RT alone (median 66 Gy/33 fr.). RT-induced cardiac complications were evaluated retrospectively using Common Terminology Criteria of Adverse Events v3.0.
Results: The median follow-up for surviving patients was 85 months. The overall and cause specific survival rates were 59% and 79%, respectively. Ninety-three patients were analyzed for evaluation for cardiac complications. Cardiac complications (⩾G3) were observed in 10 patients (10%): pleural effusion in 1 (1%), cardiac ischemia in 5 (5%) and arrhythmia in 4 (4%). Among 5 patients with cardiac ischemia, 2 died in acute myocardial infarction and 3 needed the stent placement. Among 4 patients with arrhythmia, 2 died in heart failure and 2 needed the pacemaker implantation. Four of 13 patients (31%) with cardiovascular diseases before RT experienced deterioration of the disease.
Conclusions: Cardiac complications (⩾G3) were observed in 10% of patients treated by RT alone for stage I esophageal cancer: pleural effusion in 1%, cardiac ischemia in 5% and arrhythmia in 4%. We think our data can be used for comparison with the data of cardiac complications after CRT for esophageal cancer patients.

930 POSTER

Comparative dosimetric study of dynamic conformal arc (DCA), conformal beam (CB) and intensity-modulated radiosurgery (IMRS) for childhood cerebral arteriovenous malformations (cAVM) treatment

J. Casals Farran[1], A. Mañes Garcia[1], J.F. Calvo Ortega[1], A. Eraso Urien[1], S. Moragues Femenia[1], J. Acebes Martin[2]. *[1]Grupo Hospitalario Quiron, Radiation Oncology, Barcelona, Spain; [2]Hospital Universitari de Bellvitge, Neurosurgery Department, Barcelona, Spain*

Purpose: To investigate the dosimetric differences among DCA, CB and IMRS techniques for cAVM treatment in children.
Methods and Materials: Between 03/05 and 11/06 we have treated six children with cAVM younger than 18 years (range: 6−18 years). First symptoms were: hemorrhage in 5 patients and neurologic deficit in 1 patient. cAVM volume ranged from 0.15 to 7.22 cc (mean = 2.26 cc). Spetzler-Martin grade was as follows: Grade 2, n = 1 and Grade 3, n = 5. AVM score ranged from 0.175 to 1.62. Three patients (50%) had other treatment before radiosurgery: 2 embolization and 1 partial surgery. Prescribed dose at the peripheral isodose (81−92%) ranged from 16.7 to 19 Gy (mean = 17.6 Gy).
We calculated DCA, CB and IMRS plans for each patient. The following dosimetric parameters were analysed for all plans: conformity index (CI), heterogeneity index (HI), normal brain tissue complication probability (NTCP), obliteration probability (OP), success probability (SP), normal brain dose-volume histograms and probability of a second cancer incidence (PSC).
Results: IMRS was superior to DCA and CB for homogeneity and conformity, IMRS was discreetly worse for NTCP than DCA and CB (5.9%, 5.3%, 5.4% respectively), and so for SP (58.9%, 59.4% and 59.4%). Equal OP was obtained for each plan on each patient (range 70.8−77.5%), since OP only depends on the minimal dose on the lesion. Percentage of normal brain volume receiving low doses was higher in IMRS than in DCA and CB approaches respectively but without clear influence in PSC. Dosimetric parameters always fulfilled the RTOG recommendations.
Conclusions: IMRS treatment improves target conformity and homogeneity, but increases the volume of normal tissue exposed to low doses of radiation. No important differences were found between DCA and CB techniques.

