191 POSTER

MRI IN THE TREATMENT PLANNING OF RADIATION THERAPY IN CERVICAL CARCINOMAS

L. Thomas, B. Chacon, M. Kind, O. Lasbareilles, P. Muyldermans, J. Pigneux, A. Le Treut, G. Kantor
Institut Bergonié, 180, rue de Saint-Genès, 33076 Bordeaux Cedex, France

Purpose: To evaluate MRI in the planning of radiation therapy in patients with cervical carcinoma especially in the design of lateral radiation treatment portals.

Material and Methods

First step: 18 patients with cervical carcinoma (1 T1N-, 2 T2aN-, 1 T2bN0, 10 T2bN-, 2 T2bN+, 2 T3bN+) underwent simulation films with an isocentric four field technique based on palpatory findings (11 patients: first group) and on diagnosis MRI and clinical findings (7 patients: second group).

Second step: MRI was then performed in treatment position with skin markings of the isocenter of the radiation fields.

Third step: for each patient the simulated lateral field was superimposed on the midsagittal MRI Image and the simulated anterior radiation field on the midcoronal MRI Image.

Fourth step: the adequacy of the margins was evaluated by correlating the simulated treatment portals with MRI defined target volume.

Results: In the first group of patients (11 cases), MRI in treatment position has led to a change of the radiation fields in nine patients: six patients had a modification of the lateral fields (in one case we had to decrease the anterior and posterior border, in five cases we had to increase the posterior border). Three patients had a modification of the anterior portal (increase of the superior border) and of the lateral portal (increase of anterior and posterior border) these modifications ensured an adequate coverage of the posterior tumor border and of the uterine fundus with safety margins.

In the second group of patients (7 cases) MRI in treatment position has led to a change in lateral portals in five patients (increase of the posterior border) to ensure an adequate coverage of the posterior border of the cervix tumor.

Conclusion: Diagnosis MRI and MRI in treatment position are necessary to ensure an adequate coverage of the cervix tumor and of the uterine fundus especially in lateral fields when treating cervical carcinomas with a four field technique. Otherwise AP/PA pelvic radiotherapy is the safest technique.

192 POSTER

A QUALITY MANAGEMENT PROGRAM FOR INTERSTITIAL AND INTRALUMINAL HDR-BRACHYTHERAPY: ANALYSIS OF INFLUENCE ON THE QUALITY ASSURANCE

J. Stanković, Lj. Jelić, M. Sarić, M. Durbaba, Z. Todorović, D. Mileusnić
Department of Radiotherapy, Institute of Oncology and Radiology, Pasterova 14, 11000 Belgrade, Yugoslavia

A Quality Management (QM) program for HDR-Brachytherapy has been developed after commissioning of the Microselectron HDR unit at Radiotherapy Department of Institute of Oncology and Radiology in Belgrade, Yugoslavia. This program, based on multidisciplinary level, follows current international regulations for brachytherapy dose administration and the highest professional standards. Each procedure (step) was described as well as the role of each subject (radiotherapist, radiophysicist, technologist, nurse, etc.).

From January 1993 to January 1995 more than 280 cancer patients have come for consultation to determine if interstitial/intraluminal brachytherapy was appropriate treatment modality. About 10% of patients were rejected and referred to a classic RT. In seven cases a decision was changed just before brachytherapy (in preparation and pre-planning procedure), finding inappropriate for catheter implantation (interstitial). In two patients, one implanted flexible catheter was damaged during the application or verification procedure that was followed by correction action in application and/or planning. One patient pulled out an esophageal catheter during the planning-checking procedure probably due to lack in preparation step. In eight cases deviation of the treatment time was observed during data transfer procedure (from computer to the unit), six due to the unknown change in the machine information of calibration conditions (date and/or source strength), and in two cases due to errors in manual machine data input (subjective-technologist's).

This QM program scheme reduces the possibility of errors and helps avoid technical problems in brachytherapy performance from the preparation to the therapy alone. Each program step is fully documented and served not only for patient record, but as comprehensive data for further investigations.

