Only three patients underwent surgery prior to radiosurgery, and the majority (73.2%) received one or many embolisations prior to radiosurgery. In patients followed with angiography for a minimum of three years, 93.8% (30/32) had complete obliteration, after a median of 24.2 months post treatment. Only one patient presented a non fatal haemorrhage between treatment and obliteration. The symptomatic radionecrosis rate is of 8.8%. The median modified Rankin score of our patients is 2, with the mode being 1. No patients defined their symptoms as severely disabling.
Conclusions: Our study shows both obliteration and complication rates in the upper limit of those reported in the literature. Radiosurgery thus seems a good treatment option for small AVM at our center. Furthermore, widespread use of embolization does not seem to affect obliteration rate outcome.

8732 POSTER

Extraventricular Neurocytoma − Clinical Features, Treatment Outcomes, and Prognostic Factors

M. Kim[1], I. Kim[1], S. Park[2]. [1]*Seoul National University Hospital, Department of Radiation Oncology, Seoul, Korea;* [2]*Seoul National University Hospital, Department of Pathology, Seoul, Korea*

Purpose: To know clinical features, treatment outcomes, and prognostic factors of extraventricular neurocytoma (EVN), a new disease entity since 2007 by the WHO classification of tumours of the central nervous system.
Methods and Materials: Since 2007, thirteen patients were diagnosed as EVN at Seoul National University College of Medicine. There were 7 patients with atypical EVN, 6 patients with EVN. At the same period, there were 5 patients with central neurocytoma (CN), and no patients of atypical CN. Median age for all patients was 44 years old (range, 5−67), and 12 patients were male. In case of atypical EVN, 5 patients had subtotal resection, and 2 patients had gross total resection. Among 6 patients with EVN, 5 patients had gross total resection, 1 patient had only stereotactic biopsy. Three patients of CN had gross total resection, and 2 patients of CN had subtotal resection. All patients of atypical EVN and 1 patient of EVN had radiotherapy (median 57.6 Gy, range, 45–61.2). None of CN received radiotherapy. Only one patient with atypical EVN received concurrent temozolomide during adjuvant radiotherapy.
Results: Of atypical EVN, number of patients with complete response (CR), partial response (PR), and stable disease (SD) at 1 month after adjuvant RT completion was 1, 1, and 5 patients respectively. At 4 months after adjuvant RT, there were 1, 1, and 5 patients of CR, PR, and SD, respectively. Among 5 patients of response with SD, three patients experienced local recurrence at 6, 23, and 25 months after treatment completion. One patient experienced local recurrence with leptomeningeal seeding, and died due to progression of disease at 14 months after adjuvant RT. Other two patients received re-operation and gamma-knife radiosurgery, respectively. The median and 2-year progression-free survival of atypical EVN was 25.7 months, and 61%. None of patients with EVN experienced recurrence. Of CN, one patients experienced local recurrence at 16 months after initial surgery, and have gamma-knife radiosurgery. At present time, 2 patient of atypical EVN, 5 patient of EVN, and 2 patient of CN are alive without evidence of disease. Three patients of atypical EVN, 1 patient of EVN, and 3 patients of CN still have disease, although size of tumour was markedly decreased. One patient of atypical EVN, who had already gamma-knife radiosurgery to recurrent tumour, has ongoing chemotherapy due to progression of disease.
Conclusion: The local control rate of EVN with atypical feature was poor, even if adjuvant radiotherapy was given (although, no statistically proven). Compared with other previous studies of atypical CN, the local control rate of atypical EVN is also poor.

8733 POSTER

Gossypol Induces Apoptosis and Synergize With Radiotherapy and Temzolomide in Glioblastoma Cells

C. Festuccia[1], G. Gravina[1], F. Marampon[1], L. Biordi[1], C. Ficorella[1], V. Tombolini[1]. [1]*University of L'aquila, Experimental Medicine, L'aquila, Italy*

