study was made on 45 patients that received radiotherapy, 19 of them started without prevention and the others 26 were controlled since the beginning. Mucositis level was evaluated every week following the OMS criteria. U-Mann-Whitney test was used to compare the two groups. Statistical significant differences were found between both ($P = 0.0001$). Median value mucositis in the prevention protocol (PPG) and no prevention protocol groups were 0 and 1 respectively. The differences were more important between the 3th and 5th weeks. Tolerance treatment was better in PPG.

180 POSTER

SIMULATION BY A DIAGNOSIS CT IN THE VOCAL CORD CARCINOMA. PRELIMINARY RESULTS IN TEN PATIENTS

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To optimize the radiotherapy of the vocal cord carcinoma we started their simulation by a diagnosis CT. Since June 1994 to February 1995 ten patients were simulated and treated. With a thermoplastic mask the patients were referred to the radiology department. Some real size CT slices every 2 mm were obtained in the treatment position. The center, dimensions and limits of the fields were established in the CT room. After, a dosimetric study was performed in our department. We found anatomical differences in each patient that had repercussion in the treatment approach (location and size of the vocal cord and contour of the neck). This procedure allowed us the selection of the best radiotherapy approach for each patient. We report the advantages of this technique for each patient and we describe the rules for this simulation technique.

181 POSTER

RADIATION-INDUCED PNEUMONITIS DUE TO POSTOPERATIVE IRRADIATION FOR BREAST CANCER—INCIDENCE AND RISK FACTORS

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Objective: Radiation-induced pneumonitis (RIP) is an acute side effect in 5–57% of patients postoperatively irradiated for breast cancer. Pulmonary fibrosis and spontaneous pneumothorax can be late sequelae resulting from RIP. Clear dose response curves exist for single dose lung

irradiation in animal models. For fractionated radiotherapy of lung parts correlation between irradiated lung volume and incidence of RIP is presumed but clear data are missing.

Material and methods: 296 consecutively irradiated breast cancer patients (1989–1993) with 302 treated chest wall sites ware evaluated. Computer-assisted calculation of dose distribution was performed in all cases. Six weeks after completion of therapy all patients were examined and received chest x-ray (CXR). CXRs were independently evaluated by two radiologists for radiation-induced lung abnormalities confined to the treated lung portion. The irradiated lung volume was calculated according to dose distribution. Patients with radiographically confirmed pneumonitis were compared to a population matched with regard to the lung volume.

Results: Pneumonitis was diagnosed radiologically in 45/302 (14.9%) cases. Lung volume irradiated with a dose of 25 Gy and more in those patients was 79.6–534.8 ccm. No difference was seen in the treated lung volume compared to the control group matched for tumor site, operation treatment volume, fractionation, systemic treatment and age. Only the extent of operation had a significant impact on the incidence of pneumonitis and irradiated lung volume.

Conclusion: Our data suggest that the significance of radiation-induced pneumonitis in the irradiated lung volume is minor as expected on the ground of experimental results. The size of irradiated lung volume is the most important factor for the incidence of pneumonitis. In daily routine, the latter correlates with the extent of breast resection.

182 POSTER

AN ALTERNATIVE DEVICE FOR PROTON THERAPY: ECRIPAC

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Proton beam therapy is a technologically advanced means of achieving extremely precise radiation dose distribution. But development of proton therapy has been impaired by its high cost (20 to 70 millions dollars). We propose a rather radical change for proton therapy since the new device is expected to be not only very compact but also remarkably economic. The device is a plasma accelerator, called ECRIPAC (Electron Cyclotron Resonance Ion Accelerator).

In short, in the new project we want to replace the heavy, large and expensive cyclotrons and synchrotrons by a new type of accelerator yielding similar proton fluxes and energy but exhibiting a much smaller size and weight. The cost of this accelerator should be orders of magnitude smaller. For instance, a length of the order of one meter and weight of less than 300 kg. To produce around 10^{10} protons/s at an energy as high as 200 MeV, it needs only a few kilowatts of average electrical power and a minimum of manpower for its maintenance. Under these conditions, the entire accelerator could be mounted on a revolving chassis, pivoting around the patient, which would facilitate the beam deflection system and change the gantry principle.

The project ECRIPAC of a plasma accelerator is developed by a group of international specialists in France. Its theoretical performance in particle energy and beam current is deduced from analytical and numerical studies undertaken between 1990 and 1993. The results yield beam characteristics very similar to those obtained by the classical accelerators. Thus an experimental development or ECRIPAC has been recently decided. The prototype will be built at Palaiseau.