193 POSTER

PULMONARY FUNCTION TESTS AFTER RADIATION THERAPY FOLLOWING PNEUMONECTOMY

P. Van Houtte[1], M. Françoise[2], M. Pascale[2]
[1] Institut Jules Bordet, Brussels, Belgium
[2] Centre Léon Bérard, Lyon, France

Radiation is often necessary after pneumonectomy, immediately or for local recurrence. High radiation doses represent a challenge due to the limited tolerance of the lung and to the necessity of preserving the remaining lung parenchyma. To evaluate the lung radiation tolerance after high radiation dose, pulmonary function tests were performed before surgery and after radiation.

Thirty-two patients (pts) were irradiated after pneumonectomy for lung cancer. The mean radiation dose was 56 Gy (48–66 Gy), delivered with a linac and multiple complex fields. Fourteen patients received a dose higher than 60 Gy. For 10 patients two or more sets of pulmonary function tests are available (before surgery and after radiation at least) and allow to evaluate the irradiation scheme safety.

Median survival was 19 months, 3-year survival rate 31%. Six pts died of local recurrence, 12 of lung infection with respiratory distress syndrome, without relapse. No patient developed a clinical radiation pneumonitis, most of them had a minimal paramediastinal fibrosis at CT scan. Post-irradiation pulmonary lung tests were compared to the theoretical values of the estimated defect observed after pneumonectomy. No significant decrease in FEV1/IVC (Forced Expiratory Volume 1 s/Inspiratory Vital Capacity) was observed in 10 evaluable patients; the values are comparable to those expected after pneumonectomy without irradiation (FEV1/IVC: 61 to 100%), showing that irradiation did not alter the pulmonary function.

CT scan based-treatment planning and the use of complex beams positioning allow a lung optimal parenchymal preservation. Through this procedure, a high dose of radiation can be delivered to mediastinum and bed tumor.

194 POSTER

RADIATION THERAPY OF BREAST CARCINOMA: CONFIRMATION OF PRESCRIPTION DOSE

M. S. Ravindra Yaparpalvi, Doracy P. Fontenla, L. Yu, P. Lai, B. Vikram
Department of Radiation Oncology, Montefiore Medical Center, 111 East 210th Street, Bronx, New York 10467, U.S.A.

The purpose of this study is quantitation of dose delivered during tangential breast radiation therapy and measurement of scatter dose to the contralateral breast for three different breast set-up techniques. A commercial semi-conductor diode system is used for dose measurements. In-vivo dose measurements on 11 patients undergoing tangential breast radiation therapy with 6 MV photons were performed. Scatter doses to the contralateral breast for three breast set-up techniques were measured and documented as a function of distance from the field edge and various beam modifiers commonly used in breast radiation therapy. The in-phantom measurements resulted in dose accuracy within ± 1.5%. Dose measurements on patients resulted in standard deviations of 1.2%, 2.3% for the medial entrance exit doses and 1.7%, 2.2% respectively for the lateral entrance, exit doses. In patients, the scatter doses to the opposite breast at a 5 cm perpendicular distance from the medial field edge resulted in cumulative scatter doses of 247 cGy to 530 cGy from the tangential fields and an additional 50 cGy from the supraclavicular or axillary field if included. Quantitative verification of the prescribed daily dose is important in breast radiation therapy to ensure precision in patient set-up and accuracy in dose delivery.

195 PUBLICATION

THE INVESTIGATION OF RADIOTHERAPY PLANNING IN BREAST CANCER WITH CT AND RELEVANT DIFFERENCES

H. Alanyali, N. Öztürk, S. Yurtsever, M. Kmay, F. Akman
Department of Radiation Oncology Dokuz Eylül University Medical School İNCİRALTI/İZMİR, Turkey

In this study, we investigated, the use of computerized tomography at the treatment planning of breast or chest wall tangential fields and to compare them with the relevant set-up positions. The differences were marked and the changes at the percentages of irradiated lung volumes were studied. The contours of the chest wall or breast of 9 patients included in this trial were taken at the center lines of the treatment fields and the chest wall thicknesses and the lung volumes were determined by

ultrasonography and computerized tomography, respectively. As a result, it was determined that, the height of the treatment fields and the beam entrance points of the lateral tangential beams showed 2.2 ∓ 1.2 and 2.6 ∓ 0.9 cm alterations, respectively. Thus the lung proportions in the treatment volumes were underestimated in the average of %61.84 ∓ 25.8 in the treatment plans performed with CT alone.