The median survival of patients diagnosed with grade IV astrocytomas (glioblastoma multiforme or GBM) is less than a year whatever the conventional therapies chosen (surgery, radiotherapy [RT] and/or chemotherapy [CT]). Therefore, new alternatives are highly needed. Recent studies suggest that gossypol, a bioactive phytochemical produced by cotton plants, is a promising agent against solid tumours. The current studies were undertaken to examine the chemotherapeutic efficacy of gossypol on human GBM cell lines as well as the sensitizing effects of this drug versus RT and the alkylating agent, temozolomide.
Gossypol reduced viability of a set of seven GBM cell lines (U87MG, A172, U251, U138, U373, LN228 and T98G) with an IC_{50} between 3−5 μM. A reduction in cell number can either be the consequence of gross injury to the cells, cytotoxicity, or the consequence of an actively driven biochemical process such as cell cycle arrest or apoptosis. To ensure that the growth inhibitory effect of gossypol on GBM cells was not a consequence of cytotoxicity, LDH leakage in response to 1, 5, and 10 μM of gossypol was performed. As demonstrated gossypol exerted no cytotoxicity on GBM cells. Additionally, molecular and functional analyses suggested that the decrease in viability was associated with increased DNA damage and the induction of apoptosis. We demonstrated that exposure of GBM cells to gossypol (1−10 μM) reduced the expression and activity of proteins involved with ERK/MAPK signaling pathway, JAK/Stat signaling pathway, and cell structure whereas Gossypol activated proteins that are involved in the mitochondrial apoptotic pathway and increased the phosphorylation of p53 at serine-392, which is phosphorylated in response to DNA damage. The effects of gossypol were similar in GBM expressing or not cancer stem cell phenotype suggesting that this agent could inactivate survival pathways involved in the cancer stem cell mediated recurrence.
We observed also increased the efficacy of both RT with Combination indices (CI) ranged between 0.34 and 0.76. The effects of temozolomide were also amplified by gossypol treatment in MGMT negative GBM cell lines with CI ranged between 0.52 and 0.82 whereas these effects were additive (CI of 1.00) or only partially synergistic (CI=0.89–0.97) in MGMT positive GBM cell lines.
Collectively, this data supports the use of gossypol as a novel agent for GBM as ameliorative agents of RT and CT.

8734 POSTER

Treatment of Low Grade Glial Tumours With Robotic Stereotactic Radiosurgery

P. Hurmuz[1], F. Zorlu[1], A. Aydin[1], M. Cengiz[1], G. Ozyigit[1], M. Gurkaynak[1], F. Yildiz[1], D. Yildiz[1], F. Akyol[1]. [1]*Hacettepe University Faculty of Medicine, Department of Radiation Oncology, Ankara, Turkey*

Background: We retrospectively evaluated our robotic stereotactic radiosurgery (SRS) treatment results in patients with low grade glial tumours.
Material and Methods: Twenty-nine patients with the diagnosis of low grade glial tumour treated between June 2007 and September 2010 with robotic SRS were evaluated. The median age was 36 years old (range, 4−70) and 11 of them were female. Ten patients had prior radiotherapy (RT) history and the median delivered dose was 60 Gy (range, 54−60 Gy). The time interval between the first RT and the salvage SRS was median 28 months. SRS was delivered with CyberKnife® (Accuray Inc., Sunnyvale, CA). The median SRS dose was 25 Gy (15−35 Gy) and it was given in 1−6 fractions (median 5 fractions). Homogeneity and conformality index values were 1.27 and 1.58 respectively. The volume of the tumour treated was median 26 cc (range, 0.5–130 cc).
Results: Median follow up was 21 months (range, 3−40 months). Overall survival and loco-regional control (LRC) rates were 82.7%, 68%, respectively. Increase in total BED2 dose values resulted in higher LRC ($p = 0.047$). The treatment was generally well tolerated. We observed no serious late toxicity at the time of reporting.
Conclusion: Robotic SRS seems to be a valid option in the treatment of patients with low grade glial tumours with low toxicity rates.

8735 POSTER

Simultaneous In-field Boost for Patients With 1 to 4 Brain Metastases Treated With Volumetric Modulated Arc Therapy With or Without Surgery − a Prospective Study on Quality-of-life

F. Caparrotti[1], M. Laouiti[1], K. Malek[1], D.C. Weber[1]. [1]*Hopital Cantonal De Geneve, Radiation Oncology, Geneva, Switzerland*

Background: To assess treatment toxicity and patients' survival /quality of life (QoL) after volumetric modulated arc therapy (VMAT) with simultaneous in-field boost (SIB) for cancer patients with 1−4 brain metastases (BM) treated with or without surgery.
Methods and Materials: Between March and December 2010, 29 BM patients (total volume BM, <40 cm^3) aged <80 years, KPS $\geqslant$ 70, RPA <III were included in this prospective trial. Whole brain VMAT (30 Gy) and a SIB to the BM (40 Gy) was delivered in 10 fraction. Mean age was 62.1±8.5 years. Fifteen (51.7%) underwent surgery. KPS and MMSE were prospectively assessed. A self-assessed questionnaire was used to assess the QoL (EORTC QLQ-C30 with -BN20 module).
Results: After a mean FU of 5.4±2.8 months, 14 (48.3%) patients died. The 6-month overall survival was 55.1%. Alopecia was only observed in 9 (31%) patients. In 3-month survivors, KPS was significantly ($p = 0.01$) decreased. MMSE score remained however stable ($p = 0.33$). Overall, QoL did decrease after VMAT. The mean QLQ-C30 global health status ($p = 0.72$) and emotional functional ($p = 0.91$) scores were decreased (low QoL). Physical ($p = 0.05$) and role functioning score ($p = 0.01$) were significantly worse and rapidly decreased during treatment. The majority

of BN20 domains and single items worsened 3 months after VMAT except headaches ($p = 0.046$) and bladder control ($p = 0.26$) which improved.
Conclusions: The delivery of 40 Gy in 10 fractions to 1−4 BM using VMAT was achieved with no significant toxicity. QoL, performance status, but not MMSE, was however compromised 3 months after treatment in this selected cohort of BM patients.

