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MRI IN THE TREATMENT PLANNING OF RADIATION THERAPY IN CERVICAL CARCINOMAS

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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.

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

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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.

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PULMONARY FUNCTION TESTS AFTER RADIATION THERAPY FOLLOWING PNEUMONECTOMY

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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.

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RADIATION THERAPY OF BREAST CARCINOMA: CONFIRMATION OF PRESCRIPTION DOSE

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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.

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

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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