196 PUBLICATION

ENDOBRONCHIAL HDR BRACHYTHERAPY: A CURATIVE APPROACH FOR VERY LIMITED NON-SMALL CELL CARCINOMAS

P. Baldeyrou, H. Marsiglia, E. Lartigau, M. Albano, M. Delapierre, T. Le Chevalier, P. Ruffie, R. Arriagada, A. Gerbaulet
Institut Gustave-Roussy, 94800 Villejuif, France

Endobronchial high dose rate brachytherapy (BT) is an alternative treatment for very small and limited bronchial carcinomas in patients with chronic respiratory deficiency after past history of lung cancer treated by surgery and/or external radiotherapy.

Study of toxicity and results of high dose rate B.T. in 18 patients with 21 limited and endoscopically visible lesions.

Patients: Medium age: 65—Sex Ratio: 16 M/2 F—OMS: 2. Localization of tumors: main bronchus = 9, lobar and segmental bronchus = 12. No adenopathy on CT-scan. No other therapy possible because of respiratory deficiency.

The treatment was: 6 sessions of 5 Gy with a 7-day interval with one or two catheter applicators. A CT-scan with catheter was perforated to have a better visualization of the tumor and to assess the relation between the tumor, the normal structures and the applicator. In 12 treatments, the dose prescription point was at < 1 cm and in 9 treatments at 1 cm.

With a mean follow-up of 9 months, toxicity on bronchus was nil; 18 tumors were locally controlled, 3 failures were observed and 1 peribronchial recurrence suspected. The 3 treatment failures were in relation with a wrong evaluation of the distance between the tumor and the applicator.

197 PUBLICATION

RADIOTHERAPY COUPLING BORON NEUTRON CAPTURE THERAPY (BNCT) AND ^{252}CF BRACHYTHERAPY

I.F. Chaves, T.P.R. Campos
Department of Nuclear Engineering, Federal University of Minas Gerais, 30160–060 Belo Horizonte, Brazil

Neutron radiation techniques applied onto human body cavities are investigated as oncological radiation therapy. The proposal treatment consists of the coupling of two distinct techniques: Boron Neutron Capture Therapy (BNCT) and Brachytherapy through discreets sources of neutrons. Biological and radiodosemetrical aspects of the coupled technic are considered. Nuclear aspects, such as the nuclear reactions occurred in tumoral region and the forms of evaluation the isodose curves are discussed. The coupled technic BNCT and Brachytherapy is studied as a possible oncological treatment. The computational evaluation of the doses for simulating clinical situations are presented, based on a ^{252}Cf neutron source. The theoretical results shows that the dose is close to six times greater in the tumor than in the health tissues neighboring to the cancer region, with low concentration of the boron incorporated radiosensitisers.

198 PUBLICATION

MEDULLARY COMPRESSION AND RADIOTHERAPY

S. Cariello, E. Catalano[1], D. Napoli, D. Di Gennaro[1], A. Frusciante[1]
Department of Oncology
[1]Department of Radiotherapy, Azienda Ospedaliera S. Giovanni Di Dio E Ruggi D'aragona, Salerno, Italy

We treated 54 patients affected by medullary compression, by radiotherapy with 60-Co, in the period 1985–1993; there were 42 bone metastasis, 5 intramedullary metastasis, 7 were paravertebral neoplasms. The primitive cancers were: 19 breast, 10 prostate, 12 non-small cell lung, 4 small cell lung, 2 kidney, 1 melanoma, 1 soft tissue sarcoma, 1 colon and in 4 patients there was no history of cancer. We detected no difference, using 2 fractionation schedules (30 Gy/10 F vs. 40 Gy/20 F). Pain improved dramatically in 45 of 54 patients (83%), with reduction of analgesics (73 vs. 20%), and a mean duration time of 5 months. The 9 patients that had no improvement were: 2 lung adenoca, 1 melanoma, 1 soft tissue sarcoma, 1 kidney, 2 prostate, 2 breast cancer; 4 of these were affected by intramedullary metastasis.

