

preoperative irradiation and chemo-irradiation on the healing of colonic anastomoses.

Methods: 92 male Wistar rats were divided into four groups; a control (I, $n = 20$), a sham irradiated (II, $n = 20$), irradiation (III, $n = 32$), which received fractionated irradiation to the pelvis to a total dose of 22 Gy, 5.5 Gy per fraction in four consecutive days, and chemo-irradiation (IV, $n = 20$) which received irradiation plus intraperitoneal 5-Fluorouracil (5-FU, 20 mg/kg) for five consecutive days. All groups underwent left colonic segmental resection and primary anastomosis 3 to 4 days following therapy. Abdominal wound healing, anastomotic complications and anastomotic bursting pressure measurement were recorded.

Results: On the third and seventh days, the mean bursting pressures of anastomoses were determined; 36.5 mm Hg and 208 mm Hg in group I; 38.5 and 228 in group II; 25 and 150 in group III and 27 and 162 in group IV, respectively. ($p < 0.01$ for group III and IV). The burst occurred at the anastomoses in all animals tested on the third postoperative day; one in group I (10%), none in II, six in III (37.5%), and four in IV (40%) on the seventh postoperative day.

Conclusion: Preoperative fractionated irradiation and chemo-irradiation seem to delay the healing of colonic anastomoses in rat. Therefore, in order to prevent anastomotic complications, one may prefer to protect the anastomoses by diverting stoma.

473

PUBLICATION

Colorectal carcinoma – Intraoperative radiotherapy with Afterloading-Flab-Technique

C. Tonus¹, Ch. Kolotas², P. Appel¹, N. Zamboglou², H. Nier¹. ¹Department of Surgery; ²Department of Radiooncology, Städtische Kliniken Offenbach, Germany

The Intraoperative radiotherapy (IORT) is a new concept in the treatment of colorectal tumours.

Between 10/94 and 12/96 22 patients (adjuvant 8, palliative 14) received IORT. Chemo- and percutan radiotherapy was already applied at all patients with advanced and recurrent colorectal tumours. The intraoperative irradiation was performed through HRD-Iridium-Afterloading. A flexible flab – individually adapted to the "tumored" – was used as applicator. The contact-dose was 10 Gy.

The mean operation time (rectum resection 2/rectum amputation 13/debulking 7) increased 30 minutes at average. 4 patients had postoperative complications – possibly correlated to irradiation – in form of perianal wound problems (2) and sacrovesical fistulas (2). Up today – in average 10 months (2–21) after operation – 16 patients are tumour-recurrence free. Four patients have a local tumour progression combined with good quality of life. Only 2 patients died (marasmus; acute kidney failure).

With the Afterloading-Flab-Technique a technical simple, little harmful procedure is disposable in the therapy of colorectal tumour. Even when IORT through electronic radiation is not possible or the patients are already treated with rays, a higher irradiation dose is applicable. Obtaining a low rate of local tumour recurrence the Afterloading-Flab-Technique is a valuable treatment alternative to extended, high risk resection procedures.

474

PUBLICATION

Clips and scar as the guidelines for breast radiation boost after lumpectomy

F. Kovner¹, R. Agay¹, O. Merimsky¹, M. Inbar¹, J. Klausner², S. Chaichik¹. ¹Department of Oncology; ²Department of Surgery "B" Tel-Aviv Sourasky Medical Center and Sackler Faculty of Medicine, Tel-Aviv University, Israel

Purpose: Evaluate the accuracy of external irradiation boost design, based either on the metallic clips in the tumour bed, or on the skin scar after lumpectomy.

Methods: Thirty one consecutive patient were investigated. Metallic clips were put by surgeon during lumpectomy, marking the length, width and depth of tumour bed (TB). Electron beam external radiation boost fields were simulated both by surgical clips and by scar for each patient. Two cm have been taken in every direction of the clips. When the field has been planned by scar, 2 cm were added to the length of the scar in both directions, the width of the field was planned adding 2 cm in each of 2 directions to the maximal diameter of removed tumour. Fields area, boost volume, fields overlap were calculated and compared.

