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First results in stereotactic fractionated radiotherapy (SFR) for patients with meningioma

S. Villa[1], D. Linero[2], D. Fontes[3], S. Marin[1], V. Navarro[1], C. Majos[3], E. Ferran[4]. [1] *Institut Catala Oncologia, Radiation Oncology, Hospitalet.Barcelona, Spain;* [2] *Institut Catala Oncologia, Physics, Hospitalet. Barcelona, Spain;* [3] *IDI.CSU Bellvitge, Neuroradiology, Hospitalet. Barcelona, Spain;* [4] *CSU Bellvitge, Neurosurgery, Hospitalet. Barcelona, Spain*

Objective: To analize our first results in meningioma patients treated by SFR in non-surgical series in relation to local control and toxicity.

Methods: We studied 40 patients (30 females and 10 males) affected with meningioma with median age of 55.3 y (r 22-79). Tumors were located in base of the skull, cranial convexity and parasagital areas. In 25 p. (62.5%) histology of meningioma was confirmed. At the admision 26/40 had KPS >70. Patients were treated using 2 different relocatable frames (Beverly frame and Brain Lab). Median dose was 52 Gy (r 30-56) with fractions of 2-2.5 Gy per day. We have planned with ISSIS-2 or Brain Scan dosimetric programs with fixed fields.

Results: Median follow-up was12 m. (1-39). All patients are alive at the moment of last F-U. In 30 p (75%) it was considered stable disease, 9 p (22.5%) decreased their tumour sizes, and 1 p progressed (malignant meningioma). Patients with KPS > 70 increased up to 32. Acute toxicity observed was: astenia and dizziness 7 p, neuralgia 6 p, vomiting 5 p, alopecia 4 p, cefalalgia 3 p, somnolence, anorexia and conjuntivitis 2 p, intolerance to frame 1 p. Late toxicity was: cranial nerves 5 p, desorientation, vomiting, astenia and MRI hipersignal in T2 in 1 p.

Conclusions: In spite of short follow-up we have acquired enough experience with both different relocatable frames and dosimetric programs. Also, we found that acute toxicity is similar to historical series with conventional RT but late effects are minimal. Local control is satisfactory with standard doses of radiation in this first analysis.

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Optical wave guides in radiation dosimetry

S. Gripp[1], F. Haesing[2]. [1] *Heinrich-Heine-University, Radiation Therapy Dept., Duesseldorf, Germany;* [2] *Forschungszentrum Juelich, ZEL, Juelich, Germany*

Purpose: To investigate the suitability of optical wave guides as radiation dosimeters in clinical dosimetry.

Methods: The optical absorption of silica is increased by ionizing radiation due to color center formation. The total attenuation depends on the fiber sensitivity, the dose, and the optical path length. We studied silica fibers doped with germanium (effective atomic number Zeff=23) and lead (Zeff=68), respectively, in electron and photon fields. The influence of dose, dose rate, energy, and temperature on the induced attenuation was studied. Depth dose measurements in a water equivalent phantom were performed and compared to an ionization chamber. The lead doped fiber was used for in-vivo dosimetry in electron fields during intraoperative irradiation.

Results: The radiation-induced attenuation is proportional to the absorbed dose if fading, i.e. partial thermal recovery after irradiation, is compensated. The fiber sensitivity depends on the photon energy, in particular with lead doping. The highest sensitivity was measured with 0.1 MV x-rays. Depth dose curves in photon fields are influenced by the energy dependence. The sensitivity is less dependent on the energy of electron beams. In the range 6-20 MeV the sensitivity increases by 0.5% per MeV. During intraoperative radiotherapy in an animal model the applied dose was simultaneously determined with a lead doped silica fiber.

Conclusion: Radiation induced attenuation of optical wave guides can be used in radiation dosimetry. Lead and germanium doped silica fibers are suitable. In contrast to TLDs optical wave guides provide a real time measurement. Applications of the current fibers in photon fields are limited by the high Zeff, resulting in an energy-dependent sensitivity. With electron beams the energy-dependence is less pronounced. In vivo applications are feasible in electron fields.

