comparable with photon chest wall irradiation. Electron chest wall irradiation is relatively simple and safe and therefore is recommended.

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## An effectiveness evaluation of simplified hemibody irradiation

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**Aim of the study:** Assessing of simplified hemibody irradiation (HBI) technique as a palliative treatment of patient with multiple, painful bone metastases.

**Material and method:** The material comprised 23 patients with multiple painful bone metastases (25 cases of HBI). In no one case bone metastases in skull and distal part of limbs were found, so these parts of the body were excluded from irradiated field. All patients were irradiated using 6 MV photons from two opposite AP_PA fields. The dose of 6 Gy was delivered for UHBI and 8 Gy for LHBI. No tissue density corrections were considered and no shields were used. The degree of pain relief and performance status improvement was assessed one and two months after treatment, depending on clinical and histopathological diagnosis and type of bone metastases. The dependencies between degree of pain relief, performance status and different biological and technical factors were checked.

**Results:** The biggest mean degree of pain relief (100%) was obtained in the cases of multiple myelomas, prostate cancers (78%) and lung cancers (88%). Taking into account histopathological diagnosis, the best answer has been found in multiple myeloma and squamous cell cancer (88%). The difference between degrees of pain relief for types of metastases also was found (65% for osteolitic vs. 50% for osteoclerotic metastases). No difference between UHBI and LHBI was found. The statistically significant correlation between pain relief, performance status improvement and decrease of analgetics use was found.

**Conclusion:** The obtained results suggest that presented simplified HBI is an effective treatment modality for patients with multiple painful bone metastases, giving an in

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## Nonoperative treatment for locally advanced esophageal carcinoma

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**Introduction:** Radiotherapy is one of the most widespread methods for treatment of locally advanced esophageal carcinoma. The purpose of this study was the comparison of different radiotherapy regimens.

**Materials and Methods:** 152 cases of squamous cell carcinoma arising from the cervical and thoracic esophagus (stage II–IV) were treated by radiation therapy at the institute. All patients were divided into 4 subgroups according to the treatment policy. 1st group of 46 patients was treated by external beam radiotherapy (EBRT) to a dose 30 Gy/15 fractions/3 weeks. After 2 weeks rest they continued to receive treatment with $^{60}$Co-HDR intracavity brachytherapy (IBT) to a dose 15–20 Gy delivered in 3–4 sessions of 5 Gy each week apart. Simultaneously these patients got EBRT to a dose 20 Gy/10 fractions/2.5 weeks. 2nd group of 41 patients was treated by EBRT to a dose 30 Gy/5 Gy per fraction/6 fractions per week. IBT was provided in 2–3 days after EBRT. The average dose delivered by IBT (Selectron, source $^{137}$Cs, pellets LDR-MDR) was 15 Gy; the dose per fraction was 5 Gy twice per week. The dose was calculated at 0.5 cm below esophageal mucosa at both groups. In the 3rd group (29) the $^{137}$Cs-IBT to dose 15 Gy/3 fractions was provided in two weeks after EBRT dose 40–45 Gy/19–21 fractions/4–4.5 weeks. For 36 patients of 4th group EBRT alone was done to a dose of 51–54 Gy/17–18 fractions/3.5 weeks.

**Results:** There was remarkable increase to the end of the 1st year in relief of dysphagia and local control in groups with IBT. The level of benign radiation-induced esophageal ulceration's and strictures was maximum in 2nd group. The survival rate from all groups is represented in the table.

| | EBRT + IBT1 ($^{60}$Co) 46 | EBRT + IBT2 ($^{137}$Cs) 41 | EBRT + IBT3 ($^{137}$Cs) 19 | EBRT 36 |
|---|---|---|---|---|
| 1-y | 72.73 ± 6.2% | 69.23 ± 5.1% | 57.89 ± 5.3% | 36.11 ± 5.1% |
| 3-y | 27.23 ± 5.7% | 11.54 ± 5.8% | 15.79 ± 4.3% | 8.33 ± 4.1% |
| 5-y | 19.57 ± 4.2% | 7.32 ± 4.4% | 5.26 ± 3.6% | 4.11 ± 2.7% |

**Conclusion:** Use of HDR-brachytherapy combined with traditional fractionated is the most preferable from investigated regimens.