Results: The volume of tumour bed and the area of the radiation fields, designed on the basis of scar (VS and AS), were 1.48 time larger, than the corresponding fields and tumour bed volumes, defined by the clips (AC and VC), ($p < 0.001$). Only 74% of AC were covered also by AS, leaving

26% of AC outside the field, designed on the basis of the scar. While AC included all the clips, AS covered only 88% of the clips, delineating TB ($p < 0.05$). On the average, 1/4 of the TB can be left untreated by the field built considering the surgical scar to be reliable landmark for the boost. On the other hand, 41% of SA was not covered by CA, which meant that while treating according to scar, about 40% of the field area could be irradiated unnecessarily.

Conclusion: Surgical scar is unreliable landmark for the planning of radiation tumour bed boost after breast conserving surgery. It can miss considerable part of tumour bed, compromising local control rate. On the other hand, even larger portion of scar oriented boost can be irradiated unnecessarily, thus compromising the cosmetic results, which are the main goal of breast conserving treatment.

475

PUBLICATION

Radiation therapy for chemodectoma of the head and neck region; long term results

A. Kaweckj, Z. Szutkowski, K. Bujko. Department of the Head and Neck Cancer, Cancer Center Warsaw, Poland

Chemodectoma is rare neoplasm arising from non-chromaffin cells of chemoreceptors. Most frequently chemodectoma is localised in the head and neck region, especially in the temporal bone region and carotid body. Treatment of choice in early stages of chemodectoma is surgery. The aim of this paper is estimation of the effectiveness and tolerance of radiotherapy for locally advanced head and neck chemodectoma.

TEMPORAL BONE REGION: Between 1970 and 1990 thirteen patients with temporal bone region chemodectoma were treated with radiotherapy in Cancer Center in Warsaw. All patients had advanced disease with bone involvement and/or cranial nerves injuries. Patients were treated with Co-60 rays and two wedged fields technic was used in all cases. Total dose ranged from 45 to 65Gy. Response was obtained in 12/13 pts.

During observation only patient died from chemodectoma progression. Treatment was well tolerated and we didn't observe any serious late complications.

CAROTID BODY: Between 1974 and 1990 six patients with locally advanced carotid body tumor (diameter more than 5 cm) were treated with radiotherapy in our center. Co-60 rays and opposite fields technic were used in all cases. Total dose ranged from 45 to 60Gy. Complete regression was obtained in 3 patients and partial regression in 3 other cases. During observation (more than 5 years) we haven't noted progression in any case. Also we didn't observe any serious late complications after treatment.

Conclusions: Our results confirmed data of other authors suggested that radiotherapy is effective treatment for temporal bone region chemodectoma. Radiotherapy is also effective treatment for carotid body tumor. Tolerance of radiotherapy in both localisations is good.

476

PUBLICATION

Impact of anatomical variability on dose delivery by three field technique in adjuvant radiotherapy of breast cancer

V. Vinh-Hung, D. Verellen, P. Deconinck, J. Van de Steene, D. Van den Berge, K. Claassens, N. Linthout, A. Bel, M. Voordeckers, G. Storme. Department of Radiotherapy, Oncologisch Centrum, Free University Hospital of Brussel, Belgium

Purpose: To assess anatomic variability of the axilla relevant to adjuvant radiotherapy of breast cancer and interaction between treatment fields on dose distribution.

Methods: CT based treatment planning records of breast cancer patients treated post-operatively by 3-fields – anterior supraclavicular (SC), medial and lateral opposed tangential thoracic wall fields (TT) – from January 1994 to December 1995, are reviewed for availability of CT images through the SC-axilla region. Images, distances measurements are compared to simulation records and dose distributions are calculated.

Results: Mean axilla thickness measured on CT images from 43 retrieved cases is $14.5 \text{ cm} \pm 2.0$ (standard deviation). It is closely correlated to simulation records of table height (Spearman correlation $r = 0.77$, $p < 0.0001$). With dose of 46 Gy by 6 MV photons calculated at fixed depth of 3 cm for the SC field, the mid-axillary dose ranges from 32 to 44 Gy. In individual patients, dose distribution from the anterior to the posterior axilla ranges from 116% to 55%. However total planning taking into account all 3 fields could not be done reliably due to difference of patient positioning to accommodate limited CT aperture.