931 POSTER

Cost-effectiveness of particle therapy: current evidence and future needs

M. Pijls-Johannesma, D. De Ruysscher, P. Lambin. *MAASTRO Clinic, radiation oncology, Maastricht, The Netherlands*

Background: Due to the ever-expanding health care expenses, knowledge about the cost-effectiveness of treatments is continuously gaining importance. In spite of the fact that radiotherapy (RT) is a rather cheap treatment modality, increasing complexity will inevitably translate in higher costs. This is certainly so for proton and light ion therapy. In order to find current evidence on cost-effectiveness of particle therapy we systematically searched the literature.
Methods: Twelve databases were searched systematically with a predefined search strategy. No limit was applied to language or study design.
Results: Out of 773 identified papers, only 13 papers were dealing with the economic aspects of particle therapy. Seven papers described aspects of the workload, staffing levels, setting up and operating costs of a proton therapy facility. Only three papers reported on "cost-effectiveness", all on proton therapy, and performed by the same Swedish research group (Karolinska Institute, Stockholm). An economic evaluation model for childhood medulloblastoma, a cost-effectiveness analysis model for breast cancer and a cost-utility analysis based on a Markov model for breast cancer, prostate cancer, head & neck cancer and medulloblastoma was reported. The results of this latter study indicated that the average cost per QALY gaining for the four types of cancer assessed was about € 10,130. If the value of a QALY was set to € 50,000 (benchmarked varies highly between countries: € 20,000–100,000), proton treatment may be cost-effective. However, due to a high level of uncertainty because of a lack of data and many assumptions, these results should be interpreted with caution.
The content of the remaining three papers was miscellaneous.
Conclusion: So far, literature data on cost-effectiveness of proton therapy is limited, and is lacking for carbon ions. Further research into cost effectiveness of particle therapy is needed. In order to obtain valid results and decrease uncertainty, a large amount of data on costs and effects are needed. To achieve this goal, a multidisciplinary international collaboration is required.

932 POSTER

Reliability of the linear-quadratic formula for evaluating biological equivalence between single-fraction and hypofractionated radiation doses: an in vitro study

H. Iwata, Y. Shibamoto, R. Murata, N. Tomita, S. Ayakawa, H. Ogino, M. Ito. *Nagoya City University, Radiology, Nagoya, Japan*

Background: No appropriate model exists to estimate how single doses of radiation as used in gammaknife radiosurgery biologically correspond to hypofractionated doses as used in cyberknife and other stereotactic radiotherapy. The linear-quadratic (LQ) model is often used for convenience, but should be applied to 8- or more-fraction radiotherapy. In this study, we compared biological effects of single-high and hypofractionated doses in single cells and spheroids, and examined the reliability of the LQ model.
Material and Methods: V79 and EMT6 single cells received single doses of 2−12 Gy, and 2 and 3 fractions of 4 and 5 Gy each given at 4 h intervals to allow full repair of sublethal damage. Surviving fractions were determined by a colony assay. Single and fractionated doses to actually reduce cell survival to the same level were determined. From surviving fractions after single doses, the α/β ratio was obtained, and using the ratio and the LQ formula, equivalent single doses for the hypofractionated doses were calculated. The calculated doses were then compared with actually determined equivalent single doses for the hypofractionated doses. V79 spheroids (approximately 0.8 mm) received single doses of 5−26 Gy and 2−5 fractions of 5−12 Gy given at 2−4 h intervals. After irradiation, spheroids were dissociated into single cells and cell survival was determined by a colony assay. Equivalent single doses for the hypofractionated doses were calculated as done with single cells, and then they were compared with actually determined equivalent single doses for the hypofractionated doses.
Results: The α/β ratio was 5.1 for V79 single cells and 0.23 for EMT6. In both cell lines, equivalent single doses for hypofractionated doses calculated from the LQ formula were approximately 12%-15% lower than the actually measured biologically-equivalent single doses. In V79 spheroids, the former doses were approximately 20%-24% lower than the latter doses. Thus, the LQ model calculation underestimated the equivalent dose in both single cells and spheroids.
Conclusion: It is not appropriate to use the LQ formula for estimation of equivalent single and hypofractionated doses. The use of the LQ model may underestimate the effect of hypofractionated radiation.

933 POSTER

Quality Management System and organization of services in radiotherapy as a result of implementation of European Union directives and other international documents to the Polish law based on the experience of Great Poland Cancer Centre

M. Bogusz-Osawa[1], J. Malicki[2], A. Roszak[3], K. Slosarek[4]. *[1]Great Poland Cancer Centre, Dept. of Trainings Scientific Cooperation and QA, Poznan, Poland; [2]Great Poland Cancer Centre, Medical Physics Dept., Poznan, Poland; [3]Great Poland Cancer Centre, Radiation and Gynaecological Oncology Ward, Poznan, Poland; [4]Oncology Centre – M. Sklodowska-Curie Institute in Gliwice, Medical Physics Dept., Gliwice, Poland*

Background: There are many reasons for the implementation of the Quality Management System in radiotherapy: lawful regulations, safety of patients and staff, progressive computerization of the process of treatment, technological development, implementation of sophisticated techniques, increasing awareness of the society, the possibility of free selection of treatment centre all over Europe etc.
Aims of this work were (a) the evaluation of the level of influence of EU law and recommendations of European and International organizations on the development of Polish law establishing conditions for safe use of ionizing