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

distant metastases died. Local recurrence is detected in two cases and second series of RT was applied. A case with regional recurrence was treated with CT alone. Two cases were lost in follow up (one having a pulmonary metastasis). The rest of the patients are disease free.

186 POSTER

CF252 INTERSTITIONAL NEUTRON THERAPY OF MALIGNANT TUMOURS OF VAGINA

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In 1987–1994 a total of 82 patients with malignant tumours of vagina, aged 29–81 years, underwent interstitial brachytherapy with Cf252. Needle sources (active length 20–30 mm) with an increasing activity on the ends were applied. The activity of the needle sources were 3–6 μg of Cf. The application of special template devices made it possible to implant sources in a strictly preset geometry for the whole course of irradiation. Complete tumour regression was observed in 71 patients (86.6%), partial regression—in 6 patients, and in 5 patients no effect was observed. Five year survival was 46% for all treated patients. The radiation reactions were evident after 2–3 weeks and manifested as squamous epithelitis. In 2 cases radiation ulcers developed. *Conclusion:* The results of treatment with Cf252 neutron interstitial brachytherapy are encouraging and further active research in this new and exciting field of radiotherapy would be very useful.

187 POSTER

LOCAL RECURRENCE AFTER CONSERVATIVE SURGERY AND RADIOTHERAPY OF BREAST CANCER. RETROSPECTIVE ANALYSIS

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We have analyzed 90 patients treated in our Institute for stage I and II breast cancer from 1989–1990.

All patients have been treated with limited surgery, lymphadenectomy and radiotherapy. The mean age was 51.8 years (r30–80). Menstrual status—32 patients were pre or perimenopausal (35.5%) and 58 (64.5%) were postmenopausal. Ductal infiltrant carcinoma was present in 78.8%. The mean dose received to the breast 58 Gy TD (r 60–70).

Final margin status was predictive factor for local recurrence. Sixty-two patients (68.8%) had negative margin status and only 5 of them (8.06%) developed local failure. On the other side all patients with positive margin status (28–32.2%) had developed local failure. Multivariate analysis for the other predictive factors and five year survival rate will be presented at the conference.

188 POSTER

RADIATION THERAPY OF PATIENTS WITH CERVICAL AND UTERINE CARCINOMAS IN CONDITIONS OF THE TUMOR RADIOSENSITIVITY MODIFICATION

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A method of local application of radiomodifying preparations (metronidazole solved in dimethylsulfoxide-MZ in DMSO) in patients with gynecological cancer was developed to enhance a damaging effect of radiation upon the tumor.

The studies performed in the excised uterine operational preparations revealed that the MZ diffusion allows to create high MZ concentrations in tumors (6000–8000 mcg/g). A model of experimental radiotherapy of implanted mice tumors showed that local MZ application results in the enhancement of damaging effect of radiation upon tumor tissue.

Radiotherapy with MZ was given to 116 patients with uterine carcinomas and to 184 with the cervical ones. This method allowed to increase the rates of tumor radiation regression and to enhance a 5-year survival of the patients.

189 POSTER

FACTORS INFLUENCING TREATMENT FIELD ACCURACY IN FRACTIONATED RADIOTHERAPY

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Purpose: Field placement errors can substantially contribute to local recurrences in radiotherapy. Demands for use of advanced treatment techniques have lead to improved patient fixation devices and improved portal verification systems. But fractionated treatment without patient fixation is still daily routine in most departments of radiotherapy. We evaluated the factors influencing treatment field accuracy in patients with fractioned radiotherapy without the use of fixation devices.

Material and methods: From 9/93 until 12/93 61 patients with isocentric opposing fields or single stationary fields of the thoracic or abdominal region were examined in respect of treatment field deviations from simulation film. We performed weekly portal verification films for each patient. The extend of treatment field deviation from simulation films were correlated to objective patient data (age, weight), subjective patient data (Karnofsky score, self assessed pain and anxiety scores) treatment intent (palliative vs. curative) and to daily workload.

Results: Deviations of treatment field borders varied from 0 cm to 3.8 cm (medium: 0.8 cm). The percentage of field placement errors >1 cm was significantly increased in patients treated in palliative intent ($P < 0.025$). Factors influencing treatment field accuracy were the absolute number of patients per treatment machine and day, the self assessed pain score and the self assessed anxiety score during simulation or treatment.

Conclusions: Modern treatment techniques (linear accelerators, 3D-treatment planning, etc.) allow to reduce planning and treatment volumes. Therefore, an accurate treatment field set-up must be warranted in order not to compromise treatment results. To keep treatment field deviations as small as possible patient fixations should be used, the radiotherapist must adequately care for the patient's medical and psychological welfare and sufficient daily set-up time must be given.

190 POSTER

TLD-MEASUREMENTS OF THE INCREASE OF SURFACE DOSE DUE TO WOUND DRESSINGS DURING PERCUTANEOUS IRRADIATION

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Objective: Since any prolongation of overall radiotherapy time may affect the outcome of treatment, skin protection promises to improve the results of percutaneous irradiation. Different non-irritant dressing materials have been tested in the treatment of radio induced skin lesions. However, the increase of skin dose caused by wound dressings may enhance skin reaction. Therefore we measured the dose due to different wound dressings.

Material and methods: Dose increase at the skin covered by wound dressings was measured during therapeutic irradiation. The investigated materials were a silicon-coated polyamide net (Mepitel, Mölnlycke), a hydrocolloid dressing (Varihesive, Merck&Co.) and an alginate dressing (Kaltostat, Convatec). Measurements were carried out by thermoluminescent dosimetry during irradiation with electrons (5 MeV to 40 MeV) and photons (6MV and Co60).

Results: Dose increase depended on quality and energy of beam and on the beam arrangement. For electrons absolute values at the surface were relatively high for all materials (85–96%), but there was only a small dose increase (5–10% compared to uncovered skin). For photons dose increase depended also on the material. The lowest dose increase was measured for Mepitel, the thinnest coating. During irradiation with a single stationary field perpendicularly to the skin dose values of 32% (6MV) and 43% (Co) related to the maximum dose and a dose increase of 39% and 65% were measured. For tangential fields (e.g. irradiation of the breast, head and neck) absolute dose values were higher (up to 60% (6MV) and 75% (Co)), but dose increase was much lower (up to 20%). The other coatings caused dose increase up to 156% related to the uncovered skin. Dose values of 85% of the maximum dose (Co) are possible.

Conclusions: Wound dressings need not be removed during irradiation with electrons, thin dressings like Mepitel need not be removed during irradiation with photons, but thicker coatings like Varihesive or Kaltostat should be taken away during photon therapy.