Conclusion: Large dose inhomogeneity was expected. The problem of 3-D dose distribution of the non-coplanar SC and TT fields is relatively

unexplored but could not be solved on this series. Prospective verification by large aperture CT image acquisition in treatment position using a simulator CT extension may be required.

477

PUBLICATION

The preventive effect of verapamil on radiation induced cataract: An experimental study

M. Cengiz¹, M. Gürkaynak¹, K. Kılıç², F. Akyol¹, İ.L. Atahan¹.

¹Departments of Radiation Oncology; ²Biochemistry, Hacettepe University, Faculty of Medicine, Ankara, Turkey

Purpose: Cataract formation is an unavoidable complication when radiation therapy, even in small doses, includes the lens. In this experimental study on rats, the preventive effect of verapamil, a calcium channel blocker, was studied on radiation induced cataract.

Methods: Experiment was performed on 40 female, 180–250 g weighted Wistar albino rats. Animals were divided into 3 groups. A control group (n = 10) was observed for 7.5 weeks. Radiation (n = 10) and verapamil groups (n = 20) which received 5 Gy radiation to whole cranium, in single fraction, including both eyes within irradiation volume, in addition verapamil group received daily subcutaneous injection of 8 mg/kg verapamil from the first day of radiation. At the end of 7.5 weeks all animals were sacrificed by bleeding. Ca, Na, K, levels were studied both in blood and in lens homogenates. Mg level could not be studied in sera for technical reasons.

Results: Serum levels of Ca, Na measured within normal ranges in all groups, but serum K level was higher than normal levels in control and radiation groups. Lens K and Na concentrations were not significantly different in control and radiation groups, but both levels were significantly lower in verapamil group (p = 0.0001, p = 0.0009). Ca levels were higher in the radiation group and lower in verapamil group compared to control ones (p < 0.0001). Mg levels were not significantly different (p = 0.590).

Conclusion: Verapamil effectively decreased the concentration of Ca in lens which is accepted as the key element in radiation cataractogenesis. Thus, it is concluded that verapamil may prevent radiation induced cataract formation.

478

PUBLICATION

Is dosimetry by planning CT the optimal method for external beam irradiation of the breast?

Ch. De Pooter, K. Haest, G. Pittomvils, G. Muylle, C. Vercauteren, M. Pouillon. Dep. Radiotherapy, A.Z. St-Augustinus, Wilrijk, Antwerp, Belgium

Purpose: In modern radiotherapy, the use of a planning CT for 3D dosimetry is widely spread. The reproducibility of the position of a patient being irradiated (IR) on the breast is difficult because of shape and composition of the breast and because of the position of shoulder and arm. Differences in position between simulation, planning CT and IR may occur. We therefore examined the possibility of these differences, their influence on treatment planning and dose calculation.

Methods: Forty pts with IR on the breast by two opposite fields were evaluated. Contours of the breast were taken after simulation and field markers were noted. The diameter between the center of both fields was measured. The size of the breast was measured by ultrasonography, which was used to complete the contours for 3D dosimetry. Each pt had a planning CT scan too, which was used for 3D dosimetry. Information of both was compared.

Results: Differences in diameter when measured by ultrasonography & contour and compared with reality were 0–3.5 mm. They occurred in ±80% and were not related to the size of the breast. There was no significant influence of these differences on dose calculations of the IR. The measurements by CTscan varied >80% and were almost always exaggerated. The differences in diameter ranged from 0–16 mm and were higher for pts with a greater size of breast. There was an influence of 0–6.4% on dosimetry and dose calculation.

Conclusion: The position of especially pts with a large size of breast is difficult to reproduce for simulation, planning CT and irradiation. This may cause a difference in dose calculation and total dose of the IR. For these pts, the dose calculations obtained by use of several contours and measurements of the breast size by ultrasonography might be more appropriate for dosimetry of external beam irradiation of the breast.