199 PUBLICATION

STATIC BEAM-SEGMENTATION CONFORMAL RADIOTHERAPY FOR CONCAVE TARGETS

S. Derycke, L. Fortan, B. Van Duyse, C. Colle, C. De Wagter, W. De Neve
University Hospital Gent, Department of Radiotherapy and Nuclear Medicine, B-9000 Gent, Belgium

In many clinical situations, local control rates are restricted because of radiation-dose limitations imposed by radiation sensitive tissues invaginating with the target. In order to avoid these dose limitations, we developed a method based on the understanding of concave dose distributions in its most elementary form, being the cylindric shell sector.

By combining and stacking distributions, individually shaped as cylindric shell sectors, targets of any shape can be uniformly irradiated with predictable dose distributions inside and to a lesser extent also outside the target volume. Brahme *et al.* (*Phys. Med. Biol.* 1989, 27, 1221–1229,) described the beam intensity profile required for homogeneous irradiation of a cylindrical shell using rotational techniques. We investigated by virtual simulation using Sherouse's GRATIS system, the beam profiles required for execution with static gantry positions. These profiles were obtained by field-segmentation and were executable with a Philips MLC multileaf collimator. For targets with a single concavity in its surface 5–8 beam incidences and 25–50 segments were sufficient to obtain a sharp dose-gradient between invaginating structure and target.

200 PUBLICATION

SIDE EFFECTS OF CONDITIONING REGIMENS PRIOR TO BONE MARROW TRANSPLANTATION

P. Feyer, V. Budach, O. Titlbach, F. Kamprad, M. Kubel, A. Walter
Department of Radiotherapy, Medical School Charité, Berlin
Department of Radiotherapy
Department of Hematology, University of Leipzig, Germany

Conditioning regimens prior to bone marrow transplantation (BMT) represent an aggressive radio-chemotherapy in order to achieve a complete tumor cell kill. Gastrointestinal reactions (G IR) are the most common side effects during conditioning concerning up to 80% of patients. We investigated 300 BMT-patients and compared single (STBI n = 105), fractionated (FTBI n = 60) as well as busulfan (BU n = 135) conditioning regarding to the acute side effects especially frequency and possibilities to influence GIR. The conditioning regimens were different in the frequency and severity of GIR. The STBI has been replaced by FTBI in order to reduce toxicity. Reversible early reactions could not be reduced by FTBI. But as a result of replacing STBI by FTBI there was a decrease of severe complications.

201 PUBLICATION

PALLIATIVE HIGH DOSE RATE BRACHYTHERAPY FOR ADVANCED LUNG CANCER

H. Marsiglia, P. Baldcyrou, R. Arriagada, E. Briot, E. Lartigau, E. Chirat, C. Haie-Meder, M. Delapierre, M. Albano, C. Petit, A. Gerbaulet
Institut Gustave-Roussy, 94800 Villejuif, France

High dose rate brachytherapy (HDRB) is an effective palliative treatment for bronchial carcinoma with an obstructive component.

We have studied the toxicity and efficacy of palliative HDRB for endobronchial tumors in areas previously irradiated or not.

HDRB (I^{192} source) delivered a same total dose of 24 Gy, giving 6 × 4 Gy in 36 days for patients with previous irradiation (Group A), or 3 × 8 Gy in 15 days for patients without previous irradiation (Group B). The given dose was prescribed according to the target volume, and the physical dose was specified at 1 cm. The treatment catheter was positioned by the pneumologist (P.B.) and the treatment volume defined according to the endoscopy and to pre-treatment CT scanner, with a 2 cm safety margin on each extremity of the macroscopic tumor. The catheter was checked by radiographic films before any HDR treatment.

Five patients were included in group A, and 15 in group B. With a mean follow up time of 12 months, three patients out of 5 in group A developed a lethal hemoptysis. No toxicity was found in group B (one limited necrosis).

HDBR is a safe and effective palliative treatment in patients without previous irradiation. For patients with previous irradiation, we noticed severe complications even if a protracted treatment with low dose per fraction is used.