8736 POSTER

Robotic Stereotactic Radiotherapy in Patients With Glomus Tumours

G. Yazici[1], G. Ozyigit[1], M. Cengiz[1], P. Hurmuz[1], S. Yuce[1], F. Yildiz[1], M. Gurkaynak[1], F. Akyol[1], A. Dogan[1], F. Zorlu[1]. [1]*Hacettepe University Faculty of Medicine, Department of Radiation Oncology, Ankara, Turkey*

Background: To assess the feasibility of radiotherapy with robotic stereotactic radiotherapy (RSR) in patients with glomus jugulare and caroticum.
Material and Methods: We treated 20 patients with glomus tumours using RSR in our department between June 2007 and September 2010. Two patients were male, and 18 were female. Fifteen patients had glomus jugulare, and 5 patients had glomus caroticum. Median age was 60 years (range, 29−79). RSR was delivered with CyberKnife (Accuray Inc., Sunnyvale, CA). Median tumour volume was 16.1 cc (2.12−96 cc). Total dose of 18–30.78 Gy (median 25 Gy) was delivered in median 5 fractions (1−5 fractions). The gross tumour volume was described as the clinical target volume. Median homogeneity and conformality indices were 1.25 (1.0–1.46) and 1.6 (1.29–3.02) respectively. The median maximum doses of right optic and left optic nerve, optic chiasm, and brain stem are 3 Gy (0–10.3 Gy), 4.11 Gy (1.5–10.7 Gy), 5.08 Gy (0.77–16.6 Gy), and 18.8 Gy (3.3–31.2 Gy), respectively. All lesions were evaluated via magnetic resonance imaging during follow-up.
Results: Median follow-up was 21.5 months (range, 3−44 months). One patient was lost to follow-up. Lesions were stable in 13 patients, whereas partial response was observed in 6 patients. Complete symptomatic response was observed in 8 patients at the third month of follow-up. Treatment related toxicity was observed in three patients (1 facial paralysis and 2 decreased hearing).
Conclusion: Fractionated RSR seems to be an appealing treatment option with minimal serious toxicity.

8737 POSTER

Retrospective Analysis of Patients With Brain Metastases Treated With Robotic Stereotactic Radiotherapy

A. Aydin[1], M. Cengiz[1], G. Ozyigit[1], G. Yazici[1], F. Yildiz[1], M. Gurkaynak[1], D. Yildiz[1], F. Akyol[1], F. Zorlu[1]. [1]*Hacettepe University Faculty of Medicine, Department of Radiation Oncology, Ankara, Turkey*

Background: To evaluate the therapeutic outcome of patients with brain metastases treated via robotic stereotactic radiotherapy (RSR).
Materials and Methods: We treated 183 patients with brain metastases via RSR in our department between June 2007 and September 2010. Patients having $\geqslant$6 lesions were not included in this analysis. One hundred and nine patients were male, and 94 were female. Median age was 55 years (ranged= 19−84). Primary diagnosis was lung cancer in 50% of patients, and breast cancer in 26%. RPA classes of patients before RSR were class I in 32%, class II and III in 53% and 9% of patients respectively. 62% of patients had solitary lesion, whereas 29% had 2−3 lesions, and 9% had 4−5 lesions. The prescribed doses were 12−32 Gy (median 18 Gy) in solitary lesions. The median prescribed doses were 18 Gy (range, 12−35 Gy) and 22.8 Gy (range, 15−25) in patients with 2−3 lesions and 4−5 lesions respectively. The median fraction number was one (range, 1−5 fractions). The median homogeneity and conformality indices were 1.2 and 1.6, respectively.
Results: Median follow-up was 10 months (1−34 months). According to primary diagnosis (lung cancer, breast cancer, others) there was a significant difference in overall survival rates (46%, 37%, and 16%, $p = 0.02$). Local and regional control rates were 53%, and there was no difference between the groups. Symptomatic overall response rate was 52%. According to number of lesions (1 lesion vs. 2−3 lesions), no significant difference was observed between groups regarding response rates and toxicities. Groups were rearranged according to number of lesions (<4 vs. $\geqslant$4) and a significant difference in symptomatic response to treatment was observed in favor of <4 lesions group. The total dose was calculated as biologic equivalent dose of 2 Gy (BED_2), and in patients with BED_2 >220 Gy the local control rates were significantly better ($p = 0.005$). However the late toxicity rate was also higher in this group ($p = 0.005$).
Conclusion: RSR is an efficient treatment modality for patients with brain metastases. We observed that BED_2 dose over 220 Gy seems to be more effective in terms of local control, but also increases the late toxicity.