479

PUBLICATION

The relations of radiation induced ultrastructural cardiac damage with serum troponin T and creatin kinase MB levels

I. Aslay¹, B. Ahiskali², G. Kemikler³, V. Yasasever⁴, E. Berrak¹, S. Özbilen¹, R. Dişci⁵, T. Gören⁵, Y. Aytekin², G. Töre¹. ¹Radiation Onc. Dept.; ²Medical Physics Dept.; ³Biochemistry Dept.; ⁴Bioistatistic Dept. of Istanbul Univ. Oncology Inst.; ⁵Histology Dept.; ⁶Cardiology Dept. of Istanbul Univ. Medical Fac., Türkiye

Purpose: Troponin-T (TnT) and creatin kinase MB (CK-MB) are specific markers of myocardial cell injury. Radiation-induced changes in the ultrastructure of the rat heart was shown but, relations of serum TnT and CK-MB levels were not investigated yet. This study was performed to search relationship between these markers and cardiac radiation damage.

Method & Material: In this time sequence study, wistar rats were exposed 20 Gy (200 kV, 0.5 Cu filter) irradiation to a field including the heart. The hearts were excised at varying time intervals (8 h–180 days) and the ultrastructure of myocardium was studied. Besides, serum TnT&CK-MB levels of irradiated and control groups were detected synchronously for every time interval.

Results: Changes were observed in myocytes at all time intervals. Although membranes of cells were intact, mitochondrial damage, characterized by swelling and fenestration, myofibrillar disarray and lysis, separation and damage of intercalated discs were seen focally. These changes increased progressively and we did not find any recovery in myocytes during the study period. TnT&CK-MB serum levels did not increase. In contrast TnT levels decreased in irradiated groups relative to control group at 24 h–180 days. CK-MB level decreased on the 60th day.

Conclusion: Radiation-induced cardiac myocyte damage did not cause an increase in serum TnT&CK-MB levels. But, these serum marker levels might be decreased by radiation induced cellular effects. These changes may be the result of intracellular radiation-mediated gene expression or extralysosomal protease activation.

480

PUBLICATION

The efficiency of total liver irradiation (TLI) in patients with Hodgkin's disease (HD)

A.T. Balashov¹, A.A. Myasnikov². ¹Petrozavodsk University, Radiology Department; ²Republican Hospital, Petrozavodsk, Russia

Purpose: Involvement of the liver into pathologic process in HD frequently determines prognosis.

Methods: 37 patients with HD (liver lesions were proved by histology) were studied to estimate the efficiency of TLI in complex therapy. In 15 patients liver lesions were revealed during primary diagnosis of HD, in 22 patients liver lesions appeared in relapse of further progression. In all patients TLI was one of the stages of complete therapy and was held on gamma-apparatus. (Single dose was 1.8–2.2 Gy, standard fractioning 5 in a week, cumulative local dose 36–44 Gy).

Results: All 15 patients (1 group) were subjected to standard polychemotherapy (PCT) (MOPP or COPP), liver lesions eradication (LLE) was reached only in 4 patients, after TLI – in 14 from 15 patients. 11 patients live more than 5 years in remission. In 22 patients (2 group) LLE as a result of complex therapy, including TLI, was reached in 17 cases, but remission only in 13 cases. Life duration and prognosis in these patients depended only on the efficiency of PCT, but not TLI.

Conclusion: TLI is most useful when liver lesions appeared in HD manifestation. In HD relapse TLI is expedient if liver is the only single extranodal site, or if PCT is effective in other zones.

481

PUBLICATION

Individualized vaginal moulds using 192-Iridium and CT evaluation in gynecological (Gyn) tumors

I. Henríquez¹, A. Rovirosa¹, Sanchez-Reyes¹, J. Güell¹, J.R. Ayuso², F. Casas¹, J. Casals¹, J.L. Osorio¹, B. Farrús¹, A. Bieta¹. ¹Radiation Oncology; ²Radiology Department, Hospital Clinic, Barcelona, Spain

Purpose: Individualized vaginal moulds along with CT-scan information to perform dosimetric study for low dose 192-Iridium (Ir) is a treatment modality used in Gyn cancer patients (ptes). We present a preliminary results of 15 ptes treated with this modality.

Methods: Since March 1995, 8 cervical cancer (6 stage IIA, 1 stage IV, 1 vaginal relapse) and 7 endometrial carcinoma (71% vaginal involvement) have been treated by vaginal moulds. All but one pte had surgery