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## The virtual simulation process

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**Introduction:** The Virtual Simulation (VS) is a modern technique allowing the definition of the anatomical contours of the region to treat and the simulation of the fields of the radiotherapic treatment. Once the CT and/or NMR images have been acquired, the Virtual Simulation software gives a three-dimensional view of the anatomy of the patient and allows the definition of the optimal characteristics of the treatment beams in relation to the anatomical structures of the patient, thus substituting the traditional simulator image.

**Methods:** During the acquisition of the CT scans a correct posistioning and immobilization of the patient is necessary, in order to riproduce it durino the treatment session. During the treatment planning session the contours are drawn onto the CT scans for the target volume and the organs at risk, according to the ICRU 62 recommendations. The software allows the visualization of the patient anatomy from the point of view of the radiation source (Beam's Eye View, BEV); this is essential in order to draw the area shielded by blocks or the multileaf collimator, thus conforming the radiation field. The treatment plan will then be completed with all the necessary dosimetric considerations and the final 2D and 3D dose distributions. Once the isocenter position is decided, the isocenter point is projected onto the patient skin by means of a system of lasers driven by the simulation software of the CT device, and a CT slice is acquired in correspondence of this point to minimize the geometrical set-up uncertainties. One very important feature of the Virtual Simulation Software is the elaboration of the Digitally Reconstructed Radiograph (DRR): this is a 2D radiographic image obtained by the elaboration of the volumetric data coming from the acquired CT scans. The DRR presents the exact geometrical perspective of the radiation source; thus on the DRR the exact dimension of the field edge is visualized together with the used shaping devices (MLC, blocks, mantles), the projection of the target volumes and of the organs at risk.

**Purpose:** This allows the user to perform a comparison between the field defined during the planning and the effectively supplied field visualized on the portal image.

**Results:** In our Clinical Center, not having at our disposal an Electronic Portal Imaging Device, we have studied and realized a software to print the DRR image on radiographic film, thus also offering a further permanent documentation. It is now possible to compare the shape of the radiation field (◇=0 mm)and the geometrical alignment between the DRR reference image and the portal image obtained during the treatment (◇ lateral beam=1.9 ± 1.9 mm), (◇ anterior beam =1 ± 1 mm).

**Conclusion:** The DRRs furthermore offer the possibility to realize a patient coordinate system by means of anatomical markers. As the spatial resolution of a DRR is limited by the voxel dimension of the original CT slices, dimensions not greater than 5 mm are more suitable to get a better identification the anatomical structures. The comparison with the DRR becomes unavoidable in the case of complex conformal treatments with a multileaf collimator, as in our case where a Dynamic Micro-Multileaf Collimator is used for the treatment of head lesions.

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## An opportunity for therapeutic index improvements in conservative therapy of early breast carcinoma

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**Purpose:** Studying the opportunity for the therapeutic index improvement in the follow directions: providing local tumour control by applying the dose of 50 Gy; and limiting the irradiation to the normal tissues.

**Material and method:** 190 patients with early breast cancer T1-2 (up to 3 cm) NO-1 MO were treated in the National Oncological Center and evaluated in two groups of case - control. In the group with coservative treatment (BCT) 122 patients were treated with postoperative radiotherapy after preserving surgery by "negative" margin between 1992 and 1997. The group-control contains 68 patients, whom was applied a radical modified mastectomy - Patey (M) between 1978-1986. The radiotherapy in N+

patients were delayed with 1-2 courses ChT. Clinical target volume (CTV) of the patients includes the preserved breast with the underlying thoracic wall of the patients with N- and N+ up to 3 positive lymph nodes. For all patients three-CT transversal scans were made for precise outlining of the CTV and the organs of risk. The target volume were irradiated with two tangential field (60 Co) without boost for the tumour bed to the prescribed total dose of 50Gy in 25 fraction for 5 weeks When the supraclaviculary fosse was included, it was treated with a total dose of a 44Gy by adding a "third" field. The adjuvant system treatment includes VI courses chemotherapy and Tam in patients, with SR+.