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Brachytherapy with Iridium-192 as a treatment of carcinoma of eyelid's tarsal structure

M. Caro-Gallarin[1], C. Conill[1], A. Vilalta[2], M. Molla[1], E. Verger[1], J. Toscas[1], A. Biete[1]. [1] *Hospital Clinic, Radiation Oncology, Barcelona, Spain;* [2] *Hospital Clinic, Dermatology, Barcelona, Spain*

Background: Surgery is the standard treatment for eyelid tumors. The use of Iridium 192 wires is often proposed as an alternative therapy to surgery especially for preserving function and to obtain better cosmetic results. The goal of this study was to evaluate the local cure rate and the cosmetics and functional results in patients with eyelid carcinoma treated with Iridium-192 wire implant

Methods and patients: From May 1993 to January 2001, 20 carcinomas of the eyelid's tarsal structure in 19 patients were treated with Iridium-192 wire implant. One patient presented 2 carcinomas in both lower eyelid. There were 11 females and 8 males. The mean age was 68 years (range 49 to 90). The tumor location was: lower eyelid 18 (90%), upper eyelid in 2 (10%). The mean tumor size was 1.18 cm (range 0,5 to 2). All tumors had histological verification: 15 of 20 (75%) were basocellular type; 4 (20%) were squamous cell carcinoma; and 1 (5%) was an adenocarcinoma. Implant procedure: The active wire inserted into a braided silk filament with atraumatic needle was inserted after the curetage of the lesion was performed. The mean lenght of implanted wires was 1.7cm (range 1.5 to 2.5) and in 3 cases two parallel implant wires were needed. In all cases 4000cGy were delivered. The mean dose rate delivered was 69.86 cGy/h (range 47.45 to 94.63).

Results: The mean follow-up was 39 months (range 1 to 94). Local control was obtained in 18 cases (90%). In two cases local failure appeared and salvage surgery was done. None of the patiens presented chronic toxicity. Good cosmetic and functional results were achieved in all patients.

Comments: The use of Iridium-192 wires is a feasible treatment of eyelid carcinomas regarding to tumor control rates and quality of functional results.

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Stereotactic BAT ultrasound positioning for upper abdominal radiation target volumes

M. Fuss, B.J. Salter, A. Sadeghi, C.R. Thomas Jr., A. Ameduri, J.M. Hevezi, T.S. Herman. *UTHSC at San Antonio, Radiation Oncology, San Antonio, TX, USA*

Purpose: Implementation of a strategy to use the BAT ultrasound positioning device to visualize IMRT target volumes (TV) and anatomical reference structures in the upper abdomen. Assessment of potential improvement on daily repositioning and feasibility of daily application.

Material/Methods: In 6 patients treated by IMRT for cholangiocarcinoma, HCC, pancreatic carcinoma and neuroblastoma, TV and organs at risk were delineated in contrast enhanced CT. In addition reference structures such as aorta, major arterial branches, portal vein, inferior vena cava and intrahepatic vessels and bile ducts in close anatomical relation to the TV, or within the TV, were delineated. For inverse treatment planning, reference structures within the TV were assigned the same dose prescription as the TV. Daily axial and sagittal ultrasound images (US) were acquired and the anatomical structures derived from the CT planning sets were superimposed. The system indicates the required 3D couch-shifts until a best match between the structures visible in the US and the structure-outlines, derived from CT data, is found.

Results: US was poor or not useful in 18 setups (15%) due to colonic and gastric air, and obesity. Identification of reference structures was excellent in 57.8% and good in 42.2% of 102 useful BAT setup controls. Mean (±SD) indicated shifts were 4.4±5.8, 2.7±4.8 and 0.9±3.1 mm in x, y and z-direction. Mean total setup time was 5.9 minutes. Reference structures most valuable for identification of TV position were (1) branches of portal vein, hepatic artery and bile ducts in intrahepatic lesions, (2) aorta, coeliac trunk, SMA and portal vein in pancreatic lesions and the neuroblastoma case. Excellent match of port film position after BAT initiated shift, let to employment of the method in selected cases.

Conclusion: BAT positioning for upper abdominal tumors is feasible and improves daily repositioning accuracy. Unlike in the established application of the BAT for prostate radiotherapy, where the target can be directly visualized, the TV in the present study was positioned relative to reference vascular structures in close anatomical relation. Future evaluations must characterize inherent limitations and reliable applicability in a larger number of patients. We see an enormous potential in improved and individualized patient positioning for stereotactic extracranial radiotherapy and radiosurgery, especially for tumors of liver and pancreas.