8738 POSTER

Hypofractionated Radiotherapy in Glioblastoma Multiforme With Poor Prognostic Factors − a Prospective Randomized Single Institute Experience

M. Behera[1], S. Dutta[2], P.K. Julka[1], D.N. Sharma[1], G.K. Rath[1]. [1]*All India Institute of Medical Sciences, Radiation Oncology, New Delhi, India;* [2]*Post Garduate Institute of Medical Education & Research, Radiation Oncology, Chandigarh, India*

Aims: To evaluate the effect of hypofractionated radiotherapy in terms of overall survival, quality of life and acute toxicities encountered in patients of Glioblastoma Multiforme GBM) with poor prognostic factors.
Materials and Methods: From Jan 2010 to Dec 2010, 70 patients were randomized after surgery to receive either a short course of radiotherapy with dose of 35 Gy /10#/2 weeks or standard radiotherapy with dose of 60 Gy/30#/6 weeks. The patients were selected on the basis of selection criteria i.e. age >50 years, KPS <70 and histology-GBM. Target volumes were described on the basis of preoperative MRIs. A margin of 3 cm was given around the visible gross tumour and edema. The primary end point was overall survival and secondary end points were acute toxicity encountered and QOL assessment.
Results: The median survival was 31 weeks ($p = 0.692$). Acute toxicities were comparable and QOL after applying EORTC-QLQ 30C and BN-20 questionnaire was good.
Conclusion: Hypofractionated radiotherapy with brain irradiation is well tolerated with palliative benefits. Conventional radiotherapy has similar outcome, however many patients having poor prognostic factors actually cannot undergo such long treatment and for these patients this hypofractionated regime can proven objectively and logistically a good practical option.

8739 POSTER

Factors Predictive of Complete Nidus Obliteration Following Linear-accelerator-based Stereotactic Radiosurgery for Intracerebral Arteriovenous Malformations

C. Herbert[1], V. Moiseenko[2], M. McKenzie[1], G. Redekop[3], F. Hsu[4], E. Gete[2], B. Gill[2], K. Luchka[2], R. Lee[2]. [1]*BC Cancer Agency, Radiation Oncology, Vancouver, Canada;* [2]*BC Cancer Agency, Medical Physics, Vancouver, Canada;* [3]*Vancouver General Hospital, Neurosurgery, Vancouver, Canada;* [4]*BC Cancer Agency, Radiation Oncology, Abbotsford, Canada*

Background: To investigate predictive factors of complete nidus obliteration following treatment with linear accelerator-based stereotactic radiosurgery for intracerebral arteriovenous malformations.
Materials and Methods: Archived plans for 48 patients who were treated at the British Columbia Cancer Agency and who had undergone post-treatment digital subtraction angiography to assess nidus obliteration were studied. Actuarial estimates of complete obliteration were calculated using the Kaplan–Meier method. Univariate and multivariate Cox proportional hazards models were used for analysis of incidence of obliteration. Log-rank test was used to search for parameters associated with complete nidus obliteration.
Results: Complete nidus obliteration was achieved in 38/48 patients (79.2%). The actuarial rate of obliteration was 75.9% at 4 years (95% confidence interval 63.1%-88.6%). On univariate analysis, prescribed dose to the margin ($p = 0.002$) and dose to isocentre ($p = 0.022$) showed statistical significance. None of the parameters showed statistical significance in a multivariate model. According to the log-rank test, prescribed dose to the margin of >20 Gy ($p = 0.004$) and dose to the isocentre of >25 Gy ($p = 0.004$) were strongly associated with complete obliteration. The actuarial rate of obliteration in patients with prescription dose equal to or larger than 20 Gy and a lesion volume of 10 cc or less was 91.6%. In patients where one of these conditions was not met, the obliteration rate was 60.9% ($p = 0.033$).
Conclusion: Reported series in the literature suggest a number of different factors are predictive of complete obliteration of arteriovenous malformations following radiosurgery. However, differing definitions of volume and complete obliteration makes direct comparison between series difficult. This study demonstrates that complete obliteration of the nidus following linear accelerator-based stereotactic radiosurgery for arteriovenous malformations appears to be most closely related to the prescribed marginal dose. In particular, a marginal dose of >20 Gy is strongly associated with obtaining complete obliteration of the nidus.