**Results:** 5 year local control in 96,0% of patients, excellent 51,6% and good 41,0% cosmetic results, were accomplished, as in only 1,6% postradiotherapy pulmofibrosis was diagnosticised This method is accessible and feasible to all patients. It allows homogenous irradiation of CTV and sparing the organs of risk. The combination of unfavourable factors of the tumour in a group with high risk essentially reduces the local control and the overall survival. The aesthetic results depend only on the volume of the removed tissues and on the type of surgical incisions for the primary tumour and the axillary dissection. BCT proved a better local control versus M, but the 5 years overall survival was not significantly different in the two treatment methods - 95,8% versus 92,5%

**Conclusions:** The individualised CT planning and the applying of a 50Gy dose without "boost" in the tumour bad. leads to better treatment, cosmetic results and minimal late complications This imposes the BCT as a successful alternative of the modified radical mastectomy.

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### A study of 40 patients with nasopharyngeal cancer (stage 1 to 4) treated with radiation therapy using CT simulation with a single isocentre technique and 3 dimensional planning

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**Purpose:** Nasopharyngeal Cancer(NPC)is a very common cancer affecting mainly the Chinese ethnic group in Malaysia.The incidence is approximately 25 per 100000 population. Treatment simulator is the main planning tool for radiation treatment of NPC.At the University of Malaya Medical Center(UMMC),CT Simulation using a single isocentre and 3 dimensional planning was used in a pilot study to plan NPC.In this paper we analysed the treatment outcome using the planning technique,which we designed.

**Materials:** From 1998 to 1999,40 patients with NPC were planned at UMMC using CT simulation.30% of the patients were stage 1 and 2,70% were stage 3 and 4 disease.The patients were planned with their neck extended and immobilized in a beam directing shell.4mm to 5 mm scans slices were performed to include the head and upper chest.A single isocenter was chosen in the neck and marked on the patient. Critical structures and tumour volume were outlined on each CT slices on the CT simulation planning console.3 beams were used to treat the post nasal space and a single anterior beam for the neck using a half beam block technique.Shielding of structures were "drawn" on the digital reconstructed radiograph (DRR) and the planned volume checked by scrolling through the axial,saggital and coronal cuts on the CT simulation console.The plan was exported to a 3D treatment planning system for final dosimetry.Each field was verified on electronic portal image and compared with the planned digital reconstructed radiographs prior treatment.

**Results:** CT simulation was useful in defining the anatomy,outline of critical structures,tumor and target volume with a higher degree of accuracy compared to conventional simulation.Of the 40 patients in the study group,1 defaulted treatment.100% of the 39 patients who completed treatment achieved complete or major response at the end of radiation treatment.1 patient died early following adjuvant chemotherapy.The local control rate at 24 months was 100%.2 patients had systemic relapse at 12.5 and 18 months of follow up and treated with salvage chemotherapy.The survival rate at 2 years was 95%.

**Conclusion:** CT simulation provides a superior anatomical and tumor definition in three dimensions compared to conventional simulation.The initial findings indicate that is highly effective in controlling early as well as advanced stages of NPC.In UMMC,CT Simulation has now replaced the conventional planning method of using a treatment simulator.