183 POSTER

CT PLANNING OF HDR BREAST IMPLANTS: A CONTRIBUTION TO QUALITY ASSURANCE

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The purpose of this presentation is to describe the procedure of the interstitial boost therapy planning in breast cancer irradiation in the Hospital of Sisters of Mercy in Linz, Austria. The use of a boost irradiation at the primary tumour site is associated with an increased local control. Maximum effectiveness of the boost irradiation depends on accurate location of the target volume which is the surgical tumour bed. There are some reports about localization techniques of the boost volume for external irradiation. Less has been reported about the target volume localization of HDR interstitial implants of the breast. We have introduced the development of a treatment planning method to obtain accurately located interstitial implants and homogenous dose distributions and therefore full coverage of the target volume. At the time of the boost irradiation, treatment planning is started in the simulator room, to define the needle position and therefore the target volume represented by the implanted clips. Then the implantation is done in the afterloading room. A device for patient transportation between Iridium unit, simulator and CT scanner has been constructed. The implanted needles and the clips are visualized by means of the CT-scanner. So the source dwell position and therefore the length to be irradiated can be determined in order to provide adequate coverage of the clipped tumour bed. The isodose distribution and the relationship to the surrounding tissues is obtained by the planning compute of the remote afterloading device. So the source dwell times can be determined if there will be an overdosage for the normal tissues. We conclude that this procedure with careful attention to the source position by CT planning results in an accurate treatment of the target volume. The implant and the dose distribution to the surrounding normal tissues are documented by the CT images. The planning procedure is made feasible by the use of the special transportation device and has the advantage of patient immobilization.

184 POSTER

RADIOTHERAPY RESULTS IN EARLY STAGE (T1–T2) VOCAL CORD CARCINOMA

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In early stage larynx carcinoma, the function preserving treatment can be performed only if patients are evaluated properly. In this study we present the preliminary results of 44 patients of early stage larynx carcinoma which are treated according to the prospective larynx carcinoma protocol of Dokuz Eylül Head And Neck Cancer Group. Forty-three patients were male and 1 patient was female. The average age is 61 (27–87). Thirty-seven patients were staged as T1N0 and 7 patients as T2N0. In 40 cases, the tumor localization was in the glottic and in 4 cases in the supraglottic area. The tumor histology was squamous cell carcinoma in 36 patients, in-situ carcinoma 7 and small cell carcinoma in 1 patient. Lung cancer was detected as a second primary in 1 patient. Diagnosis was made by biopsy in 28 cases, by stripping in 12 cases, by cordectomy in 1 case, by polypectomy in 1 case, and by mass excision in 2 cases. All cases were treated by radiotherapy alone. Treatments were completed in all cases. The delivered total dose is 66–70 Gy in 33–35 fractions (in 200 cGy fractions). There was total tumor regression in all cases, 2 months after radiotherapy. No serious side effects were observed. The self evaluation of voice quality was revealed as very satisfactory in 43 patients. Only in the cordectomy case the voice quality was unsatisfactory. The case with lung cancer is lost to follow up. Two cases died because of other reasons and the rest are disease free.

185 POSTER

OUR TREATMENT PROTOCOL IN NASOPHARYNGEAL CARCINOMA

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Nasopharynx cancers are classified differently from other types of head and neck cancers by their extensive lymphatic spread and frequent distant metastasis. In most cases RT is the only treatment modality because of the localization. Neoadjuvant chemotherapy studies are held to have better results in the local-regional advanced disease .39 was treated in our clinic between August 91–June 94. Thirty of the 39 cases were treated according to the NF cancer treatment protocol of Dokuz Eylül University Head and Neck Cancer Group. Our treatment protocol for Stage I–III disease is curative RT and for Stage IV disease both neoadjuvant CT (CDDP + Bleomycin + Methotrexate) and RT. This protocol is activated in October 1992. Twenty-six cases were Stage IV, 3 cases Stage III, 1 case Stage II. Fifteen cases were treated by RT and CT and 15 cases were treated with RT alone. The applied RT technique and total doses are standard in all cases. Each case is irradiated with 50 Gy to the supraclavicular and cervical areas without lymphatic involvement and with 70 Gy irradiation to the primary tumor and to involved cervical lymph node areas. Neoadjuvant CT is applied two courses every 21 days and after subsequent tumor response evaluation, RT was started. Median follow-up period is 22 month (3–40 months). Three cases with