## Genitourinary cancer

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### Combination Studies with the Farnesyltransferase Inhibitor R115777 and Chemotherapy Agents

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Farnesyltransferase (FT), an enzyme that catalyzes the first step in the post-translational modification of ras and other important polypeptides involved in cell proliferation, has emerged as an important target for cancer therapy. R115777, one of the first FT inhibitors to undergo clinical testing, has shown promising activity in leukemia and breast cancer. Phase III studies have been completed with this compound. We examined the effect of combining R115777 with several classes of antineoplastic drugs in various human tumor cell lines. Colony forming assays were utilized to examine the effect of treating cells with cisplatin (CDDP), melphalan, gemcitabine (GEM) or 5-FU in combination with R115777 in a number of cell lines, including the A549 NSCLC line as well as T98G glioblastoma, MCF-7 breast, BxPC-3 pancreatic and HCT-116 colon carcinoma cell lines. The combination of R115777 and CDDP exhibited synergy that is dependent on sequence of administration and on the model system utilized. The combination of R115777 and GEM was additive, while the combinations with melphalan and 5-FU were less than additive. Based on these findings, we undertook a phase I trial to define the MTD, toxicities, PK, and clinical activity of the combination of R115777 (po BID d1-14), GEM (d1, d8), and CDDP (d1), on a 21-day cycle in patients (pts) with advanced cancers. To date, 25 pts have received 68 cycles of treatment through 5 dose levels. The most common and dose-limiting toxicity is neutropenia. Thrombocytopenia (10 grade 3, 1grade 4), rash (2 grade 3), nausea (8 grade 2, 1 grade 3), and fatigue (1 grade 2). Six objective responses (5 PRs, 1CR) have been documented in 18 evaluable patients. PK and in vivo correlates of FT inhibition at the MTD (R115777 300 mg po BID, GEM 1000 mg/m2, CDDP 75 mg/m2) will be presented. Supported by grants from NIH (CA77112, RR00585) and Janssen Research Foundation.

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### Results of exclusive brachytherapy in the treatment of carcinoma of the penis

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**Purpose:** To assess the role of exclusive brachytherapy (BT) as a conservative approach in the treatment of penis carcinoma.

**Methods:** Between 1973 and 1995, 145 patients (pts) with penis carcinoma were treated with a conservative approach consisting of exclusive BT. The median age was 58 years (20–83). A history of phymosis was found in 27% of the pts, and precancerous lesions were observed in 30% of the pts. Stage distribution was: T1 in 107 pts (74%), T2 in 18 pts (12%), T3 in 11 pts (8%) and impossible to assess in 9 pts. Inguinal nodes were present in 17 pts (12%). One patient presented with metastases. One hundred and twenty pts (83%) had circumcision prior to BT, the 25 remaining pts had already a history of previous circumcision: BT was performed using the hypodermic needles technique. The mean radioactive line number was 6 (2–18) in a mean number of 2 planes (1–5). The mean radioactive length was 26 cm (4–108). The mean delivered dose according to the Paris system rules was 67 Gy (20–80). The mean treated volume was 28 $cm^3$ (5–137). Treatment of clinically present inguinal node consisted of node dissection completed by external irradiation, depending on pathologic findings.

**Results:** Of the population, 22 (15%) printed a local relapse, 14 of them (64%) being controlled by either a partial amputation (10 pts), a total amputation (2 pts) or a new BT (2 pts). Twenty-five pts (17%) presented an inguinal lymph node relapse. Eleven of the 25 pts (44%) were controlled by either lymphadenectomy or external irradiation or both. Eighteen pts (12%) presented metastases. A total of 79 late complications (all grade) (54%) were recorded. Urethral stricture and necrosis were the two most common complications. In 29 cases (20%) complications required surgery, consisting of partial amputation. With a median follow-up of 120 months, 79 pts (55%) are alive. Twenty-two pts died of tumor.

**Conclusion:** BT gives good local control in the conservative approach of penis cancer. The major carcinologic event was represented by inguinal lymph node relapse, showing the need for a more systematic surgical approach with inguinal dissection.